The Hong Kong Institute of Education
香港教育學院

Psychometric Society

The 76th Annual and the 17th International Meeting of the Psychometric Society

Pre-Conference Workshop
18 July 2011

Annual Meeting
19-22 July 2011

IMPS 2011
Hong Kong

Assessment Research Centre
評估研究中心

Department of
Psychological Studies

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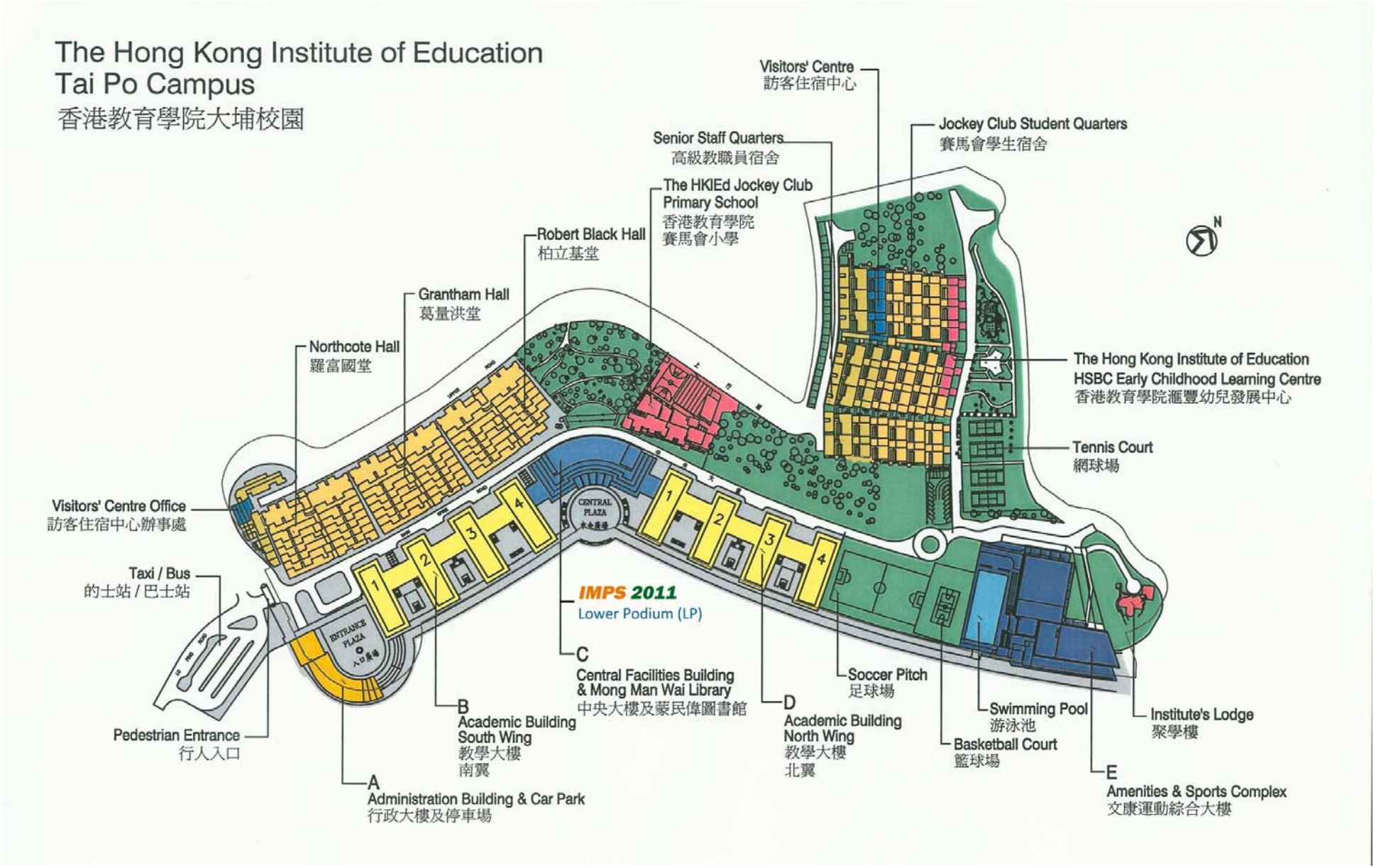
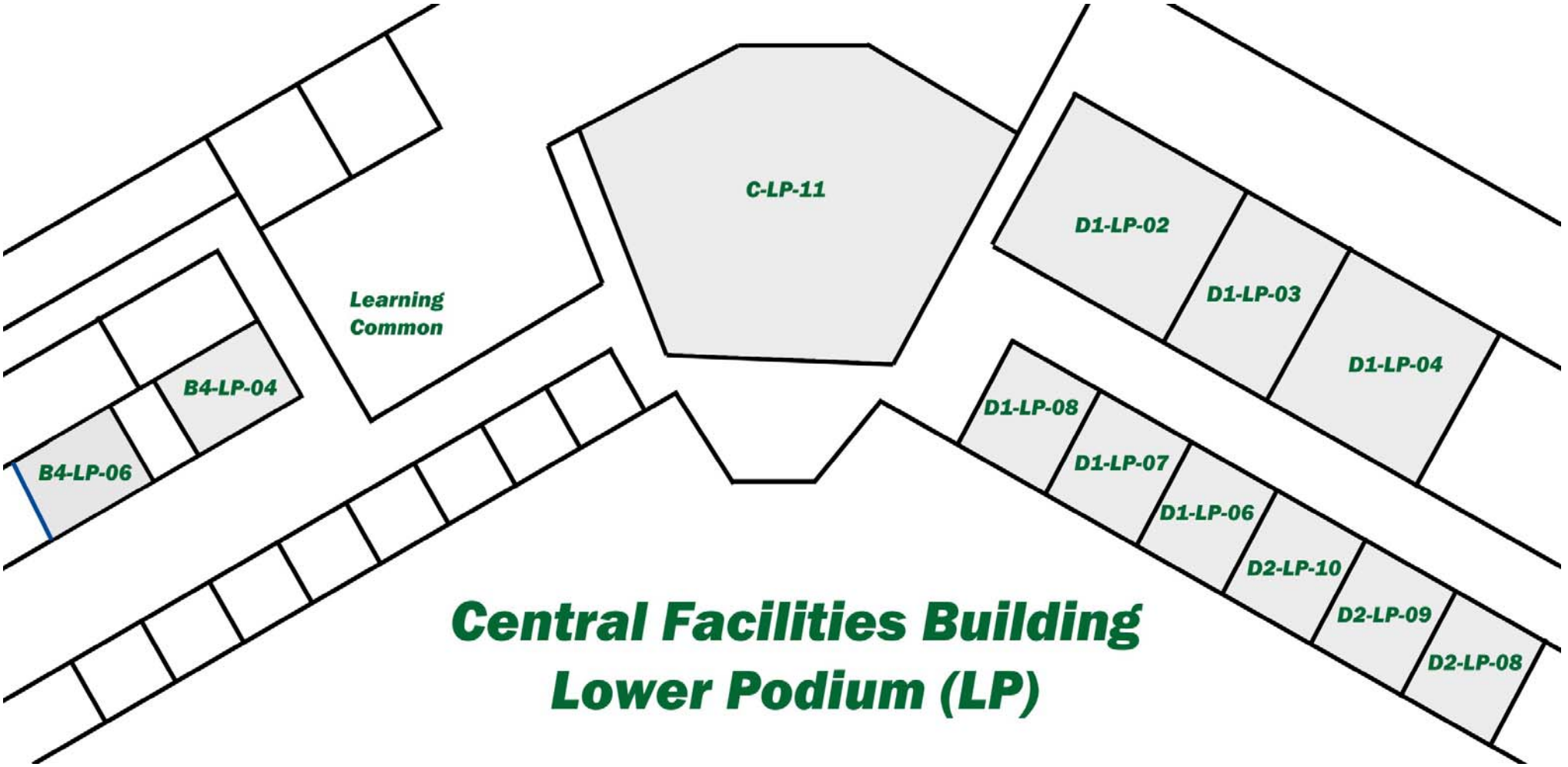
IMPS 2011 Campus Map



Main Conference Venue Layout



Schedule at a Glance

Pre-conference Workshops, Monday 18 July, 2011

9:00am - 9:30am	Registration						
Room	**C-1F-01A**	**B2-LP-01**	**Bl-LP-02**	**B4-P-03**	**A-4/F-02**	**A-4/F-02**	
9:30am							
	Workshop:	Workshop:	Workshop:	Workshop:			
-	(p. 1)	(p. 2)	(p. 4)	(p. 7)			
12:00 pm	Cognitive Diagnosis	Bayesian Evaluation	Psychometrics in R	EQSIRT	Editorial Council		**12:00pm**
	(de la Torre)	(Hoijtink, Klugkist)	(Rusch, Mair)	(Wu, He,	Meeting		**- 13:30pm**
2:00 pm				Bentler, Mair)		Board of	**2:00pm**
						Trustees	**- 3:30pm**
-						Meeting	
5:00pm							

Main Conference, Tuesday, 19 July, 2011

Note: Presenters with last names marked with star ★ in the **Schedule at a Glance** are junior presenters, who are eligible for the Best Junior Presenter Award.

8:30am – 9:00am	Registration							
9:00am – 9:50am	Conference Opening Ceremony & Group Photo (**Room C-LP-11**)							
9:55am – 10:50am	Keynote Address: Thissen (**Room C-LP-11**) (p. 10)							
10:50am – 11:10am	Coffee & Tea Break (**Lower Podium Floor of Block D1 & D2**)							
Room	**D1-LP-03**	**D1-LP-04**	**D1-LP-06**	**D1-LP-07**	**D1-LP-08**	**D2-LP-08**	**D2-LP-09**	**D2-LP-10**
11:10am – 12:30pm	Invited sym.: Validity (p. 11) Borsboom van der Maas Maul Zand Scholten Markus	Invited sym.: Measurement (p. 12) Mittelhaëuser★ Emons Zwitser★ Béguin	CDM I (p. 13) Chiu Sun★ Park★ Yang Yan	IRT Theory I (p. 14) Ip Irribarra★ Weissman Straat★	Bayes IRT (p. 15) Sudsaen Hoijtink Su★ Ra Wang★	Multivariate I (p. 16) Browne Okada Lee Kohei Takane	CTT-reliability (p. 17) Kruyen★ Okada Al-Mahrazi Huang★ Wu★	DIF Method (p. 18) Strobl Dai Liu Lin
12:30pm – 1:30pm	Lunch (**Learning Commons & Room B4-LP-07 to B4-LP-12**)							
1:30pm – 2:50pm	Invited sym.: Hierarchical (p. 19) Li Hansen★ Lee★ Yang★	Invited sym.: Missing Data (p. 20) Takai Yuan Sobel Kano	CDM II (p. 21) Liu Rojas★ Wang★ Cui Ayers	IRT Theory II (p. 22) Li Arai Li Nogami Jiao	Bayesian I (p. 23) Gruhl★ Zhou★ Kaplan Fang Fung	Multivariate II (p. 24) Okubo Chen★ Tan Tang★	CTT-rater (p. 25) Ikehara★ Cohen Ricker-Pedley Ling Wang★	DIF New (p. 26) Kim Sun★ Liu★ Tsai★ Chang★
3:00pm – 3:30pm	State of the Art Talk: Wicherts (**Room D1-LP-02**) (p. 27)				State of the Art Talk: Markus (**Room D1-LP-04**) (p. 28)			
3:30pm – 3:50pm	Coffee & Tea Break (**Lower Podium Floor of Block D1 & D2**)							
4:00pm – 5:20pm	Invited sym.: Missing Data (p. 29) van der Palm★ Van Ginkel Savalei Falk★	Invited sym.: SCA (p. 30) Timmerman Hwang Adachi ten Berge	CDM Ap. (p. 31) Lee Kang Huang Zhang Fung	IRT Ap. I (p. 32) Zhang van der Linden Mo Otsu Beersingh	Bayesian II (p. 33) Li Beland★ Song Yousfi Tijmstra★	Multivariate III (p. 34) Wu★ Ornstein★ Hong Jiao	Practical CAT (p. 35) Li Chien★ Leung Huang Chen★	DIF Ap. (p. 36) Huang Feldman Ong Yu Yulianto
5:30pm – 7:30pm	Opening Reception & Travel Award & Lifetime Achievement Award & Poster Session I		5:30pm - 5:45pm	Travel Award & Lifetime Achievement Award Announcement (**Room D1-LP-02**) (p. 37)				
			5:45pm - 6:00pm	Opening Reception (**Lower Podium Floor of Block D1 & D2**) (p. 38)				
			6:00pm - 7:30pm	Poster Session I (**Lower Podium Floor of Block D1 & D2**) (pp. 39-47)				

Main Conference, Wednesday, 20 July, 2011

Note: Presenters with last names marked with star ★ in the **Schedule at a Glance** are junior presenters, who are eligible for the Best Junior Presenter Award.

8:30am – 9:00am	Registration						
9:00am – 9:40am	Invited Talk: A.A. von Davier (**Room D1-LP-02**) (p. 48)				Invited Talk: Croon (**Room D1-LP-04**) (pp. 49-50)		
9:50am – 10:45am	Keynote Address: Lee (**Room C-LP-11**) (p. 51)						
10:50am – 11:10am	Coffee & Tea Break (**Lower Podium Floor of Block D1 & D2**)						
Room	**D1-LP-03**	**D1-LP-04**	**D1-LP-06**	**D1-LP-07**	**D1-LP-08**	**D2-LP-08**	**D2-LP-10**
11:10am – 12:30pm	Invited symposium: CDM & IRT (p. 52) Kelderman Rijmen von Davier	Invited sym.: Longitudinal (p. 53) Gates★ Liu★ Shiyko Markus	Equating (p. 54) Lim★ Zhao Gao★ Lee Tseng★	IRT Ap. II (p. 55) Cheng Liu★ Chen Gomez Conijn	Missing data (p. 56) Lin Kim He Meng	Multivariate IV (p. 57) Junker★ Nishida Xiong Liang Klugkist	E-testing (p. 58) Kosinski Wang Chang★ Wong Lin
12:30pm – 1:30pm	Lunch (**Learning Commons & Room B4-LP-07 to B4-LP-09**) & Student Luncheon (**Room B4-LP-10 to B4-LP-12**)						
2:00pm – 10:30pm	Social Event (Hong Kong Tour) (p. 59)						

Main Conference, Thursday, 21 July, 2011

Note: Presenters with last names marked with star ★ in the Schedule at a Glance are junior presenters, who are eligible for the Best Junior Presenter Award.

8:30am – 9:00am	Registration							
9:00am – 9:40am	Invited Talk: Hoshino (**Room D1-LP-02**) (p.60)				Invited Talk: Kamakura (**Room D1-LP-04**) (p. 61)			
9:50am – 10:45am	Keynote Address: Heiser (**Room C-LP-11**) (p. 62)							
10:50am – 11:10am	Coffee & Tea Break (**Lower Podium Floor of Block D1 & D2**)							
Room	**D1-LP-03**	**D1-LP-04**	**D1-LP-06**	**D1-LP-07**	**D1-LP-08**	**D2-LP-08**	**D2-LP-09**	**D2-LP-10**
11:10am – 12:30pm	Invited symposium: Marginal Models (p. 63) van der Ark Kuijpers★ Croon	Symposium: CD-CAT (p. 64) Chen★ Mao Wu★ Pan★	Measurement (p. 65) Zhang Wu★ Sano Xi	Rasch (p. 66) Alexandrowicz Schuster Spoden★ Yau Kao	SEM Theory I (p. 67) Jung★ Braeken Millsap Bentler Suk	GLNMEM (p. 68) Wu Visser Martin Choi★ Liu	Validity (p. 69) Smithson Xie Wang Xu Jatnika	DIF (p. 70) Kim McGuire Choi Edwards Liu★
12:30pm – 1:30pm	Lunch (**Learning Commons & Room B4-LP-07 to B4-LP-12**)							
1:30pm – 2:50pm	Invited symposium: Longitudinal (p. 71) Tan Serroyen Shkedy Carr	Symposium: Learning Progression (p. 72) Wilson Schwartz Ayers Diakow★	LCA (p. 73) Bouwmeester Choi Miyazaki Zhang Gao	Rasch (p. 74) Li Xu★ Draxler Islam★ Tam	SEM Ap. I (p. 75) Teo Suah★ Schweizer Lee★ Tze	HLM (p. 76) Miyazaki Chung Carlson Lin Wang	Validity I (p. 77) Shih Huang★ Kittagali Fan Ting★	Standard setting (p. 78) Hsieh Janssen Ahmad Brown von Davier
3:00pm – 3:30pm	State of the Art Talk: Meijer (**Room D1-LP-02**) (p. 79)				State of the Art Talk: Karabatsos (**Room D1-LP-04**) (p. 80)			
3:30pm – 3:50pm	Coffee & Tea Break (**Lower Podium Floor of Block D1 & D2**)							
4:00pm – 5:20pm	Invited symposium: SEM (p. 81) Nakagawa Ogasawara Lee Usami	Symposium: Dynamics (p. 82) Halpin Grasman Tuerlinckx De Boeck	Response Time (p. 83) Meng Wang★ Yang Yang Ro	Categorical (p. 84) Kroonenberg Zhao Hsu Bennink★ Ryu	FA (p. 85) Bentler Zhang Hsieh★ Yamamoto★ Timmerman	Computational (p. 86) Ning Luo★ Li★ Xiong Ho	Validity I (p. 87) Liao★ Liu Musalek★ Johar★	CAT-CDM (p. 88) Chen★ Shang Mao Wen Lin★
5:30pm – 7:00pm	Poster Session II (**Lower Podium Floor of Block D1 & D2**) (pp. 89-98)							

Main Conference, Friday, 22 July, 2011

Note: Presenters with last names marked with star ★ in the **Schedule at a Glance** are junior presenters, who are eligible for the Best Junior Presenter Award.

8:30am – 9:10am	Dissertation Award Talk (**Room D1-LP-02**) (p. 99)						
Room	**D1-LP-03**	**D1-LP-06**	**D1-LP-07**	**D1-LP-08**	**D2-LP-08**	**D2-LP-09**	**D2-LP-10**
9:20am – 10:40am	Symposium: Heterogeneity (p. 100) Chow Lodewyckx Lo★ Sabastien	MIRT (p. 101) Leenen Wu★ Tao Lee Wiberg	Rasch Ap. I (p. 102) Hendrickson Le Engelhard Nussbaum Wang	SEM Theory II (p. 103) Song Cham Lee Yang Cheung★	Longitudinal (p. 104) Wang Hsieh Reynolds Ryoo	Validity I (p. 105) Chiang★ Sun★ Almeda Zou★ He★	CAT (p. 106) Lee★ Ali Chao★ Barrada Tang★
10:50am – 11:10am	Coffee & Tea Break (**Lower Podium Floor of Block D1 & D2**)						
11:10am – 11:40am	State of the Art Talk: Strobl (**Room D1-LP-02**) (p. 107)				State of the Art Talk: Yu (**Room D1-LP-04**) (p. 108)		
11:50am – 12:30pm	Invited Talk: Skrondal (**Room D1-LP-02**) (p. 109)				Invited Talk: de la Torre (**Room D1-LP-04**) (p. 110)		
12:30pm – 1:30pm	Lunch (**Learning Commons & Room B4-LP-07, B4-LP-09 to B4-LP-12**)						
1:30pm – 2:50pm	Symposium: LVM (p. 111) Molenaar★ Jak★ Barendse★ Verhage★	MIRT Ap. (p. 112) Chi Rusch★ Chow★ Chang★ Chao	Rasch Ap. II (p. 113) Chan★ Huang Razak Yao★ Kwan	SEM Ap.II (p. 114) Yung Wu Kim Hsueh★ Wu	Mixture (p. 115) Dumenci Lu Ohashi★ Zhong Jin	Validity II (p. 116) Wang Lin★ Yu★ McClellan Jacob	Nonparametric (p. 117) Roussos Larocque Brusco Ligtvoet Smits★
3:00pm – 3:50pm	Presidential Address (**Room C-LP-11**) (p. 118)						
3:50pm – 4:20pm	Closing Ceremony (**Room C-LP-11**) (p. 119)						
4:30pm – 5:10pm	Business Meeting (**Room B4-LP-04**) (p. 120)						
6:00pm – 9:00pm	Banquet & Best Junior Presenter Award & Best Poster Presentation Award (**Lake Egret Nature Park**) (p.121)						

Workshop Registration Includes (18 July 2011)

- Admission to the workshop registered.

Note: Lunch and coffee & tea break are not included in the workshop registration.

Main Conference Registration Includes (19 - 22 July 2011)

- Admission to all events during the conference
- Participant bag containing IMPS 2011 Final Program
- Snacks, coffee and tea in the coffee & tea breaks
- Lunches on 19 through 22 July
- Conference banquet on 22 July (Alcoholic drink is not included)

Guest Registration Includes (19 - 22 July 2011)

- Snacks, coffee and tea in the coffee & tea breaks
- Lunches on 19 through 22 July
- Conference banquet on 22 July (Alcoholic drinks is not included)

(Participant bag containing IMPS 2011 Final Program and the admission to all events during the conference are not included.)

TABLE OF CONTENT

Pre-conference Workshops, Monday 18 July, 2011

Cognitive Diagnosis Modeling: A General Framework Approach
Monday, 18 July, 9:30 a.m. -- 5:00 p.m., C-1F-01A (Library eLeaning Studio)
Jimmy de la Torre, Rutgers, The State University of New Jersey, USA

Abstract
The primary aim of skills or cognitive diagnosis is to develop and analyze tests in ways that reveal information with more diagnostic value, when compared with traditional approaches. In the methods for cognitive diagnosis that we consider mastery of a finite set of skills can be represented by a list of binary latent variables. The main objective of cognitive diagnosis is to classify examinees according to this list of skills. This workshop aims to provide both the theoretical underpinnings and practical experience necessary for participants to use cognitive diagnosis modeling in applied settings.

The theoretical component of the workshop will provide a comprehensive overview of cognitive diagnosis modeling, and will include the following topics: what is the cognitive diagnosis modeling paradigm and how it differs from the traditional unidimensional framework, what steps are involved in attribute identification and validation, what is the Q-matrix and what role does it play in cognitive diagnosis modeling, what are some of the commonly used cognitive diagnosis models and how are they related to each other, how are model parameters estimated and how is model-data fit evaluated, how are cognitive diagnosis models compared and selected, and what procedures are involved in constructing an optimally diagnostic assessment.

The practical component of the workshop will provide participants with a hands-on experience on the different aspects of cognitive diagnosis modeling through various exercises. Participants will learn how to identify attributes, construct appropriate tasks given some attribute specifications, validate attributes and tasks, run computer codes to estimates different cognitive diagnosis models, compare fits of competing models at the item and test level, empirically evaluate the appropriateness of a Q-matrix, and construct a test based on a specific set of constraints and given a pool of calibrated items.

Bayesian Evaluation of Informative Hypotheses

Monday, 18 July, 9:30 a.m. -- 5:00 p.m., B2-LP-01

Herbert Hoijtink and Irene Klugkist, University Utrecht, the Netherlands

Abstract

Are you *happier* if a p-value is .049 rather than .051? Did you ever have *trouble* finding a meaningful interpretation upon finding one or more significant test results? Did you ever *worry* about the interpretation of p-values when testing more than one hypothesis? Do you *like* large sample sizes because more tests will be significant? Did you ever *quit* a research project because none of the tests were significant? If you answer "yes" to one or more of these questions, and if you have one or more theories with respect to the state of affairs in you research domain, this course may be useful because it will temper your *happiness*, reduce your *trouble*, address your *worries*, discuss your *liking*, and provide an alternative for *quitting* by teaching you a new way to analyze your data: Bayesian evaluation of informative hypotheses.

Null-hypothesis testing is an important tool in social scientific research. It can be used to make inferences with respect to the unknown state of affairs in a population of interest. The null-hypothesis is usually of the type "nothing is going on" and the alternative hypothesis usually states "something is going on but I don't know what", to give an example: H0: m1=m2=m3=m4, that is, the four means are equal, versus H1: m1,m2,m3,m4, that is, the four means are not all equal. First of all it is questionable whether a population where "nothing is going on" is a serious option ("something which is irrelevant is going on" is probably a better option). Secondly, if a test indicates that H0 should be rejected, we have to conclude that "something is going on but I don't know what", which is not very informative.

In this course Bayesian evaluation of informative hypotheses will be introduced as an alternative for null-hypothesis testing. An informative hypothesis contains a researcher's expectation with respect to the state of affairs in the population of interest. If he expects four means to be ordered the hypothesis might be H2a: m1>m2>m3>m4, where > denotes larger than. If another scientist has other expectations, a competing hypothesis can be formulated e.g. H2b: m1<m2>m3=m4. It will be shown that Bayesian model selection can be used to evaluate H2a, H2b and, if desired, in addition H0 and H1, without suffering from the drawbacks of hypothesis testing using p-values sketched in the introduction.

Further information about informative hypotheses (applications, publications, dissertations and software) can be found at http://tinyurl.com/informativehypotheses. The slides to be used during the workshop and an accessible paper worthwhile reading before attending the

workshop can be found at http://tinyurl.com/hoijtink under “Side line activities” at the bottom of the page, in the first week of June 2011.

References (go to http://tinyurl.com/informativehypotheses for more information)

Hoijtink, H., Klugkist, I. and Boelen, P.A. (2008). *Bayesian evaluation of informative hypotheses.* New York: Springer.

Klugkist, I., Laudy, O. and Hoijtink, H. (2005). Inequality Constrained Analysis Of Variance: A Bayesian Approach. *Psychological Methods,* 10 (4), 477-493

Klugkist, I. and Hoijtink, H. (2007). The Bayes Factor for Inequality and About Equality Constrained Models. *Computational Statistics and Data Analysis,* 51, 6367-6379.

Kuiper, R. M., Klugkist, I. & Hoijtink, H. (2010). A Fortran 90 Program for Confirmatory Analysis of Variance. *Journal of Statistical Software, 34*, 1-31.

Kuiper, R. M. and Hoijtink, H. (2010). Comparisons of Means Using Exploratory and Confirmatory Approaches. *Psychological Methods, 15*, 69-86.

Mulder, J., Klugkist, I., van de Schoot, R., Meeus, W., Selfhout, M. and Hoijtink, H. (2009). Bayesian model selection of informative hypotheses for repeated measurements. *Journal of Mathematical Psychology, 53,* 530-546.

Mulder, J., Hoijtink, H. and Klugkist, I. (2010). Equality and inequality constrained multivariate linear models: objective model selection using constrained posterior priors. *Journal of Statistical Planning and Inference, 140,* 887-906.

Psychometrics in R

Monday, 18 July, 9:30 a.m. -- 5:00 p.m., B1-LP-02

Thomas Rusch and Patrick Mair, Vienna University of Economics and Business, Austria

Abstract

Over the last few years the R Open Source environment for statistical computing has become one of the most popular analysis tool in the field of computational statistics. Recently, numerous packages in the area of Psychometrics have been implemented.
The striking features of R are the following: R is Open Source which means that it is freely available and the user has full insight into the source code. R consists of a base distribution that includes the vector and matrix oriented R language and contains basic statistical techniques. In addition to this base distribution more than 2700 add-on packages are available freely for download via the Comprehensive R Archive Network (CRAN). These packages are implemented in a standardized manner which means that once the user has gained understanding of basic R concepts, he or she can use all of these packages in the same way. Another striking feature is that everything in R is stored as an object. Thus, results are not static text output but can be post-processed by means of additional data manipulation or used for subsequent analysis. Finally, it has to be mentioned that R has a powerful plot engine. Graphical outputs are highly customizable and can be plotted on a level suitable for journal publication.

The aim of this workshop is to teach participants the basic concepts of the R language and the R environment, respectively, and show them how to use R for basic statistical and advanced psychometric modeling. No prior R experience is needed in order to follow the workshop. The workshop consists of three modules: The first module, "R Introduction and R programming" deals with basic concepts and the organization of R. It introduces the R language by means of psychometric examples. We start with a "tour" of the CRAN (Comprehensive R Archive Network) repository, show important on-line resources such as manuals, the R-help repository, and subject-specific task views. We explain how to import external datasets and how to install and load packages. Furthermore, we examine which data types exist in R and how to sub-select or extract elements from these data types. A core emphasis of this module is the use of R functions which we introduce in a conceptual way (help files, arguments, values). Finally, since R is matrix oriented, we show some basic matrix computations which should help the participants to implement their newly developed methods in R. Throughout the modules we will also show possibilities for plotting data and corresponding results using the R plot engine.

The second module introduces basic statistical modeling where we focus on linear and generalized linear models. The corresponding "glm" function is very powerful and versatile

and works with a simple formula syntax for model specification which will be explained in detail. As a slightly advanced topic the computation of (generalized) linear mixed-effects models (e.g., multilevel models) using the "lme4" package will be demonstrated. The corresponding "lmer" function can be used in a similar fashion as the "glm" function.
The third module is all about psychometric methods in R. We start with some descriptive multivariate techniques for categorical data such as correspondence analysis and Gifi methods ("homals"). As an additional exploratory approach we will demonstrate the "smacof" package for multidimensional scaling. Briefly, it will be shown how classical test theory can be performed in R. A strong emphasis of this module is on item response models. We will focus on the "eRm" package for extended Rasch models and the "ltm" package for higher parameterized IRT models. Within this context we will also point out the computation of non-parametric IRT ("mokken" package) and multidimensional IRT models using "MCMCpack". Finally, we will demonstrate the computation of classical latent variable methods such as simple factor analysis and structural equation models using the newly developed package "lavaan".

Throughout the workshop we use real-life datasets from the psychometric area. All datasets, the full R code file and additional materials will be available at

http://statmath.wu.ac.at/~mair/IMPS2011/

prior to the workshop such that the participants can fully reproduce our demonstrations. At the end of the workshop the participants will have a conceptual and technical understanding of R such that they can use this environment for their own analyses and hopefully have a starting point for implementing their own methods.

Links:
Main R website: http://R-project.org
CRAN download repository: http://CRAN.R-project.org
Psychometrics task view: http://cran.r-project.org/web/views/Psychometrics.html
Suggested code editors:
Tinn-R under Windows OS: http://www.sciviews.org/Tinn-R/
Aquamacs for Mac OS: http://aquamacs.org/
Emacs including ESS for Linux: http://ess.r-project.org/

Selected Books:

Venables, W. N., & Smith, D. M. (2002). An Introduction to R. Bristol, UK: Network Theory. Freely available at http://cran.r-project.org/doc/manuals/R-intro.pdf.

Dalgaard, P. (2008). Introductory Statistics with R. New York: Springer.

Chambers, J. (2008). Software for Data Analysis: Programming with R. New York: Springer.

Adler, J. (2010). R in a Nutshell. Sebastopol, CA: O'Reilly.

Crawley, M. J. (2008). The R Book. Chichester, UK: Wiley.

Selected Articles: (freely available at http://www.jstatsoft.org)

Mair, P., & Hatzinger, R. (2007). Extended Rasch modeling: The eRm package for the application of IRT models in R. *Journal of Statistical Software, 20(9)*, 1-20.

de Leeuw, J., & Mair, P. (2009b). Multidimensional scaling using majorization: SMACOF in R. *Journal of Statistical Software, 31(3)*, 1-30.

de Leeuw, J., & Mair, P. (2009a). Gifi methods for optimal scaling in R: The package homals. *Journal of Statistical Software, 31(4)*, 1-21.

Rizopoulos, D. (2006). ltm: An R Package for Latent Variable Modeling and Item Response Analysis, *Journal of Statistical Software, 17(5)*, 1-25.

van der Ark, L. A. (2007). Mokken Scale Analysis in R. *Journal of Statistical Software, 20(11)*, 1-19.

EQSIRT: A New Software for IRT Modeling

Monday, 18 July, 9:30 a.m. -- 5:00 p.m., B4-P-03

Eric Wu, Sam He, Peter M. Bentler, and Patrick Mair, University of California, Los Angeles, and Multivariate Software, Inc., USA

Abstract

In this workshop we present a new, comprehensive and user-friendly IRT software by Multivariate Software, Inc., who have been developing the EQS software for Structural Equation Modeling.

The target group of the workshop are applied researchers who are interested in a easy-to-use software for their IRT computations. This workshop will introduce the software and will show the capabilities of the program with respect to many different IRT models using real-life use-cases. At the end of the day the participants will have a detailed overview of the software and the corresponding models such that they can do their own IRT computations using EQSIRT.

The first of the three modules starts with a general introduction into the software including the graphical user interface and the EQS-like syntax. We explain basic options for data handling and manipulation as well as descriptive analysis. Then, we move on with binary IRT models such as the Rasch model, 2-PL, and 3-PL. An interesting option offered by the software is the possibility to put restrictions on the item parameters (equality restrictions as well as fixing parameters onto a certain value).

With respect to classical polytomous models we are going to present the rating scale model, the partial credit model, the graded response models, and the nominal response model. In general, the basic estimation setting is a MML approach which also allows for spline approximation of the latent trait. Optionally, item parameters can also be estimated in a MCMC way. Similarly, for the person parameters we provide ML as well as Bayesian routines. In this module we are also going to discuss relevant goodness-of-fit measures and various IRT plots.

Module 2 addresses the highly relevant issue of dimensionality assessment. We present the implementation for categorical factor analysis (FIML, MCEM, tetrachoric/polychoric correlations). Within this context multidimensional IRT extensions of the basic models addressed above are explained in detail. In the program we use MCMC to estimate the parameters.

In the afternoon, module 3 is about IRT models with covariates. We start with DIF and multiple-group computations. The core aspect of this model is a non-linear mixed-effects IRT model framework that allows for the inclusion of covariates; either as fixed-effects or random effects. This extends the framework proposed in the book by de Boeck and Wilson (2002).

Links:
Main R website: http://www.mvsoft.com/

Selected Books:
Baker, F. B., & Kim, S. H. (2004). Item Response Theory: Parameter Estimation Techniques. New York: Dekker.
Embretson, S. E., & Reise, S. (2000). Item Response Theory for Psychologists. Mahwah, NJ: Lawrence Erlbaum Associates.
De Ayala, R. J. (2009). The Theory and Practice of Item Response Theory. New York: Guilford Press.
De Boeck, P. and Wilson, M. (2004). Explanatory Item Response Models: A Generalized Linear and Nonlinear Approach. New York: Springer.
Reckase, M. (2009). Multidimensional Item Response Theory. New York: Springer.

Selected Articles:
Woods, C. M., & Thissen, D. (2006). Item response theory with estimation of the latent population distribution using spline-based densities. Psychometrika, 71, 281-301.
Sheng, Y. (2010). Bayesian estimation of MIRT models with general and specific latent traits in MATLAB. Journal of Statistical Software, 34(3), 1-27.
Bentler, Jennrich (2011).
He, S., Mair, P., Wu, E., & Bentler, P. M. (2011). A nonlinear mixed model approach to item response theory.

Main Conference, Tuesday, 19 July, 2011

Conference Opening Ceremony & Group Photo
Tuesday, 19 July, 9:00 a.m. -- 9:50 a.m., C-LP-11

All participants are warmly invited to attend the Conference Opening Ceremony.

Rundown:

- Welcome Speech by Professor Anthony B. L. Cheung, President of The Hong Kong Institute of Education
- Welcome Speech by Professor Klaas Sijtsma, President of Psychometric Society
- Welcome Speech by Professor Wen Chung Wang, Chair of Local Organizing Committee.
- Music Performance
- Information Session and Announcement
- Group Photo

Keynote Address: Psychometric Engineering Redux: Making a PROMIS®
Tuesday, 19 July, 9:55 a.m. -- 10:50 a.m., C-LP-11

Presenter:

David Thissen, University of North Carolina at Chapel Hill, USA

Over the past century, a relatively small number of applied government-related projects in the United States have had enormous subsequent impact on psychometrics in its narrow definition: psychological measurement or test theory. Early examples include the development of Army Alpha and Beta in 1917-18 (and the Woodworth Personal Data Sheet in 1919), the Aviation Psychology Program to use psychological tests for flight-crew selection, a project to select agents for the Office of Strategic Services subsequently reported as *The Assessment of Men*, and *The American Soldier* studies in the 1940s. In the second half of the twentieth century, support from the U.S. Office of Naval Research and the Air Force Office of Scientific Research funded a great deal of development of item response theory (IRT) in the 1960s, 70s, and 80s, with the goal of making the Armed Services Vocational Aptitude Battery (ASVAB) a computerized adaptive test. The "new design" of the National Assessment of Educational Progress (NAEP) by the Educational Testing Service for the National Center of Education Statistics involved further development of IRT. In the first decade of the 21st century, the Patient Reported Outcomes Measurement Information System (PROMIS®) initiative, funded by the National Institutes of Health (NIH), has been a stimulus to take the theoretical development of IRT to new levels. This presentation includes a brief review of some contributions from the earlier projects, and descriptions of some of the psychometric advances attributable (in part) to PROMIS. The metamessage remains that applied problems inspire basic psychometric research.

Chair:

Terry Ackerman, University of North Carolina at Greensboro, USA

Invited Symposium : Validity Theory
Tuesday, 19 July, 11:10 a.m. -- 12:30 a.m., D1-LP-03

Organizer:

Denny Borsboom, University of Amsterdam, the Netherlands

Presenters (marked with asterisks):

How to Think About the Relation Between Constructs and Observations
Denny Borsboom*, University of Amsterdam, the Netherlands

The Relation Between Process Models for Decision Making and Latent Variable Models for Individual Differences
Han van der Maas*, University of Amsterdam, the Netherlands

Method Effects: Concepts and Models
Andrew Maul*, University of Oslo, Norway

The Guttman-Rasch Paradox: Why The Interval Level Of Measurement Unparadoxically Goes Poof When Precision Increases
Annemarie Zand Scholten*, University of Amsterdam, the Netherlands

Score Interpretation: The Goldilocks Model
Keith A. Markus*, The City University of New York, USA

Invited Symposium : Issues in Educational Measurement and Examinations
Tuesday, 19 July, 11:10 a.m. – 12:30 a.m., D1-LP-04

Organizer:

Anton Béguin, Cito Institute of Educational Measurement, The Netherlands

Presenters (marked with asterisks):

Using Mixed IRT Models to Compare the Effectiveness of Different Linking Designs: The Internal Anchor versus the External Anchor and Pre-Test Data
Marie-Anne Mittelhaëuser*, Cito Institute of Educational Measurement/Tilburg University, The Netherlands
Anton Béguin, Cito Institute of Educational Measurement, The Netherlands
Klaas Sijtsma, Tilburg University, The Netherlands

On the Usefulness of Latent Variable Hybrid Models for Detecting Unobserved Person Heterogeneity and Person Misfit in Educational Testing
Wilco Emons*, Tilburg University, The Netherlands

Complex Decision Rules and Misclassification: Who Should Take a Retest?
Robert Zwitser*, Cito Institute of Educational Measurement, The Netherlands

Vertical Comparison Using Reference Sets
Anton Béguin*, Cito Institute of Educational Measurement, The Netherlands
Saskia Wools, Cito Institute of Educational Measurement, The Netherlands

Parallel Session: Cognitive Diagnosis Modeling - Theory I
Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m., D1-LP-06

Presenters (marked with asterisks):

A Model-Free Approach to Cognitive Diagnosis: Robustness Under Misspecification and Implications for Latent Structure Identification
Chia-Yi Chiu*, Rutgers, The State University of New Jersey, US

A Cognitive Diagnosis Method Based on Q-Matrix and Generalized Distance
Jianan Sun*, Beijing Normal University, China
Shumei Zhang, Beijing Normal University,China
Tao Xin, Beijing Normal University,China
Yu Bao, Beijing Normal University,China

Mixture Higher-Order DINA Model for Differential Attribute Functioning
Yoon Soo Park*, Columbia University, USA
Young-Sun Lee, Columbia University, USA

A Hybrid Model of HO-IRT and HO-DINA Models
Chih-Wei Yang*, National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan

Research on Factors Influencing Diagnostic Accuracy in AHM and DINA
Yuanhai Yan*,Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China

Moderator:

Mark Wilson, University of California, Berkeley, USA

Parallel Session: Item Response Theory - Methodology I
Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m., D1-LP-07

Presenters (marked with asterisks):

Projective IRT for Purified Constructs
Edward Ip*, Wake Forest University, USA

Model Selection for Tenable Assessment: Selecting a Latent Variable Model by Testing the Assumed Latent Structure
David Torres Irribarra*, University of California at Berkeley, USA
Ronli Diakow, University of California at Berkeley, USA

Optimum Information Bounds for IRT Models
Alexander Weissman*, Law School Admission Council, USA

A New Scaling Procedure Based on Conditional Association for Assessing IRT Model Fit
Hendrik Straat*, Tilburg University, Netherlands
Andries van der Ark, Tilburg University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

Moderator:

Paul De Boeck, University of Amsterdam & K.U.Leuven, The Netherlands/ Belgium

Parallel Session: Bayesian Methods in Item Response Theory
Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m., D1-LP-08

Presenters (marked with asterisks):

Variational Bayesian Approximation Method for Inference in Item Response Models
Pattarasuda Sudsaen*, The University of New South Wales, Australia

Bayesian Person Fit Evaluation: A Non-Parametric Approach
Herbert Hoijtink*, Methods and Statistics/University Utrecht, Netherlands
Sebastien Beland, Universite Du Quebec a Montreal, Netherlands

Extensions and Applications of Higher-Order Item Response Theory Models
Chi-Ming Su*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

Impacts of Prior Distributions in Testlet IRT model
Jongmin Ra*, The University of Georiga, USA
Seock-Ho Kim, The University of Georgia, USA

The Exploration and Comparison of the Ability Estimation Methods for Multidimensional Test
Yue Wang*, Beijing Normal University, China
Hongyun Liu, Beijing Normal University, China

Moderator:

Brian Junker, Carnegie Mellon University, USA

Parallel Session: Multivariate Data Analysis I
Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m., D2-LP-08

Presenters (marked with asterisks):

Rotation to Higher Order Invariance In Dynamic Factor Analysis
Michael Browne*, The Ohio State University, USA
Guangjian Zhang, The University of Notre Dame, USA

Analysis of Brand Switching Among Sliced Cheese by Asymmetric Multidimensional Scaling
Akinori Okada*, Tama University, Japan
Tsurumi Hiroyuki, Yokohama National University, Japan

Maximum Entropy Procedure, A Univariate Discrete and Continuous Distributions Simulating Procedure with the Parameter Constraints
Yen Lee*, National Cheng Kung University, Taiwan
Chung-Ping Cheng, National Cheng Kung University, Taiwan

Nonsingular Transformation of Tucker2 Solutions for Representing Stimulus-Response Relationships by Sparse Networks
Adachi Kohei*, Osaka University, Japan

On the Extended Wedderburn-Guttman Decomposition
Yoshio Takane*, McGill University, Canada

Moderator:

Pieter M. Kroonenberg, Leiden University, Netherlands

Parallel Session: Classical Test Theory - Reliability Issue
Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m., D2-LP-09

Presenters (marked with asterisks):

Test Length and Decision Making in Psychology: When Is Short Too Short?
Peter Kruyen*, Tilburg University, Netherlands
Wilco Emons, Tilburg University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

An Empirical Comparison of Methods for Estimating Reliability
Kensuke Okada*, Senshu University, Japan

Cronbach's Coefficient Alpha Reliability for Scale Scores of Dichotomous Items Test
Rashid Al-Mahrazi*, Sultan Qaboos University, Oman

Estimating the Reliability of Aggregated and Within-Person Centered Scores in Ecological Momentary Assessment
Po-Hsien Huang*,National Taiwan University, Taiwan
Li-Jen Weng, National Taiwan University, Taiwan

Generalizability Analysis of Constructed-Response and Hands-On Performance Tasks in Home Economics
Chiao-Ying Wu*, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan

Moderator:

Won-Chan Lee, University of Iowa, USA

Parallel Session: Differential Item Functioning - Advanced Method
Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m., D2-LP-10

Presenters (marked with asterisks):

Rasch Trees: A New Method to Detect Differential Item Functioning in the Rasch Model
Carolin Strobl*,LMU Munich, Germany
Julia Kopf, LMU Munich, Germany
Achim Zeileis, Universität Innsbruck, Austria

Applying the Mixture Rasch Model with Covariate to Explore Potentially Differentiating Functioning Items
Yunyun Dai*, University of California at Los Angeles, USA

Detection of Differential Item Functioning Based on Multilevel Rasch Model
Hui Liu*, South China Normal University, China
Ming-Qiang Zhang, South China Normal University, China
Xiao-Zhu Jian, Jinggangshan University, China
Muhui Huang, South China Normal University, China

Integrating Bootstrap technique with Hierarchical Generalized Linear Model to Perform DIF Detection for Small Size Sample
Jing-Jiun Lin*, National Chung Cheng University, Taiwan
Ya-Hui Su, National Chung Cheng University, Taiwan

Moderator:

Shu-Ying Chen, National Chung Cheng University, Taiwan

Invited Symposium: Special Models with Special Solutions: Statistical Issues in Hierarchical Item Factor Models
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-03

Organizer:

David Thissen, University of North Carolina at Chapel Hill, USA

Presenters (marked with asterisks):

The Lord-Wingersky Algorithm After 25+ Years: Version 2.0 for Hierarchical Item Factor Models
Li Cai*, University of California at Los Angeles, USA

Limited-Information Goodness-of-fit Testing of Hierarchical Item Factor Models
Mark Hansen*, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

Calibration, Scaling, DIF, and Projection: A Common Framework Using Multidimensional IRT
Moonsoo Lee*, University of California at Los Angeles, USA
Mark Hansen, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

A Multilevel Item Bifactor Model
Ji Seung Yang*, University of California at Los Angeles, USA
Scott Monroe, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

Invited Symposium : Analysis of Missing Data and Causal Inferenc
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-04

Organizer:

Yutaka Kano, Osaka University, Japan

Presenters (marked with asterisks):

Estimation and Use of Mean and (Co)Variance with Monotonic Missing Data
Keiji Takai*, Kansai University, Japan

Missing not at Random versus Misspecified Distributions: Bias and the Role of Auxiliary Variables
Ke-Hai Yuan*, University of Notre Dame, USA

Mixture Modelling of Treatment Effects with Multiple Compliance Classes and Missing Data.
Michael E. Sobel*, Columbia University, USA
Bengt Muthén, Muthen & Muthen, USA

Bias of the Direct MLE for NMAR Missingness: Theoretical Approach
Yutaka Kano*, Osaka University, Japan

Parallel Session: Cognitive Diagnosis Modeling - Theory II
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-06

Presenters (marked with asterisks):

Statistical Inference of the Q-matrix in Diagnostic Classification Models
Jingchen Liu*, Columbia University, USA
Gongjun Xu, Columbia University, USA
Zhiliang Ying, Columbia University, USA

Examining Attribute Classification Accuracy with General and Specific CDMs When Sample Size Is Small
Guaner Rojas*, Autónoma University of Madrid, Spain
Julio Olea, Autónoma University of Madrid, Spain

A Simulation Study of FCA for Identifying Attributes in Cognitive Diagnostic Assessment
Wenyi Wang*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China
Lihong Song, Jiangxi Normal University, China

Estimating Classification Consistency and Accuracy for Cognitive Diagnostic Assessment
Ying Cui*, University of Alberta, Canada

Cognitive Diagnosis Models with Longitudinal Growth Curves for Skill Knowledge
Elizabeth Ayers*, University of California, Berkeley, USA
Sophia Rabe-Hesketh, University of California, Berkeley, USA

Moderator:

Brian Junker, Carnegie Mellon University, USA

Parallel Session: Item Response Theory - Methodology II
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-07

Presenters (marked with asterisks):

A Comparison of Estimation Methods for Decision Consistency Indexes
Zhen Li*, Beijing Normal University, China
Tao Xin, Beijing Normal University, China

Estimation of Abilities Using the Globally Optimal Scoring Weights under Polytomous IRT Models
Sayaka Arai*, The National Center for University Entrance Examinations, Japan
Shin-ichi Mayekawa, Tokyo Institute of Technology , Japan

Log-linear Item Response Models for Polytomous Data
Zhushan Li*, Boston College, USA

Effects of Using The Reciprocal of the Number of Choices as Lower Asymptote Parameters of the 3PL Model
Yasuko Nogami*, The Japan Institute for Educational Measurement, Inc., Japan
Natsuko Kobayashi, The Japan Institute for Educational Measurement, Inc., Japan
Norio Hayashi, The Japan Institute for Educational Measurement, Inc., Japan

A Three Parameter Item Response Theory Model with Varying Upper Asymptote Effects
Hong Jiao*, University of Maryland, USA
George Macready, University of Maryland, USA
Jianjun Zhu, Pearson Educational Measurement, USA
Weitian An, University of Maryland, USA

Moderator:

Alexander Weissman, Law School Admission Council, USA

Parallel Session: Bayesian Methods and Applications I
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-08

Presenters (marked with asterisks):

A Semiparametric Bayesian Latent Trait Model for Multivariate Mixed Type Data
Jonathan Gruhl*, University of Washington, USA
Elena Erosheva, University of Washington, USA
Paul K. Crane, University of Washington, USA

Bayesian Estimation in Ideal Point Discriminant Analysis
Lixing Zhou*, McGill University, Canada
Yoshio Takane, McGill University, Canada

A Two-Step Approach for Bayesian Propensity Score Analysis
David Kaplan*, University of Wisconsin-Madison, USA
Jianshen Chen, University of Wisconsin-Madison, USA

Comparison of Simple Mediation Analysis: Distribution of the Product, Bootstrap and MCMC Method
Jie Fang*, South China Normal University, China
Min-Qiang Zhang , South China Normal University, China

Simulation Study on the Use of Hierarchical Bayesian Modeling in Expert Judgment for School Based Assessment (SBA) Moderation
Tze-ho Fung*, Hong Kong Examinations and Assessment Authority, Hong Kong

Moderator:

Herbert Hoijtink, Methods and Statistics/University Utrecht, Netherlands

Parallel Session: Multivariate Data Analysis II
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D2-LP-08

Presenters (marked with asterisks):

Fitting Mixed Multi-Dimensional Beta Distribution To Scored Data
Tomoya Okubo*, The National Center for University Entrance Examinations, Japan
Shin-ichi Mayekawa, Tokyo Institute of Technology, Japan

Simple Slops are Not as Simple as You Think
Xidan Chen*, University of North Carolina at Greensboro, USA
Douglas Levine, University of North Carolina at Greensboro, USA

Estimates of Sparse Data Variance Components in the Generalizability Theory Framework
Xiaolan Tan*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Comparing Methods to Evaluate Predictor Importance in Lexicographical Models
Razia Azen, University of Wisconsin - Milwaukee, USA
Shuwen Tang*, University of Wisconsin - Milwaukee, USA
David Budescu, Fordham University, USA

Moderator:

Wei-ming Luh, National Cheng Kung University, Taiwan

Parallel Session: Classical Test Theory - Rater Effects Issue
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D2-LP-09

Presenters (marked with asterisks):

Proposal of Evaluation Model of Teaching, Integrating Difference in Importance of Criteria and Various Student Ratings
Kazuya Ikehara*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

The Effect of the Rater Replacement Procedure on the Measurement Error of Ratings
Yoav Cohen*, National Institute for Testing & Evaluation, Israel

Should first impressions count? Examining Scoring Performance of Raters Who Initially Failed Certification
Kathryn Ricker-Pedley*, Educational Testing Service, USA

Investigating the Agreement Among Statistical Measures of Inter-Rater Agreement: Simulations and Some Empirical Applications
Guangming Ling*, Educational Testing Service, USA

The Formation and Control of Neutralization in Subjective Rating
Bo Wang*, the Chinese University of Hong Kong, Hong Kong

Moderator:

Anders Skrondal, Norwegian Institute of Public Health, Norway

Parallel Session: Differential Item Functioning - New Strategies
Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D2-LP-10

Presenters (marked with asterisks):

A Method for Detecting Differential Item Functioning Using the Bayes Factor
YoungKoung Kim*, The College Board, USA
Matthew Johnson, Columbia University, USA

Iterative MIMIC for DIF detection in Polytomous Items with Small Samples and Many DIF Items
Shuyan Sun*, University of Cincinnati, USA

Differential Item Functioning Detection Using Logistic Regression with SIBTEST Correction and DIF-free-then-DIF strategy
Tien-Hsiang Liu*, National Chung Cheng University, Taiwan
Yeh-Tai Chou, National Chung Cheng University, Taiwan
Ching-Lin Shih, National Sun Yat-Sen University, Taiwan

The Performance of DIF-Free-Then-DIF Strategy in MIMIC method
Chu-Chu Tsai*, National Sun Yat-sen University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

How Many Anchor Items Should be Selected in DIF-Free-Then-DIF Strategy?
Hsuan-Chih Chang*, National Sun Yat-sen University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

Moderator:

Seock-Ho Kim, The University of Georgia, USA

State of Art Talk: It's Alive! A review and Prospect of Measurement Invariance Research

Tuesday, 19 July, 3:00 p.m. – 3:30 p.m., D1-LP-02

Presenter:

Jelte Wicherts, University of Amsterdam, Netherlands

In 1980 Arthur Jensen concluded that cognitive ability tests showed no appreciable bias against minorities and in 2000 Hunter and Schmidt even declared the issue of test bias scientifically dead. However, the over 550 papers that refer to Meredith's (1993) Psychometrika article show that the topic of measurement invariance is more alive than ever.

In this talk I review the literature on measurement invariance in the realm of cognitive ability testing. After introducing the general framework, I shortly criticize the case against measurement bias as expressed by Jensen, Hunter, and Schmidt. I then present the major psychometric approaches to the study of measurement invariance at the item and subtest level. I discuss the links between these approaches, their (dis)advantages, and the findings they typically produce. I argue that failures of measurement invariance should not be dismissed as nuisances but rather as good starting points for more research. Substantively driven research of measurement invariance is illustrated by data from experiments of the effects of stereotype threat on test performance.

Chair:

Roger Millsap, Arizona State University, USA

State of Art Talk: Test Validity: Looking Back and Looking Forward
Tuesday, 19 July, 3:00 p.m. – 3:30 p.m., D1-LP-04

Presenter:

Keith Markus, The City University of New York, USA

The theory of test validity has become more sophisticated over the decades, but invites further development. Looking back, one can discern three distinct change processes that have helped shape test validity theory over the decades: expansion, synthesis, and partition. Looking at the four validity/validation chapters in *Educational Measurement* one finds dramatic shifts in the underlying philosophical orientation. One also finds a consistent narrowing and deepening of the content coverage and emphasis of the chapters. Looking forward, a more fine-grained focus on the interpretation of psychometric models offers a means of making the idea of a construct theory more concrete and also encourages greater emphasis on experimental and quasi-experimental validation research. Alignment of test score interpretation, test use, and validation evidence helps to demarcate the scope of validation, but also leads to a dynamic cyclical model relating these three elements. Finally, the argument based approach to validation has procedural implications for the relationship between validation efforts and test stakeholders. These implications also lead to a more dynamic, cyclical view of test validation.

Chair:

Denny Borsboom, University of Amsterdam, the Netherlands

Invited Symposium : Multiple Imputation and Missing Data
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-03

Organizer:

Joost R. van Ginkel*, Leiden University, The Netherlands

Presenters (marked with asterisks):

A Comparison of Two Multiple Imputation Methods for Categorical Data: Multivariate Imputation by Chained Equations and Latent Class Imputation
Daniël van der Palm*, Tilburg University, The Netherlands
L. Andries van der Ark, Tilburg University, Netherlands
Jeroen K. Vermunt, Tilburg University, Netherlands

Multiple Imputation and (Repeated Measures) Analysis of Variance
Joost R. van Ginkel*, Leiden University, The Netherlands
Pieter M. Kroonenberg, Institute of Education and Child Studies, Netherlands

Some Explorations of the Local and Global Measures of Missing Information
Victoria Savalei*, University of British Columbia, Canada

Robust Two-Stage Approach Outperforms Robust Full Information Maximum Likelihood with Incomplete Nonnormal Data
Carl Falk*, University of British Columbia, Canada
Victoria Savalei, University of British Columbia, Netherlands

Invited Symposium : Structured Component Analysis
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-04

Organizer:

Kohei Adachi, Osaka University, Japan

Presenters (marked with asterisks):

The Generic Subspace Clustering Model
Marieke E immerman*, University of Groningen, Netherlands
Eva Ceulemans, Katholieke Universiteit Leuven, Belgium
Kim De Roover, Katholieke Universiteit Leuven, Belgium

Functional Multiple-set Canonical Correlation Analysis
Heungsun Hwang*, McGill University, Canada
Kwanghee Jung, McGill University, Canada
Yoshio Takane, McGill University, Canada
Todd S. Woodward, McGill University, Canada

Three Kinds of Hierarchical Relations among PCA, Nonmetric PCA, and Multiple Correspondence Analysis
Kohei Adachi*, Osaka University, Japan
Takashi Murakami, Osaka University, Japan

An Equal Components Result for Indscal with Orthogonal Components
Jos M.F. ten Berge*, University of Groningen, Netherlands
Mohammed Bennani, University of Groningen, Netherlands
Jorge N. Tendeiro, University of Groningen, Netherlands

Parallel Session: Cognitive Diagnosis Modeling – Applications
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-06

Presenters (marked with asterisks):

Application of Mixture IRT to Multiple Strategy CDM Analysis
Young-Sun Lee*, Columbia University, USA
Yoon Soo Park, Columbia University, USA

Cognitive Diagnostic Assessment on Primary School Students' Mathematics Word Problem Solving
Chunhua Kang*, Beijing Normal University Zhejiang normal university, China
Tao Xin, Beijing Normal University, China

An Innovative Class-Based Cognitive Diagnostic BW Model and Its Applications
Tsai-Wei Huang*, National Chiayi University, Taiwan

Application of Rule Space Model in Intelligence Tests
Min-Qiang Zhang*, South China Normal University, China
Xiao-Zhu Jian, South China Normal University Jinggangshan University, China

Evaluating the Quality of A Cognitive Model in Mathematics Using the Hierarchical Attribute Method
Cecilia, B. Alves, University of Alberta, Canada
Mark, J. Gierl, University of Alberta, Canada
Hollis Lai, University of Alberta, Canada
Karen Fung*, University of Alberta, Canada

Moderator:

Levent Dumenci, Virginia Commonwealth University, USA

Parallel Session: Item Response Theory - Applications in Ability Measures
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-07

Presenters (marked with asterisks):

Towards Cognitive Response Theory for Today's CAT Practice
Quan Zhang*, Jiaxing University, China

A Paradox in the Study of the Benefits of Test-Item Review
Wim J. van der Linden*, CTB/McGraw-Hill, USA
Minjeong Jeon, University of California, Berkeley, USA
Steve Ferrara, CTB/McGraw-Hill, USA

Comparing IRT and CCT by Examining Their Estimates for Competency
Lun Mo*, FWISD and The University of Memphis, USA
Xiangen Hu, The University of Memphis, USA

Comparing Test Difficulties of NCT English Examiations using Non-linear Factor Analysis
Tatsuo Otsu*, The NCUEE and JST CREST, Japan
Takamitsu Hashimoto, The NCUEE and JST CREST, Japan

Examining Gender Differences in Mathematics Performance Across Grades, Subscales, Racial/Ethnic Groups and Achievement Spectrum
Yvette Beersingh*, Morgan State University, USA

Moderator:

Quan Zhang, Jiaxing University, China

Parallel Session: Bayesian Methods and Applications II
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-08

Presenters (marked with asterisks):

The Effect of Informative Priors on Estimating the Variability of Estimated Variance Components for MCMC procedure
Guangming Li *, South China Normal University, China
Min-Qiang Zhang , South China Normal University, China

A Bayesian Person-Fit Evaluation For Polytomous Response Data
Sebastien Beland*, Universite du Quebec a Montreal, Canada
Herbert Hoijtink, Utrecht University, Netherlands
Gilles Raiche, Universite du Quebec a Montreal, Canada
David Magis, Université de Liège, Belgium

Bayesian Analysis of Random Coefficient Dynamic Factor Models
Hairong Song*, University of Oklahoma, USA

Integrating Concepets of Profile Analysis and Person fit: An application to the Computerized Test System of the German Federal Employment Agency
Safir Yousfi*, German Federal Employment Agency, Germany

Evaluating Latent Monotonicity Using Bayes Factors
Jesper Tijmstra*, Utrecht University, Netherlands
David J. Hessen, Utrecht University, Netherlands
Herbert Hoijtink, Utrecht University, Netherlands
Peter G. M. van der Heijden, Utrecht University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

Moderator:

Iwin Leenen, Investigación y Evaluación, Mexico

Parallel Session: Multivariate Data Analysis III
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D2-LP-08

Presenters (marked with asterisks):

Assessing Win-or-Loss Team Performance in Playoff Competitions by Diffusion Algorithm of Network Analysis
Nan-Yi Wu*,National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

Rank Based Polychoric Correlation
Johan Lyhagen, Uppsala University, Sweden
Petra Ornstein*, Uppsala University, Sweden

Modeling Group-Mean Differences of Emotion Factors by Parafac2
Sungjin Hong*, University of Illinois at Urbana-Champaign, USA

Sampling Distribution's Effect on the Significance Result and Effect Size
Can Jiao*, Shenzhen University, China
Min-Qiang Zhang, South China Normal University, China

Moderator:

Ralph Carlson, The University of Texas Pan American, USA

Parallel Session: Practical Considerations of Computerized Adaptive Testing
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D2-LP-09

Presenters (marked with asterisks):

A Comparison of Item Exposure Methods in Computerized Adaptive Testing
Ming-Yong Li*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Xiao-Zhu Jian, South China Normal University, China

Using the Information-Stratified Method to Control Item Exposure in Computerized Adaptive Testing
Yung-Tsai Chien*, National Taichung University, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Hsiao-Chu Chen, National Taichung University, Taiwan

How would Mixed Item Selection Approach Work with Weighted Deviation Model and Shadow Test Assembly for Constrained Adaptive Testing?
Chi Keung Eddie Leung*, The Hong Kong Institute of Education, Hong Kong

Integrating the Stocking and Lewis Conditional on Ability Procedure with the Maximum Priority Index in Computerized Adaptive Testing
Ya-Hui Su*, National Chung Cheng University, Taiwan
Yan-Lin Huang, National Chung Cheng University, Taiwan

Improving the Efficiency of Stratification Procedures in Computerized Adaptive Testing
Jyun-Hong Chen*,National Chung Cheng University, Taiwan
Shu-Ying Chen, National Chung Cheng University, Taiwan

Moderator:

Alexander Weissman, Law School Admission Council, USA

Parallel Session: Differential Item Functioning - Applications
Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D2-LP-10

Presenters (marked with asterisks):

The Functional Equivalence of the PISA 2006 Science Assessment between Hong Kong and Mainland Chinese Students
Xiaoting Huang*, Peking University, China

A Comparison of Methods for Investigating Longitudinal Measurement Invariance in the Study of Growth over Time
Betsy J. Feldman*, University of Washington, USA
Katherine E. Masyn, Harvard University, USA
Shubhabrata Mukherjee, University of Washington, USA
Paul K. Crane, University of Washington, USA

Investigating Socially Desirable Responses Using DIF
Priyalatha Govindasamy, University Science Malaysia, Malaysia
Saw Lan Ong*, University Science Malaysia, Malaysia

A DIF and Facets Analysis of a Chinese as Second Language Course Test
Keling Yu*, The Hong Kong Institute of Education, Hong Kong

Are Tes Analogi Verbal (TANAVA) Free from Gender Bias?
Aries Yulianto*, University of Indonesia, Indonesia

Moderator:

Terry Ackerman, University of North Carolina at Greensboro, USA

Travel Award & Lifetime Achievement Award Announcement
Tuesday, 19 July, 5:30 p.m. -- 5:45 p.m., D1-LP-02

Psychometric Society Travel Award Winners:
Shuyan Sun, University of Cincinnati, USA
"Iterative MIMIC for DIF detection in Polytomous Items with Small Samples and Many DIF Items"

In-Hee Choi, University of California, Berkeley, USA
"Mixture Extensions of the Linear Logistic Test Model (LLTM) using Markov Chain Monte Carlo (MCMC) Estimation"

Younyoung Choi, University of Maryland, USA
"Dynamic Bayesian Inference Network for Modeling Learning Progressions over Multiple Time Points"

ETS Travel Award Winner:

Josine Verhagen, University of Twente, The Netherlands
“Analyzing Longitudinal Survey Data: A Bayesian IRT Model with Occasion-Specific Item Parameters”

Host:

Terry Ackerman, University of North Carolina at Greensboro, USA

Psychometric Society Lifetime Achievement Award Winner:

Bengt Muthén, University of California, Los Angeles, USA

Host:

Klaas Sijtsma, Tilburg University, Netherlands

Opening Reception

Tuesday, 19 July, 5:45 p.m. -- 6:00 p.m., Lower Podium Floor of Block D1 & D2

All participants are warmly invited to attend the opening reception. Snacks and drinks will be served.

Poster Session I

Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m., Lower Podium Floor of Block D1 & D2

Poster Presenters (marked with asterisks):

Organizational Work Passion for Workers' Behavior and Attitude—The Moderating Role of Organizational Commitment

Xiaopeng Li*,South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Empirical Study of Organizational Commitment about Victoria, Chinese Bilingual Teachers

Guixiong Liu*,Xinjiang Normal University, China
Min-Qiang Zhang, South China Normal University, China

Research on the Relationship Between Personality and Social Network Positions of High School Students

Shao qi Ma*,South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Nan nan Zhang, South China Normal University, China
Can Jiao, Shenzhen University, China

The Influence of Test Development on the Accuracy of KS - P Model

Yuna Han*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Xiao-Zhu Jian, South China Normal University, China

Psychometric Assessment of the Patient Activation Measure Short Form (PAM-13) in Rural Settings

Man Hung*, University of Utah, USA
Matthew Samore, University of Utah, USA
Marjorie Carter, University of Utah, USA

College Students' Perception of a Gender Course in Taiwan: Test of Gender and Age Variables

Su-Fen Liu*, National Pingtung Institute of Commerce, Taiwan

Analysis of a Mediated (Indirect) Moderation Model
Geert van Kollenburg*, Tilburg University, Netherlands
Marcel A. Croon, Tilburg University, Netherlands

Bayesian Analysis of Change in Educational Testing Using Generalized Linear Mixed Model with Dirichlet Process
Keng-Min Lin*, National Taiwan Normal University, Taiwan
Rung-Ching Tsai, National Taiwan Normal University, Taiwan

Evaluation of Mean and Covariance Structure Analysis Model in Detecting Differential Item Functioning of Polytomous Items
Rung-Ching Tsai*, National Taiwan Normal University, Taiwan
Ming-Jin Ke, National Taiwan Normal University, Taiwan

The Impact of Brand Equity on Cost of Borrowing
Byron Y. Song, Concordia University, Canada
Jooseop Lim*, Concordia University, Canada
Jeong Bon Kim, City University of Hong Kong, Hong Kong

Using Structural Equation Modeling to Estimate Composite Reliability in Hierarchical Modeling
Jinlu Tu*, Shanxi Normal University , China
Xuqun You, Shanxi Normal University , China

A Comparison of the Different Developmental Trajectories of the Perception of Mental Health Problems in Taiwanese Adolescents
Sieh-Hwa Lin*,National Taiwan Normal University, Taiwan
Pei-Jung Hsieh, National Academy for Educational Research, Taiwan

Undergraduate Students‘ Attitudes Toward Statistic
Fitri Ariyanti *, Padjadjaran University, Indonesia
Ratna Jatnika, Padjadjaran University, Indonesia

A Bayesian Parameter Simulation Approach to Estimating Mediation Effects with Missing Data
Fairchild Amanda*, University of South Carolina, USA
Enders Craig, Arizona State University, USA

A study of the Factors Related to Mathematics Achievement and Literacy on Large-Scale Assessment

Shin-Huei Lin*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

A Study of the Relationship between Mathematics Learning Disposition and Achievement of Sixth Grade Students

Yi-Chun Cheng*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

The Longitudinal Study of the Relationships between the Goal Orientations and Mathematics Achievements

Chang-Sheng Wang*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

The Effect of Exposure Control in Testlet-Based CAT

Wen-Shin Lin*, The University of Tainan, Taiwan
Chiou-Yueh Shyu, The University of Tainan, Taiwan

The Predictive Effects of Cognitive Components for Item Difficulty Variance of ASAP-ENG

Pei-Ju Sung*, National University of Tainan, Taiwan
Pi-Hsia Hung, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

The Contribution of Dynamic Assessment to Screen Mathematics Learning Disabilities

Li Jin Zhang*, Ningxia University, China
Zhen Feng Zhang, Ningxia University, China

The Development of the Statistical Literacy Assessment and the Scale of Statistical Attitudes for College Students in Taiwan

Yu-Ning Chao*, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

A Model of Cognitively Diagnostic Base on Q Matrix——Classifying Model of the Probability of Attributes' Mastery

Jinxin Zhu*, Fuyong Secondary School, China
Shumei Zhang, Beijing Normal University, China
Tao Xin, Beijing Normal University, China

A Study of Identifying Response Fake Using Person Fit Indexes

Sunghoon Kim*, Yonsei university, South Korea
Hee-Won Yang, Yonsei university, South Korea
Guemin Lee, Yonsei university, South Korea

Applying Cognitive Diagnosis Modeling to Psychological Diagnostic Test for More Information

Yoon Jung Kwon*,Sungkyunkwan University, South Korea

Principal Instructional Leadership Framework in China

Qian Zhao*, Beijing Normal University, China
Gang Li, Beijing Normal University, China

The Development and Implementation of The Assessment of Hierarchical Intrinsic and Extrinsic Motivation for Mathematics

Li-Yu Lin*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

Effectiveness of CATSIB on Computer Adaptive Sequential Tests

Hollis Lai*, University of Alberta, Canada
Johnson Ching Hong Li, University of Alberta, Canada
Mark, J. Gierl, University of Alberta, Canada

Perceived Family Support Moderates The Association Between Affiliate Stigma and Depression Among Caregivers of Children With Developmental Delay

Chia-Wei Hsiao*, National University of Tainan, Taiwan
Chien-ho Lin, Chimei Medical Hospital National University of Tainan, Taiwan
Pi-Hsia Hung, National University of Tainan, Taiwan

Rater Subjectivity in the Development of Imagination Test for University Student
Chi-Chan Chen*, National Taichung University of Education, Taiwan
Cheng-Te Chen, National Tsing Hua University, Taiwan
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

Internet Addiction Disorder: Categories or Dimensions?
Wenchao Ma*, Beijing Normal University, China
Yufang Bian, Beijing Normal University, China
Fang Luo, Beijing Normal University, China

Dimensionality and Item-Wording Effect of the Chinese Rosenberg Self-Esteem Scale
Yi-Chang Cheng*,National Cheng Kung University, Taiwan
Wei-ming Luh, National Cheng Kung University, Taiwan

The Study of the New Immigrant Children's Academic Achievement, Learning Belief and Learning Interests in Taiwan
Pei-Ching Chao*, National Chengchi University, Taiwan
Min-Ning Yu, National Chengchi University, Taiwan
Jia-Jia Syu, National Chengchi University, Taiwan
Po-Lin Chen, National Chengchi University, Taiwan
Pei-Chun Chung, National Chengchi University, Taiwan

Analysis on Characteristics of Diagnostic Test for Depression in Koreans
Seowoo Lee*, Pusan National University, South Korea
Daeyong Lee, Pusan National University, South Korea
Dahee Shim, Pusan National University, South Korea
Sukwoo Kim, Pusan National University, South Korea
Seock-Ho Kim, The University of Georgia, USA

Study on the Immigrant Student Mathematics Achievement Impacted Factors: Taiwan's Grade 8 in TIMSS 2007
Fang-chung Chang*, National Taipei University, Taiwan

Gender Differential Item Functioning Across Taiwan, Shanghai, Hong Kong & Macao for PISA 2009 Reading Assessment

Song-Wei Ma*, National University of Tainan, Taiwan
Pei-Ming Chiang, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan

Asian Students' Achievement Motivation: Orientations and Characteristics

Shanshan Zhang*, Ministry of Education of China, China
Hongyun Liu, Beijing Normal University, China
Kit-Tai Hau, The Chinese University of Hong Kong, Hong Kong

The Rater Effect and Differential Item Functioning of Cognitive Tests In International Civic and Citizenship Education Study

Chun-Hao Tao*, National Taiwan Normal University, Taiwan
Po-Hsi Chen, National Taiwan Normal University, Taiwan
Mei-Hui Liu, National Taiwan Normal University, Taiwan
Yao-Ting Sung, National Taiwan Normal University, Taiwan

Modification of The Hierarchy Consistency Index

Shuliang Ding*, Jiangxi Normal University, China
Mengmeng Mao, Jiangxi Normal University, China

Growth After Trauma: Validating Post Trauma Thriving Scale in the Philippines

Imelu Mordeno*, Universidade de Sao Jose, Macau

A Study on the Accuracy of Score Report in Computerized Adaptive Testing

Chiou-Yueh Shyu*, The National University of Tainan, Taiwan

Development of Learning Motivation Test for Pupils based on the forms of self-report and semi-projective

Guang Li*, Hunan Normal University, China
Lu Jiang, Hunan Normal University, China
Miewen Yan, Hunan Normal University, China
Yangming Zhou, Hunan Normal University, China
Xiang Li, Hunan Normal University, China

Development of Learning Preference Scale for Pupils Based on GGUM and CTT

Yongbo Li*, Hunan Normal University, China
Danghui Shi, Hunan Normal University, China
Ying Long, Hunan Normal University, China
Dai Zheng, Hunan Normal University, China
Jiuyuan Tang, Hunan Normal University, China

Development of Self-confidence Questionnaire for Pupils Based on CTT and IRT Unfolding Model

Danghui Shi*, Hunan Normal University, China
Xingjie Qu, Hunan Normal University, China
Fusheng Xie, YueLu Teachers' College for Vocational Studies, Changsha, China
fanmei Zeng, Hunan Normal University, China
Zi Zhao, Hunan Normal University, China

Dynamic and Comprehensive Item Selection Strategies for Computerized Adaptive Testing Based on Graded Response Model

Fen Luo*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China
Xiaoqing Wang, Jiangxi Normal University, China

Construction of Learning Attitude Test for Pupils Based on IRT Unfolding Model

Xingjie Qu*, Hunan Normal University, China
Fusheng Xie, Yuelu Teachers' College for Vocational Studies , China
Wen Tan, Hunan Normal University, China
Yan Mao, Hunan Normal University, China
Xiyou Cheng, Hunan Normal University, China

The Effect of Student's Self-Confidence, Positve Affect and Teachers' Expectations on Science Achievement

Fu-An Chi*, National Chung Hsing University, Taiwan
Jen Jang Sheu, National Chung Hsing University, Taiwan

Classification Consistency for Test Scores Composed of Testlets under IRT and non-IRT Approaches

So Yoon Park*, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

Teachers' Expectations on Students Science Achievements:Evidence From Timss 2007
Cindy Wu*, National Chung Hsing University, Taiwan
Jen Jang Sheu, National Chung Hsing University, Taiwan

The Development of Computerized Bodily-Kinesthetic Test
Yung Chih Ou*,National Taiwan Normal University, Taiwan
Po-Hsi Chen, National Taiwan Normal University, Taiwan

Sensation Seeking and Tobacco and Alcohol Use Among Adolescents: A Mediated Moderation Model
Baojuan Ye*, South China Normal University, China
Dongping Li, South China Normal University, China
Qishan Chen, South China Normal University, China
Yanhui Wang , Jiaying University, China

Scoring Thresholds Setting for Open-Ended Items on Double-Marking Online System
Lina Wang*, Beijing Normal University, China
Bo Wang, The Chinese University of Hong Kong , China
Hong-Sheng Che, Beijing Normal University, China
Meng Chen, Beijing Normal University, China
Ran Bian, Beijing Normal University, China

Devising a Moral Judgment Test for The Measurement of Care: A Lost Dimension From A Psychometric Perspective
Huan-Wen Chen*,National University of Tainan, Taiwan

The Effects of Music Learning in Elementary School Through The Dalcroze Eurhythmics
Mei-lin Chen*, National Taiwan University of Art, Taiwan

Solving Complex Optimization Problems With Many Parameters By Means of Optimally Designed Block-Relaxation Algorithms
Tom F. Wilderjans*,Katholieke Universiteit Leuven, Belgium
Iven Van Mechelen, Katholieke Universiteit Leuven, Belgium
Dirk Depril, Katholieke Universiteit Leuven, Belgium

Using the Rasch Testlet Model To Detect Testlet DIF In Chinese Passage-Based Reading Testing

Congying Guo*, Beijing Normal University, China
Yufang Bian, Beijing Normal University, China

The Development of the Chinese Janusian Thinking Test for College Students

Wei-Chun Li*, National Taitung University, Taiwan

Fixed Parameter Calibration Methods and Its Application to DIF Analysis in Online Calibration Designs

Fabiola Gonzalez-Betanzos, Autonoma University of Madrid, Spain
Francisco J. Abad*, Autonoma University of Madrid, Spain
Juan Ramon Barrada, Autonomous University of Barcelona, Spain

Evaluating the Consistency of Verbal Reports and the Use of Cognitive Models in Educational Measurement

Xian Wang*, University of Alberta, Canada .
Jacqueline P. Leighton, University of Alberta, Canada

Assessing fit of the DINA models

Jung Yeon Park*, Columbia University, USA

Teacher's Beliefs, Attitudes, and Professional Development: A Cross-Country Analysis Using Multilevel Modeling

Chi Chang*, Michigan State University, USA

A New Cognitive Diagnosis Model for Analyzing Multiple-Choice Options

Koken Ozaki*, The Institute of Statistical Mathematics, Japan

Main Conference, Wednesday, 20 July, 2011

Invited Talk: Observed-Score Test Equating--Science or Art?
Wednesday, 20 July, 9:00 a.m. – 9:40 a.m., D1-LP-02

Presenter:

Alina A. von Davier, Educational Testing Service, USA

This presentation will provide an overview of the observed-score equating (OSE) process in the historical context of standardized educational assessments. The overview will be presented from the perspective of a unified equating framework that covers all the existing OSE methods (von Davier, 2011), including IRT observed-score equating and local equating (van der Linden, 2000; Wiberg, van der Linden, von Davier, in progress). The presentation will also discuss challenges to the equating process and approaches to equating evaluation. The application of quality control tools to monitor the scores over time will be briefly described. The policy around the use of test scores, the constraints on the of the scale scores, the shifts in demographics, and their implications for the choice of specific equating methodologies will be analyzed.

Chair:

Rob Meijer, University of Groningen, the Netherlands

Invited Talk: Separating Between- and Within- Group Associations for Categorical Variables?

Wednesday, 20 July, 9:00 a.m. – 9:40 a.m., D1-LP-04

Presenter:

Marcel A. Croon, Tilburg University, Netherlands

In social and behavioural research data are often collected by means of surveys in samples of respondents or subjects (Level 1 units) which are nested within groups, teams, or organization (Level 2 units). Variables observed in such studies may be either measured at the lower individual level or at the higher group level. Analysis of such data is often carried by first aggregating the individual data to the group level, and then analyzing the association among the variables at the group level. However, results of analyses on aggregated data may be misleading since the association among the variables at the group level after aggregation not only reflects between-group variation, but also within-group variation. Moreover, in the interpretation of the results the risk of succumbing to the ecological fallacy is real: it is often forgotten that the conclusions only apply at the group level, and cannot be generalized to the individual level.

The data from such two-level studies require techniques which neatly separate the between- and within-group association among the variables. For continuous variables measured at the level of an interval scale, such techniques have been developed during the last two decades. Two-level factor analysis, two-level path analysis, and, in general, two-level structural equation models can be almost routinely carried out by the available software programs like LISREL, EQS, and Mplus.

For categorical data it is less clear how between- and within-group associations can be estimated separately. Two different proposals to achieve this results will be discussed and compared. Both approaches start from basic log-linear models for describing the association among the variables. The first approach uses the persons-as-indicators perspective and treats the scores of the individuals on the variables measured at the lower level as exchangeable indicators for a latent variable defined at the group level. The second approach also treats the groups as the units of analysis, but considers the individuals as repeated measures of a variable defined on the group level.. Both approaches yield maximum likelihood estimates of the model parameters.

Although both approaches have much in common, they differ with respect to the way in which they treat variables measured at the higher level. In this lecture both approaches will be compared. An important criterion to compare both approaches is the ease with which they allow the analysis according to complex measurement and path models. Comparison of both

models will be illustrated by analyses on simulated and real data, all carried out by means of LatentGold™.

Chair:

Matthias von Davier, Educational Testing Service, USA

Keynote Address: Bayesian Structural Equation Modeling: An Overview and Some Recent Developments

Wednesday, 20 July, 9:50 a.m. – 10:45 a.m., C-LP-11

Presenter:

Sik-Yum Lee, The Chinese University of Hong Kong, Hong Kong

In this talk, we first give an over view of a Bayesian approach which is effective in handling subtle structural equation models with complex data structures. Then, we illustrate the flexibility of this approach through applications in analyzing two models. One is a two-level longitudinal structural equation model for assessing various dynamic characteristics; while the other is a model with a general non-parametric structural equation defined by Bayesian P-splines. Some empirical results are provided.

Chair:

Wen Chung Wang, The Hong Kong Institue of Education, Hong Kong

Invited Symposium : Cognitive Diagnosis Modes, Item Response Theory, Mixture IRT, Latent Transitions Models, The Many Faces of Latent Class Analysis
Wednesday, 20 July, 11:10 a.m. – 12:30 a.m., D1-LP-03

Organizer:

Matthias von Davier, Educational Testing Service, USA

Presenters (marked with asterisks):

Extended LogLinear Rasch Models
Henk Kelderman*, VU University Amsterdam, The Netherlands

A Variational Approximation Estimation Method for the Item Response Theory Model with Random Item Effects across Groups
Frank Rijmen*, Educational Testing Service, USA

Why Latent Class Models Are Cognitive Diagnosis Models – Or The Other Way Around…
Matthias von Davier*, Educational Testing Service, USA
Xueli Xu, Educational Testing Service, USA
Kentaro Yamamoto, Educational Testing Service, USA

Invited Symposium : New Directions with Intensive Longitudinal Data
Wednesday, 20 July, 11:10 a.m. – 12:30 a.m., D1-LP-04

Organizer:

Kathleen M. Gates, The Pennsylvania State University, USA

Presenters (marked with asterisks):

Parallelism, Ergodicity, and Psychological Explanations
Keith A. Markus*, The City University of New York, USA

Accommodating Nonergodicity Across Individual Processes Using an Alternative to Granger Causality
Kathleen M. Gates*, The Pennsylvania State University, USA
Peter C. M. Molenaar, The Pennsylvania State University, USA
Michael J. Rovine, The Pennsylvania State University, USA
Nilam Ram, The Pennsylvania State University, USA

Modeling the Dynamics in Physiological Arousal between Children with Sensory Processing Disorder and Therapists during Psychotherapy
Siwei Liu*, The Pennsylvania State University, USA
Peter C. M. Molenaar, The Pennsylvania State University, USA
Michael J. Rovine, The Pennsylvania State University, USA
Matthew Goodwin, The Pennsylvania State University, USA

Time-Varying Effect Model of Intensive Longitudinal Data: An Application to Smoking Cessation Behavior
Mariya Shiyko*, The Pennsylvania State University, USA
Xianming Tan, The Pennsylvania State University, USA
Runze Li, The Pennsylvania State University, USA
Saul Shiffman, The University of Pittsburgh, USA

Parallel Session: Equating and Linking
Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m. , D1-LP-06

Presenters (marked with asterisks):

Comparison of Small-Sample Equating Methods for Mixed-Format Tests in a NEAT Design
Euijin Lim*, Yonsei University, South Korea
Hwangkyu Lim, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

Considerations to Evaluate Equating Results Based on IRT Calibration and Equating
Yue Zhao*, The Hong Kong Institute of Education, Hong Kong

The Comparison of IRT Equating Methods and Link Plans in Large Scale Assessment
Yan Gao*,Beijing Normal Univeersity, China
Tingting Yang, Beijing Normal Univeersity, China
Tao Yang, Beijing Normal Univeersity, China
Mengjie He, Beijing Normal Univeersity, China

Comparison of Multiple-Group and Single-Group Calibration Methods for Linking
Won-Chan Lee*, University of Iowa, USA
Ja Young Kim, University of Iowa, USA

Performance Evaluation of Plausible Value Method in the Equated Tests
Shiau-Chian Tseng*, National Taichung University, Taiwan
Huey-Min Wu, National Academy for Educational Research, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Kai-Chih Pai, National Taichung University, Taiwan

Moderator:

Han-Dau Yau, National Taiwan Sport University, Taiwan

Parallel Session: Item Response Theory - Applications
Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m. , D1-LP-07

Presenters (marked with asterisks):

Estimation of Classification Accuracy and Consistency under Item Response Theory Models
Ying Cheng*, University of Notre Dame, USA
Cheng Liu, University of Notre Dame, USA

Development and Validation of Learning Progression for the Oxidation-Reduction: A Rasch Measurement Approach
Kun-Shia Liu*, National Sun Yat-sen University, Taiwan
Ying-Yao Cheng, National Sun Yat-sen University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

A Rasch Approach to Measure Undergraduates' Key Competence
Li-Ming Chen*, National Sun Yat-sen University, Taiwan
Ching-Lin Shih, National Sun Yat-sen University, Taiwan
Paichi Pat Shein, National Sun Yat-sen University, Taiwan
Kun-Shia Liu, National Sun Yat-sen University, Taiwan
Ying-Yao Cheng, National Sun Yat-sen University, Taiwan

Item Response Theory Analyses of Adult Self-Ratings of the ADHD Symptoms in the Current Symptoms Scale
Rapson Gomez*, University of Tasmania, Australia

Explanatory Person-Fit Analysis in Clinical Practice
Judith Conijn*, Tilburg University, Netherlands
Wilco Emons, Tilburg University, Netherlands
Marcel van Assen, Tilburg University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

Moderator:

Catherine McClellan, Educational Testing Service, USA

Parallel Session: Missing Data
Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m. , D1-LP-08

Presenters (marked with asterisks):

Comparing Imputaion Using Differnt Partitions of Data for Latent Class Models
Ting Hsiang Lin*, National Taipei University, Taiwan
Cheng Ken Wu, , Taiwan

Differential Item Functioning (DIF) Analysis under Missing-Data Imputation Framework (MI-DIF)
Gee Hune Kim*, Columbia University, USA

Treatment of Missing Data in the Test Adopting both Basal and Ceiling Rules
Wei He*, Northwest Evaluation Association (NWEA), USA

An Estimation Method for Parameters of Two Multinomial Populations under the Stochastic Ordering with Sparse or Missing Data
Lixin Meng*,Northeast Normal University, China
Jian Tao, Northeast Normal University, China
Xiang Bin Meng, Northeast Normal University, China

Moderator:

Rob R. Meijer, University of Groningen, Netherlands

Parallel Session: Multivariate Data Analysis IV
Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m. , D2-LP-08

Presenters (marked with asterisks):

Social Network Models for Educational Interventions
Brian Junker*, Carnegie Mellon University, USA
Tracy Sweet, Carnegie Mellon University, USA

Regularized K-means Clustering with Variable Weighting
Yutaka Nishida*, Osaka University, Japan

The Different Choice of Basis Functions in Functional Data Conversion
Minping Xiong*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Functional Analysis of Variance for Data from ERPs
Shuyi Liang*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Minping Xiong, South China Normal University, China

Evaluating Order Constrained Hypotheses for Circular Data using Permutation Tests
Irene Klugkist*, Utrecht University, Netherlands
Jessie Bullens, Utrecht University, Netherlands
Albert Postma, Utrecht University, Netherlands

Moderator:

Frans E.S. Tan, Maastricht University, The Netherlands

Parallel Session: E-testing
Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m. , D2-LP-10

Presenters (marked with asterisks):

The Development of Concerto : An Open Source Online Adaptive Testing Platform
Michal S. Kosinski*, University of Cambridge, UK
John N. Rust, University of Cambridge, UK

The Development of Computer-based Case Simulations for Psychological Counseling
Peng Wang*,Jiangxi Normal University & Shandong Normal University, China
Haiqi Dai, Jiangxi Normal University, China

Building Affordable CD-CAT Systems for Schools To Address Today's Challenges In Assessment
Hua-Hua Chang*, University of Illinois at Urbana-Champaign, USA

Developing an e-Assessment System for English and Putonghua Learning
Kenneth Wong*, Caritas Institute of Higher Education, Hong Kong
Reggie Kwan, Caritas Institute of Higher Education, Hong Kong
Kat Leung, Caritas Institute of Higher Education, Hong Kong
Philip Tsang, Caritas Institute of Higher Education, Hong Kong

Developing a Computerized Performance Assessment Tool for Sensory Integration
Chin-Kai Lin*, National Taichung University of Education, Taiwan
Huey-Min Wu, National Academy for Educational Research, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan

Moderator:

Bor-Chen Kuo, , National Taichung University, Taiwan

Social Event: Hong Kong Tour

The city tour is scheduled from 14:00 p.m. to 22:30 p.m. on 20 July 2011, when there are no other sessions and events scheduled at the same time.

Note:

City tour participants please bring along your registration confirmation e-mail printout and gather at the registraion area of the conference on 13:45 p.m. of 20 July, 2011.

Main Conference, Thursday, 21 July, 2011

Invited Talk: Causal Inference Framework for Latent Variable Modeling: Application to Test-Equating and Causal Effect Estimation in Latent Variables
Thursday, 21 July, 9:00 a.m. – 9:40 a.m., D1-LP-02

Presenter:

Takahiro Hoshino, Nagoya University, Japan

In the social and behavioral sciences, the treatments or factors that the researchers are interested in are usually difficult to manipulate/assign randomly.
In such cases, simple multiple group comparisons assuming random assignment can yield severely biased results due to nonrandom assignment.
Rubin causal model incorporating potential outcomes and the assignment mechanism has recently been used as a general framework for dealing with nonrandom assignment or nonrandom sampling, and several estimation methods have been developed based on this approach in order to avoid bias due to nonrandom assignment.
In this talk I will review some recent developments in causal modeling approach and show that this approach is very useful in various psychometric models. For example, potential outcome modeling for nonequivalent group equating design reveals that this design requires stronger assumption than Missing-at-random. Moreover, multiple group item response modeling of potential outcome can incorporate nonrandom selection of test forms based on examinees' abilities or potential outcomes that are not dealt with adequately in previously proposed models.

Various causal effect estimation methods in structural equation modeling and hierarchical modeling will be also addressed in this talk.

Chair:

Yutaka Kano, Osaka University, Japan

Invited Talk: Menu Choice Modeling
Thursday, 21 July, 9:00 a.m. – 9:40 a.m., D1-LP-04

Presenter:

Wagner A. Kamakura*, Duke University, USA
Kyuseop Kwak, University of Technology Sydney, Australia

This study focuses on the menus typically found in the marketplace (e.g., restaurants and Internet vendors), where the consumer may choose one or more from dozens of options or menu items, each at a posted price or fee. We show that modeling choices out of the typical menu leads to the "curse of dimensionality," which transpires in two ways. First, the number of interactions among menu items grows disproportionately to the number of items in the menu. Second, because of these interactions, the choice set (all possible menu selections) grows geometrically with the number of items in the menu. We propose a menu choice model that circumvents these two problems in a feasible and flexible, but parsimonious way. We then apply and test the proposed model on data from both Monte-Carlo simulations and an actual choice experiment where a sample of consumers was asked to make choices from eight menus combining a base system and a subset among 25 optional features.

Chair:

Herbert Hoijtink, University Utrecht, the Netherlands

Keynote Address: Using Explanatory Unfolding Models in Prediction of Sensory Judgment and Choice

Thursday, 21 July, 9:50 a.m. – 10:45 a.m., C-LP-11

Presenter:

Willem J. Heiser, Leiden University, Netherlands

Unfolding models account for proximity data by single-peaked response functions. Two paradigms can be distinguished under which these models have been developed. In the Judge Response (JR) paradigm, unfolding provides scale values for the stimulus objects under study; the response functions describe differences between judges. In the Item Response (IR) paradigm, unfolding provides scale values for the persons under study (scores); here, the response functions describe differences between items.

Explanatory unfolding models reparametrize the scale values in terms of independent stimulus characteristics (in the JR paradigm) or person characteristics (in the IR paradigm). They may also reparametrize the single-peaked response functions in terms of independent judge characteristics (JR) or item characteristics (IR).
Introduction of the independent characteristics—or explanatory variables—into the problem has the advantage that it turns a measurement model into a prediction model. Explanatory unfolding has been more developed in the JR paradigm than in the IR paradigm. Therefore, two recent techniques are illustrated with judgment and choice data from the sensory domain.

Chair:

Mark Wilson, University of California at Berkeley, USA

Invited Symposium : Categorical Marginal Models
Thursday, 21 July, 11:10 a.m. – 12:30 a.m., D1-LP-03

Organizer:

L. Andries van der Ark , Tilburg University, The Netherlands

Presenters (marked with asterisks):

Marginal Models for Dependent, Clustered, and Longitudinal Categorical Data.
Wicher P. Bergsma*, London School of Economics, UK
Marcel A. Croon, Tilburg University, The Netherlands
Jacques A. Hagenaars, Tilburg University, The Netherlands

Estimating Categorical Marginal Models for Large Sparse Contingency Tables
L. Andries van der Ark*, Tilburg University, The Netherlands
Wicher P. Bergsma, London School of Economics, UK
Marcel A. Croon, Tilburg University, The Netherlands

Testing Cronbach's Alpha Using Feldt's Approach and a New Marginal Modeling Approach
Renske E. Kuijpers*, Tilburg University, The Netherlands
L. Andries van der Ark , Tilburg University, The Netherlands
Marcel A. Croon, Tilburg University, The Netherlands

Marginal Models for Longitudinal Categorical Data from a Complex Rotating Design
Marcel A. Croon*, Tilburg University, The Netherlands
Wicher P. Bergsma, London School of Economics, UK
Jacques A. Hagenaars, Tilburg University, The Netherlands
Francesca Bassi, University of Padova, Italy

Symposium : Cognitive Diagnostic Computerized Adaptive Testing: Key Issues on Item Selection Algorithm

Thursday, 21 July, 11:10 a.m. -- 12:30 a.m., D1-LP-04

Organizer:

Hua-Hua Chang, University of Illinois at Urbana-Champaign, USA

Presenters (marked with asterisks):

A Comparative Study of Item Exposure Control Methods in Cognitive Diagnostic Computerized Adaptive Testing
Ping Chen*, Beijing Normal University, China
Tao Xin, Beijing Normal University

Generalized Monte Carlo Approach in Cognitive Diagnostic Computerized Adaptive Testing with Content Constraints
Xiuzhen Mao*, Beijing Normal University, China
Tao Xin, Beijing Normal University

Research on Item-Selection Strategy of Computerized Adaptive Cognitive Diagnostic Testing
Zhihui Wu*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China
Gan Dengwen, Jiangxi Normal University, China

The Improved Maximum Priority Index Method and its Application in Cognitive Diagnostic Computerized Adaptive Testing
Yirao Pan*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China

Parallel Session: Measurement Issues
Thursday , 21 July, 11:10 a.m. -- 12:30 p.m., D1-LP-06

Presenters (marked with asterisks):

The Review of Two Methods of Questionnaire and Dimension - Traditional Methods and Facet Theory
Li Zhang*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Does Increasing Number of Points in Likert Scale Better Approaches Normality?
Huiping Wu*, Central China Normal University, China
Shing On Leung, University of Macau, Macau

Exploring Added Value Subscores with Item Topic Modeling
Makoto Sano*, Prometric Japan Co., Ltd., Japan

A Random Sampling Inspection Model for Performance Measurement: An Alternative to IRT
Zhong'en Xi*, Chongqing University of Post and Telecommunications, China

Moderator:

Mark Wilson, University of California, Berkeley, USA

Parallel Session: Rasch Models - Methodology
Thursday, 21 July, 11:10 a.m. -- 12:30 p.m., D1-LP-07

Presenters (marked with asterisks):

Traps of the Bootstrap
Rainer Alexandrowicz*, Alps-Adria-University Klagenfurt, Austria
Clemens Draxler, Ludwig-Maximilians-University Munich, Germany

Reducing Item Difficulty Estimation Bias in the Rasch Model Caused by Guessing: A Weighted Conditional Likelihood Approach
Christof Schuster*, Univeristy of Giessen, Germany
Ke-Hai Yuan, University of Notre Dame, USA

Applying the Rasch Sampler to Identify Aberrant Responding by Person Fit Statistics under Fixed α-level
Christian Spoden*, University of Duisburg-Essen, Germany
Jens Fleischer, University of Duisburg-Essen, Germany
Detlev Leutner, University of Duisburg-Essen, Germany

Optimizing Distribution of Rating Scale Category in Rasch Model
Han-Dau Yau*, National Taiwan Sport University, Taiwan
Wei-Che Yao, National Taiwan Sport University, Taiwan

Monitoring Compromised Items on Live Exams
Shu-Chuan Kao*, Pearson, USA
John Stahl, Pearson, USA

Moderator:

Anders Skrondal, Norwegian Institute of Public Health, Norway

Parallel Session: Structural Equation Modeling - Methodology I
Thursday, 21 July, 11:10 a.m. -- 12:30 p.m., D1-LP-08

Presenters (marked with asterisks):

Dynamic Generalized Structured Component Analysis: A Structural Equation Model for Analyzing Effective Connectivity in Functional Neuroimaging
Kwanghee Jung*, McGill University, Canada
Yoshio Takane, McGill University, Canada
Heungsun Hwang, McGill University, Canada

A Copula Approach to Dyadic Data: Negative Affect in Couples
Johan Braeken*, Tilburg University, Netherlands
Emilio Ferrer, University of California Davis, USA

Replacing Moderated Multiple Regression with Multiple-Group Path Analysis under Invariance Constraints in Predictive Studies
Roger Millsap*, Arizona State University, USA
Margarita Olivares-Aguilar, Arizona State University, USA

SEM and Regression Estimation in the Absolute Simplex (Bentler-Guttman Scale)
Peter Bentler*, University of California at Los Angeles, USA

Functional Extended Redundancy Analysis
Heungsun Hwang, McGill University, Canada
Hye Won Suk*, McGill University, Canada
Jang-Han Lee, Chung-Ang University, South Korea
Debbie S. Moskowitz, McGill University, Canada

Moderator:

Adachi Kohei, Osaka University, Japan

Parallel Session: Generalized Linear and Nonlinear Mixed Effects Models
Thursday, 21 July, 11:10 a.m. -- 12:30 p.m., D2-LP-08

Presenters (marked with asterisks):

On the Likelihood Ratio Test for Bivariate ACE Models
Hao Wu*, Virginia Commonwealth University, USA
Michael, C. Neale, Virginia Commonwealth University, USA

Measuring Implicit Learning with Random Effects: An Application of The Linear Ballistic Accumulator Model
Ingmar Visser*, University of Amsterdam, Netherlands
Thomas Marshall, University of Amsterdam, Netherlands

On the Statistical Meaning of the Identified Parameters in a Semiparametric Rasch Model
Ernesto San Martin*, Pontificia Universidad Catolica de Chile, Chile

Combining Generalizability Theory and Item Response Theory using the GLLAMM Framework
Jinnie Choi*, University of California at Berkeley, USA
Mark Wilson, University of California at Berkeley, USA
Sophia Rabe-Hesketh, University of California at Berkeley, USA

The Multilevel Generalized Graded Unfolding Model
Chen-Wei Liu*, The Hong Kong Institute of Education, Hong Kong
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

Moderator:

Wagner A. Kamakura, Duke University, USA

Parallel Session: Test Development and Validation
Thursday, 21 July, 11:10 a.m. -- 12:30 p.m., D2-LP-09

Presenters (marked with asterisks):

Never Say "Not:" Impact of Negative Wording in Probability Phrases on Imprecise Probability Judgments
Michael Smithson*, The Australian National University, Australia
David Budescu, Fordham University, USA
Stephen Broomell, Pennsylvania State University, USA
Han-Hui Por, Fordham University, USA

Is Test Taker Perception Of Assessment Related to Construct Validity?
Qin Xie*, The Hong Kong Institute of Education, Hong Kong

The Effects of Individual Characteristics, Family Backgrounds, and School Region Factors on Students' Bullying: A Multilevel Analysis of Public Middle Schools in China
Li-Jun Wang*, Zhejiang Normal University, China
Hai-Gen Gu, Shanghai Normal University, China
Xian-Liang Zheng, Gannan Normal University, China
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

Factor Structure and Psychometric Properties of Two Shortened Scales for Measuring Competency for Universities Students in the 21st Century
Nicole Ruihui Xu*, University of Macau, Macau
Shing On Leung, University of Macau, Macau
Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

The Psychometric Properties of Survey of Attitudes Toward Statistics (SATs)
Ratna Jatnika*, University of Padjadjaran, Indonesia
Fitri Ariyanti, University of Padjadjaran, Indonesia

Moderator:
Matthias von Davier, Educational Testing Service, USA

Parallel Session: Differential Item Functioning & Local Independence
Thursday, 21 July, 11:10 a.m. -- 12:30 p.m., D2-LP-10

Presenters (marked with asterisks):

Detection of Differential Item Functioning in Multiple Groups Using Item Response Theory Methods
Seock-Ho Kim*, The University of Georgia, USA
Allan S. Cohen, The University of Georgia, USA
Youn-Jeng Choi, The University of Georgia, USA
Sun-Joo Cho, Vanderbilt University, USA
Sukwoo Kim, Pusan National University, South Korea

Incorporating Differential Item Function into Longitudinal Item Response Models
Leah McGuire*, University of Minnesota, USA

Detection of Differential Item Functioning in MULTILOG and IRTLRDIF
Youn-Jeng Choi*, University of Georgia, USA
Allan S. Cohen, University of Georgia, USA
Seock-Ho Kim, University of Georgia, USA

A New Procedure for Detecting Departures from Local Independence in Item Response Models
Michael Edwards*, The Ohio State University, USA
Carrie Houts, The Ohio State University, USA
Li Cai*, University of California at Los Angeles, USA

Identifying Local Dependence with a Score Test Statistic Based on the Bifactor 2-Parameter Logistic Model
Yang Liu*, The University of North Carolina, USA
David Thissen, The University of North Carolina, USA

Moderator:

Terry Ackerman, University of North Carolina at Greensboro, USA

Invited Symposium : Some Aspects of Design and Analysis in Longitudinal Studies
Thursday, 21 July, 1:30 p.m. – 2:50 p.m., D1-LP-03

Organizer:

Frans E.S. Tan, Maastricht University, The Netherlands

Presenters (marked with asterisks):

Maximin Marginal Designs for Longitudinal Studies
Frans E.S. Tan*, Maastricht University, The Netherlands

Modeling HIV Viral Rebound using Differential Equations
Jan Serroyen*, Maastricht University, The Netherlands
Geert Molenberghs, Hasselt University and K.U. Leuven, Belgium

Model Based Estimates of Long-Term Persistence of Induced HPV Antibodies: Hierarchical Bayesian Approach
Ziv Shkedy*, Hasselt University and K.U. Leuven, Belgium
Mehreteab Fantahun, Hasselt University and K.U. Leuven, Belgium
Geert Molenberghs, Hasselt University and K.U. Leuven, Belgium

Modelling the Impact of Hypertensive Treatments on Longitudinal Blood Pressure Measurements and Cardiovascular Events
M Carr*, University of Manchester, UK
R McNamee, University of Manchester, UK
J Pan, University of Manchester, UK
K Cruickshank, University of Manchester, UK
G Dunn, University of Manchester, UK

Symposium : Measuring a Learning Progression for Data Modeling: Alternative Psychometric Modeling Approaches
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m., D1-LP-04

Organizer:

Elizabeth Ayers, University of California, Berkeley, USA

Presenters (marked with asterisks):

Developing Assessments of Data Modeling and Mapping a Learning Progression
Mark Wilson*, University of California, Berkeley, USA
Elizabeth Ayers, University of California, Berkeley, USA
Rich Lehrer, University of California, Berkeley, USA

Mapping a Learning Progression Using Unidimensional and Multidimensional Item Response Models
Robert Schwartz*, University of California, Berkeley, USA
Elizabeth Ayers, University of California, Berkeley, USA
Mark Wilson, University of California, Berkeley, USA

Modeling Links Between Dimensions of a Learning Progression Using SEM
Elizabeth Ayers*, University of California, Berkeley, USA
David Torres Irribarra, University of California, Berkeley, USA
Mark Wilson, University of California, Berkeley, USA

Developing Assessments of Data Modeling and Mapping a Learning Progression using a Structured Constructs Model
Ronli Diakow*, University of California, Berkeley, USA
David Torres Irribarra, University of California, Berkeley, USA

Parallel Session: Latent Class Analysis
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. , D1-LP-06

Presenters (marked with asterisks):

Assessing Eye Movement Transitions using Multilevel Markov Models
Samantha Bouwmeester*, Erasmus University Rotterdam, Netherlands
Lisa VandeBerg, Erasmus University Rotterdam, Netherlands
Rolf A. Zwaan, Erasmus University Rotterdam, Netherlands

Dynamic Bayesian Inference Network for Modeling Learning Progressions over Multiple Time Points
Younyoung Choi*, University of Maryland, USA
Robert Mislevy, Univsersity of Maryland, USA

Hierarchical Bayes Granger Causality Analysis for Understanding Purchase Behaviors of Multiple Product Categories
Kei Miyazaki*, Nagoya University, Japan
Takahiro Hoshino, Nagoya University, Japan

Multilevel Latent Class Model Used in Group-level Classification: Appropriate Application of Model Criteria
Jie-Ting Zhang*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Can Jiao, Shenzhen University, China

Work-Family Conflict : A Latent Prolife Analysis
Yanhong Gao*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Moderator:

Michael E. Sobel, Columbia University, USA

Parallel Session: Rasch Models - Theory and Practice
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. , D1-LP-07

Presenters (marked with asterisks):

Validation of Hortwitz's (1987) Beliefs about Language Learning Inventory with Chinese Mainland Sample – Traditional Factor Analysis Versus Rasch Modeling
Lijuan Li*, The Hong Kong Institute of Education, China

Assessing Dimensionality Using Rasch Rating Scale Model
Kun Jacob Xu*, The Hong Kong Institute of Education, Hong Kong
Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

Sample Size Determination for Rasch Model Tests
Clemens Draxler*, Ludwig-Maximilians-Universität München, Germany

Modeling of Students' Satisfaction of an Online Database: An Empirical Study
Atiquil Islam A.Y.M. *, International Islamic University Malaysia, Malaysia

Analyzing Two-Tier Items with the Steps Model
Hak Ping Tam*, National Taiwan Normal University, Taiwan
Margaret Wu, University of Melbourne, Australia

Moderator:

Han-Dau Yau, National Taiwan Sport University, Taiwan

Parallel Session: Structural Equation Modeling - Applications I
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. , D1-LP-08

Presenters (marked with asterisks):

Measurement Invariance of Survey Data: A Cross-Cultural Analysis
Timothy Teo*, Nanyang Technological University, Singapore

Investigating Factorial Invariance of Teacher Assessment Literacy Inventory between Primary and Secondary School Teachers
See Ling Suah*, Universiti Sains Malaysia, Malaysia
Saw Lan Ong, Universiti Sains Malaysia, Malaysia

Confirmatory Factor Models for Representing Processing Strategies Associated with a Cognitive Measure
Karl Schweizer*, Goethe University Frankfurt, Germany

The Development of Leisure Satisfaction Scale for Gifted Students
Wei-Ching Lee*, Taipei Municipal University of Education, Taiwan
Chin-Fei Cheng, Taipei Municipal University of Education, Taiwan

Exploring the Validity of Learning-Related Boredom Scale in Canada and China
Virginia Man Chung Tze*, University of Alberta, Canada
Robert Klassen, University of Alberta, Canada
Lia Daniels, University of Alberta, Canada
Johnson Ching Hong Li, University of Alberta, Canada

Moderator:

Mike W.-L. Cheung, National University of Singapore, Singapore

Parallel Session: Hierarchical & Multilevel Models
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. , D2-LP-08

Presenters (marked with asterisks):

Factor Analyzing Regression Slopes in Multilevel Model
Yasuo Miyazaki*, Virgnia Tech, USA

Avoiding Boundary Estimates in Hierarchical Linear Models Through Weakly Informative Priors
Yeojin Chung*, University of California, Berkeley, USA
Sophia Rabe-Hesketh, University of California, Berkeley, USA
Andrew Gelman, Columbia University, USA
Jingchen Liu, Columbia University, USA
Vincent Dorie, Columbia University, USA

Comparison of Aggregated Scores Adjusted and Non-Adjusted for Nested Effects in Nested/Hierarchical Measures
Ralph Carlson*, The University of Texas Pan American, USA
Hilda Medrano, The University of Texas Pan American, USA
Carlo Flores, McAllen Independent School District, USA

A Hierarchical Testlet Response Theory Model
Chia-Hua Lin*, National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan
Tien-Yu Hsieh, National Taichung University of Education, Taiwan
Yan-Ru Wu, National Taichung University of Education, Taiwan

Multilevel Item Response Models for Hierarchal Latent Traits
Wen Chung Wang*,The Hong Kong Institute of Education, Hong Kong
Kuan-Yu Jin, The Hong Kong Institute of Education, Hong Kong
Joseph Kui-Foon Chow, The Hong Kong Institute of Education, Hong Kong

Moderator:
Oi-Man Kwok, Texas A&M University, USA

Parallel Session: Test Development and Validation - Ability Measures I
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. , D2-LP-09

Presenters (marked with asterisks):

A Two-Tier Testing and Bayesian Network Based Adaptive Remedial Instruction System in Dilation of a Graph
Shu-Chuan Shih*,National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan
Chih-Wei Yang, National Taichung University of Education, Taiwan

Neural Cognitive Assessments in Recognizing Pictographic and Phonemic Abilities
Pei-Tzu Huang*,National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

Kittagali Scale – a Scale to Measure Productivity under the Influence of Music, Motor and Logical Analogy
Anilkumar Kittagali*, Acharya's Bangalore B-School, India

Cognitive Diagnosis Research Based on RSM for Chinese Children' Rapid Naming and Working Memory Defects
Xiaoling Fan*, Hunan Normal University, China
Fang Liu, Hunan Normal University, China
Jun Wang, Hunan Normal University, China

The Case Study of University Teacher' Course- Arrangement in Learning Calculus
Bor-Chen Kuo, National Taichung University , Taiwan
Mu-Yu Ting*, National Formosa University, Taiwan

Moderator:

Anton Béguin, Cito Institute of Educational Measurement, The Netherlands

Parallel Session: Standard Setting and Score Use
Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. , D2-LP-10

Presenters (marked with asterisks):

An Application of Many-Facet Rasch Measurement in the Yes/No Angoff Standard Setting Procedure
Mingchuan Hsieh*, National Academy for Educational Research, Taiwan

Item-Centered Procedures for Standard Setting in the Rasch Poisson Counts Model
Jorge González, Pontificia Universidad Católica de Chile, Chile
Rianne Janssen*, Katholieke Universiteit Leuven, Belgium
Ernesto San Martin, Pontificia Universidad Católica de Chile, Chile

Setting Cutscores with the Bookmark Method: Internal and External Validation
Zamri khairani Ahmad*, Universiti sains malaysia, Malaysia
Nordin Abd. Razak, Universiti sains malaysia, Malaysia

Communicating Test Scores to Teachers: Moving from Statistics to Use
Gavin T L Brown*, The Hong Kong Institute of Education, Hong Kong
John Hattie, The University of Melbourne, Australia

Statistical Quality Control Tools and Models in Monitoring Test Scores
Alina A. von Davier*, Educational Testing Service, USA

Moderator:

Matthias von Davier, Educational Testing Service, USA

State of Art Talk: Item Response Theory and Non-Cognitive Measurement

Thursday, 21 July, 3:00 p.m. – 3:30 p.m., D1-LP-02

Presenter:

Rob R. Meijer, University of Groningen, Netherlands

Applications of item response theory (IRT) to non-cognitive measures have been numerous in recent years. Historically, IRT has been developed to solve practical problems in large-scale multiple-choice achievement and aptitude testing. In this presentation I discuss the trends and findings in the non-cognitive measurement field. Many non-cognitive instruments are constructed as unpretentious workaday instruments with little understanding of psychological theory and psychometric theory and this has impact on the application of IRT to these types of data. Emigration of IRT methodology from cognitive to non-cognitive measures raises new and interesting challenges. Topics that will be addressed are (1) What did we learn from the application of IRT models to non-cognitive data as compared to cognitive data? (2) which models are most suited to model non-cognitive measures? (3) Should we use unidimensional or multidimensional models?

Chair:

Denny Borsboom, University of Amsterdam, the Netherlands

State of Art Talk: Bayesian Unimodal Density Regression
Thursday, 21 July, 3:00 p.m. – 3:30 p.m., D1-LP-04

Presenter:

George Karabatsos, University of Illinois-Chicago, USA
Stephen G. Walker, University of Kent, Canterbury, UK

I introduce a new Bayesian nonparametric regression model, an infinite-mixture model that allows the entire probability density of the response variable to depend on the covariate vector, x. The model consists of covariate-dependent mixture weights defined by an ordered-probit regression, having an infinite sequence of random probit variances, and having systematic component defined by a random process, such as a Gaussian process. Each kernel of the infinite mixture is a possibly-distinct and general unimodal density, specifically, a scale-mixture of uniforms flexibly modeled by a nonparametric, stick-breaking prior, e.g., a Dirichlet process (DP) or a Pitman-Yor process. Discrete responses (e.g., binary 0/1) are modeled by a nonparametric scale mixture of uniforms link. The Bayesian nonparametric regression model is completed by assigning a prior distribution to all parameters and hyper-parameters of the model. A feature of the new model is that, for any given x value, the response density is unimodal when the x value is informative about the response, and is multimodal when x is not very informative. The new model is illustrated through the analysis of a real educational data, simulated data, and medical data involving binary responses. In terms of cross-validated predictive utility, the new model outperforms other regression models, including Bayesian additive regression trees, additive and generalized additive models, the LASSO, ANOVA/linear dependent DP, linear regression with Pólya tree prior on the error distribution, binary regression with DP-mixture link, normal- and DP-mixed random effects models, the single index model, and linear and generalized linear models.

Chair:

Matt Grady, University of Nebraska–Lincoln, USA

Invited Symposium : Aspects of Structural Equation Modeling
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m., D1-LP-03

Organizer:

Haruhiko Ogasawara, Otaru University of Commerce, Japan

Presenters (marked with asterisks):

A Measure of Skewness of Testing For Normality
Shigekazu Nakagawa*, Kurashiki University of Science and the Arts, Japan
Hiroki Hashiguchi, Saitama University, Japan
Naoto Niki, Tokyo University, Japan

Applications of Asymptotic Expansion In Structural Equation Modeling
Haruhiko Ogasawara*, Otaru University of Commerce, Japan

Interaction Between Strategies and Invariance/Noninvariance Conditions in Testing for Partial Invariance in Structural Equation Modeling
Soonmook Lee*, Sungkyunkwan University, Korea
Hanjoe Kim, Tennessee State University, USA

Joint Bayesian Model Selection and Parameter Estimation for Latent Growth Curve Mixture Model
Satoshi Usami*, University of Tokyo, Japan

Symposium : Process models for behavioral dynamics
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m., D1-LP-04

Organizer:

Peter F. Halpin, University of Amsterdam, The Netherlands

Presenters (marked with asterisks):

Models of Dyadic Dependence for Event Sampling Data
Peter F. Halpin*, University of Amsterdam, The Netherlands
Raoul P. P. P. Grasman, University of Amsterdam, The Netherlands
Paul De Boeck, University of Amsterdam & K.U.Leuven, The Netherlands/ Belgium

Structural Relations Underlying Multivariate Event Sequences
Raoul P. P. P. Grasman*, University of Amsterdam, The Netherlands
Peter F. Halpin, University of Amsterdam, Netherlands

Hierarchical Diffusion Models for Intensive Longitudinal Data Analysis
Francis Tuerlinckx*, K.U. Leuven, Belgium
Zita Oravecz, K. U. Leuven, Belgium
Joachim Vandekerckhove, K. U. Leuven, Belgium

Sequential Order Based GLMMs for Random Person and Item Effects
Paul De Boeck*, University of Amsterdam & K.U.Leuven, The Netherlands/ Belgium

Parallel Session: Response Time and Equating
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m. , D1-LP-06

Presenters (marked with asterisks):

A Joint Model for Item Response and Response Times Based on the Relationship Between Accuracy and Speed of Test Takers
Xiang Bin Meng*, Northeast Normal University, China
Jian Tao, Northeast Normal University, China
Ning-Zhong Shi, Northeast Normal University, China

Modeling Response Time in Computerized Testing Using Semi-parametric Linear Transformation Model
Chun Wang*, University of Illinois at Urbana-Champaign, USA
Hua-Hua Chang, University of Illinois at Urbana-Champaign, USA
Jeffrey Douglas, University of Illinois at Urbana-Champaign, USA

The Impact of Different Settings of Missing Value Options in WINSTEPS and PARSCALE on IRT Equating or Linking
Zhiming Yang*, Educational Testing Service, USA
Maolin Ye, Management School of Jinan University, China
Ming Xiao, Partory School of Business, China

A Bayesian Approach to Concurrent Calibration Analysis for Non-equivalent Groups with Anchor Test Design
Lin-shan Yang*, ShenZhen Seaskyland Educational Evaluation Co.,Ltd
Yan Liu, ShenZhen Seaskyland Educational Evaluation Co.,Ltd
Chen Yang, ShenZhen Seaskyland Educational Evaluation

Small N and Utility of An Extended Circle-Arc Equating Method
Jaehoon Seol, Prometric, USA
Shungwon Ro*, Kenexa, USA
Sarah Hagge, National Council of State Boards of Nursing, USA
Seonho Shin, Prometric, USA

Moderator:
Wim J. van der Linden, CTB/McGraw-Hill, USA

Parallel Session: Categorical Data Analysis
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m. , D1-LP-07

Presenters (marked with asterisks):

The Wellbeing of Creepies and Crawlies on The Sea Bed: A Three-Way Correspondence Analysis
Pieter M. Kroonenberg*, Leiden University, Netherlands

An Extension of Proportional Odds Models: Using Generalized Ordinal Logistic Regression Models for Educational Data
Xing Liu, Eastern Connecticut State University, USA
Jiarong Zhao*, Nanjing Normal University, China
Wei Xia, University of Connecticut, USA

Maximum Likelihood and Weighted Least Square Estimators in Estimating Nature-Nurture Models
I-Hau Hsu *, National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

Predicting Discrete Macro-Level Outcome Variables with Micro-Level Explanatory Variables: A Latent Class Approach
Margot Bennink*, Tilburg University, Netherlands
Marcel A. Croon, Tilburg University, Netherlands
Jeroen K. Vermunt, Tilburg University, Netherlands

Within-Subject Analysis of Variance and Generalized Linear Mixed Models for Binary Outcome
Ehri Ryu*, Boston College, USA

Moderator:

Jos M.F. ten Berge, University of Groningen, The Netherlands

Parallel Session: Factor Analysis
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m. , D1-LP-08

Presenters (marked with asterisks):

Exploratory Bi-Factor Analysis
Robert I. Jennrich, University of California at Los Angeles, USA
Peter Bentler*, University of California at Los Angeles, USA

The Infinitesimal Jackknife with Exploratory Factor Analysis
Guangjian Zhang*, University of Notre Dame, USA
Kristopher J. Preacher, University of Kansas, USA
Robert I. Jennrich, University of California at Los Angeles, USA

One-Stage Rotation Method for Second-Order Factor Analysis
Hsing-Chuan Hsieh*, National Chung Cheng University, Taiwan
Chung-Ping Chen , National Cheng Kung University,Taiwan

Oblique Rotation Techniques with Clustering Of Variables
Michio Yamamoto*, Osaka University, Japan

Dimensionality Assessment of Ordered Polytomous Items with Parallel Analysis
Marieke E immerman*, University of Groningen, Netherlands
Urbano Lorenzo-Seva, Rovira i Virgili University, Spain

Moderator:

Michael Browne, The Ohio State University, USA

Parallel Session: Computational Methods
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m. , D2-LP-08

Presenters (marked with asterisks):

Comparisons between the Universal Sampler and the Slice Sampler
Jianhui Ning*, Central China Normal University, China
Yuchung Wang, Rutgers University, USA

An Evaluation of Algorithms on Generating Multivariate Non-Normal Data
Hao Luo*, Uppsala University, Sweden
Fan Yang-Wallentin, Norwegian School of Management, Sweden

Bootstrap Confidence Intervals for the Meta-analysis of Correlations Corrected for Indirect Range Restriction
Johnson Ching Hong Li*, University of Alberta, Canada
Ying Cui, University of Alberta, Canada
Mark J. Gierl, University of Alberta, Canada
Wai Chan, The Chinese University of Hong Kong, Hong Kong

Application of Bootstrap Methods In Psychological Research
Qingqing Xiong*,South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Lord's Paradox and the Use of Growth and Value-Added Models for School Accountability
Andrew Ho*, Harvard Graduate School of Education, USA

Moderator:

Johan Lyhagen, Uppsala University, Sweden

Parallel Session: Test Development and Validation - Ability Measures II
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m. , D2-LP-09

Presenters (marked with asterisks):

Quantitative Neurocognitive Measurements of Procedural and Conceptual Knowledge of Spatial Ability
Ting-Yao Liao*,National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

Establish an Adaptive Diagnostic Test System for "Calculus" Using "Finding Area By Integral" Unit as an Example
Bor-Chen Kuo, National Taichung University , Taiwan
Mu-Yu Ting, National Formosa University, Taiwan
Hsiang-Chuan Liu, Asia University, Taiwan
Yu-Lung Liu*, Asia University, Taiwan

Standardization of Test Battery for Diagnostics of Motor Laterality Manifestation
Martin Musalek*, Charles University, Czech Republic

Expert Judgment for Content Validity: A Study of a Malaysian University Listening Skill Entrance Test
Elia Md Johar*, MARA University of Technology (UiTM), Malaysia
Ainol Madziah Zubairi, International Islamic University Malaysia (IIUM), Malaysia
Mohamad Sahari Nordin, International Islamic Malaysia (IIUM), Malaysia

Moderator:

Han-Dau Yau, National Taiwan Sport University, Taiwan

Parallel Session: Computerized Adaptive Testing and Cognitive Diagnosis Modeling
Thursday, 21 July, 4:00 p.m. -- 5:20 p.m. , D2-LP-10

Presenters (marked with asterisks):

A Simulation Study of Qmatrix Design to CAT Strategies for Cognitive Diagnosis
Chun-Hua Chen*, National Taichung University, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Chih-Wei Yang, National Taichung University, Taiwan

The Exploration of Item Selection Strategy for Cognitive Diagnosis_Computerized Adaptive Test
Zhiyong Shang*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China

Controlling Item Exposure in Cognitive Diagnostic Computerized Adaptive Testing
Xiuzhen Mao*, Beijing Normal University, China
Tao Xin, Beijing Normal University, China

The Comparison of Item Selection Methods in Diagnostic Computerized Adaptive Tests using Rule Space Model
Jian-Bing Wen*, East China Normal University, China

Computerized Classification Testing Under the DINA Model
Jyun-Ji Lin*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Shu-Ying Chen, National Chung Cheng University, Taiwan

Moderator:

David Thissen, University of North Carolina at Chapel Hill, USA

Poster Session II

Thursday, 21 July, 5:30 p.m. – 7:00 p.m., Lower Podium Floor of Block D1 & D2

Poster Presenters (marked with asterisks):

The Application Exploration of Survival Analysis Method in Psychological research
Chuan Chen*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Applying MCMC Algorithm in Estimating Variance Components for Generalizability Theory
Kaiyin Guo*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Guangming Li, South China Normal University, China

The Criteria and Analysis of Subjective Assessments in Testing
Rui Xiang*, Teachers College Columbia University, USA

The properness about dimension of achievement goal and role of the autonomy in learning process
Chia-Cheng Chen*,National Taiwan University of Arts, Taiwan

Students how to use self-regulated learning strategies in a web-based learning environment
Chun-Yuan Chang*, National Taipei University of Education, Taiwan

The Effect of Different Compensatory Relationships in the Variance-Covariance Structure on the Test of Fixed Effects in a Multilevel Linear Growth Curve Model
Yuan-Hsuan Lee*, National Chiao Tung University, Taiwan
Oi-Man Kwok, Texas A&M University, USA
Jiun-Yu Wu, National Chiao Tung University, Taiwan

Comparing Design-based and Model-based Latent Growth Models on Analyzing longitudinal data: A Monte Carlo Study
Oi-Man Kwok*, Texas A&M University, USA
Jiun-Yu Wu, National Chiao Tung University, Taiwan

The Recovery of Item and Person Parameters Estimated by the SCORIGHT
Bor-Yaun Twu*, National University of Tainan, Taiwan
Jui-Chiao Tseng, Min-Hwei College of Health Care Management, Taiwan
Yen-Wen Yang, Min-Hwei College of Health Care Management, Taiwan

Sample Size Determination in SEM with Nonnormal Data
Hsin-Yun Liu*, National Taiwan University, Taiwan
Li-Jen Weng, National Taiwan University, Taiwan

A Multi-dimensional Continuous Item Response Model for Probability Testing
Yiping Zhang*, Center for Research on Educational Testing, Japan
Hiroshi Watanabe, Center for Research on Educational Testing, Japan

Using Survival Analysis to Estimate Mediated Effects with Discrete-Time and Censored Data
Jenn-Yun Tein*, Arizona State University, USA
David P. MacKinnon, Arizona State University, USA

Sample Size Planning with AIPE on RMSEA Revisited: Width? Or Values?
Tzu-Yao Lin*, National Taiwan University, Taiwan
Li-Jen Weng, National Taiwan University, Taiwan

A Study of Standard Setting Method Using the Cluster Analysis
Yeonbok Park*, Korea Institute for Curriculum and Evaluation, South Korea
Jiyoung Jung, Yonsei University, South Korea
Hee-Won Yang, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

The Longitudinal Analysis of Gifted Students' Science Self-Concept and Science Achievement: A Multivariate Multilevel Latent Growth Model
Yaling Hou*, National Pingtung University of Education, Taiwan

The Development of Statistical Thinking Assessment
Chien-Yi Huang*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

A Preliminary Validity Study for the On-line Literary Reading Assessment
Lan-fang Chou*, National university of tainan, Taiwan
Pi-Hsia Hung, National University of Tainan, Taiwan

The Validity Issues of an Affective Scale Embedded in an Algebra Dynamic Assessment System
Hui Ju Sun*, National University of Tainan, Taiwan
Pi Hsia Hung, National University of Tainan, Taiwan,

A Study of the Effects of Non-equivalency of Equating Groups on Equating for Mixed-Format Tests
Jiwon Choi*, Yonsei University, South Korea
Jeonghwa Oh, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

A Speeded Item Response Model: Leave the Harder Till Later
Yu-Wei Chang*, National Tsing-Hua University, Taiwan
Rung-Ching Tsai, National Taiwan Normal University, Taiwan
Nan-Jung Hsu, National Tsing-Hua University, Taiwan

A Simulation Study to Evaluate IRT Scale Transformation Methods with Fixed c-parameters of Anchor Items
Junbum Lim*, Yonsei University, South Korea
Hwangkyu Lim, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

The Criterion-Related Validity Coefficients of A Situational Interview (si) And A Behavior Description Interview (bdi) in Railway Policeman Selection Field in China
Yingwu Li*, Tsinghua University, China
Yongda Yu, Tsinghua University, China

A Multilevel Multidimensional Rasch Model with an Application to DIF by Hierarchical Generalized Linear Model

Hsin-Ying Huang*, National Chengchi University, Taiwan
Fur-Hsing Wen, Soochow University , Taiwan
Min-Ning Yu, National Chengchi University, Taiwan

Sufficient Conditions of Equivalence in Measurement Model

Wei-Sheng Lin*, National Chung Cheng University, Taiwan
Chung-Ping Chen , National Chung Cheng University, Taiwan

Influence of Pre-Test Design on The Precision of The Parameters Estimation in The Multidimensional Items Bank

Po-Hsi Chen*, National Taiwan Normal University, Taiwan
Jar-Wen Kuo, National Taiwan Normal University, Taiwan
Yao-Ting Sung, National Taiwan Normal University, Taiwan

The Relationships between Health Responsibility, Emotional Well-being and Depression in Taiwan

Po-Lin Chen*, National Chengchi University, Taiwan
Min-Ning Yu, National Chengchi University, Taiwan
Pei-Ching Chao, National Chengchi University, Taiwan
Jia-Jia Syu, National Chengchi University, Taiwan
Pei-Chun Chung, National Chengchi University, Taiwan

A Mathematical Model for Trans-Cortical Gamma Synchronizations Under Different Perceptual Conditions

Chien-Fu Lin*, National Chung Cheng University, Taiwan
Jay-Shake Li, National Chung Cheng University, Taiwan

Model Specification for Latent Nonlinear Effects based on the Mean-Centering and Double-Mean-Centering Strategies

Shu-Ping Chen*, National Chengchi University, Taiwan
Chung-Ping Chen , National Cheng Kung University , Taiwan

The Development of The Computerized Imagination Test
Po-Hsi Chen, National Taiwan Normal University, Taiwan
Pei-Yu Lee, National Taiwan Normal University, Tanzania
Chun-Yu Hsu*, National Taiwan Normal University, Taiwan
Su-Ping Hung, National Taiwan Normal University, Taiwan
Jar-Wen Kuo, National Taiwan Normal University, Taiwan

Impact of Optimal Item Bank Design on Parallel-Form Tests for Making Pass-Fail Decisions
Ting-Ting Yang*,Beijing Normal University, China
Yan Gao, Beijing Normal University, China
Mengjie He, Beijing Normal University, China
Tao Yang, Beijing Normal University, China

Confirmatory Factor Analysis of the 100-item IPIP measure on a large Facebook dataset
Luning Sun, University of Cambridge, UK
Iva Cek*, University of Cambridge, UK
Sabine A. K. Spindler, University of Cambridge, UK
Michal S. Kosinski, University of Cambridge, UK
David J. Stillwell, University of Nottingham, UK
John N. Rust, University of Cambridge, UK

A Tutorial on Structural Equation Modeling with Incomplete Observations: Multiple Imputation and FIML Methods Using SAS
Wei Zhang*, SAS Institute Inc, USA
Yiu-Fai Yung, SAS Institute Inc, USA

Mixture Extensions of the Linear Logistic Test Model (LLTM) using Markov Chain Monte Carlo (MCMC) Estimation
In-Hee Choi*, University of California, Berkeley, USA
Mark Wilson, University of California, Berkeley, USA

Using Bifactor Model To Detect Testlet Effect
Szu-Cheng Lu*, National University of Tainan, Taiwan
Bor-Yaun Twu, National University of Tainan, Taiwan

Establishing a Confirmatory Factor Analysis Model for the Self-Efficacy for Writing Scale

Yi-Fang Wu, University of Iowa, USA
Chia-Ling Tu*, National University of Tainan, Taiwan

Utility of Local Linear Approximation in Quantifying Emotional Trajectories Of Romantic Partners

Amy Schmid*, Columbia University Teachers College, USA
Noelle Leonard, New York University College of Nursing, USA
Amanda Ritchie, New York University College of Nursing, USA
Marya Viorst-Gwadz, New York University College of Nursing, USA

Incorporating Response Time To Model Test Behavior In A Structural Equation Modeling Framework

Shu-Chen Chan*, National Taiwan Normal University, Taiwan
Rung-Ching Tsai, National Taiwan Normal University, Taiwan

Effects of the Open Recruiting System for Principal Employment on the School Performance in Korea

Hyejin Kim*, Pusan National University, South Korea
Chang-nam Hong, Pusan National University, South Korea
Gyeong-ryeon Gwak, Pusan National University, South Korea
Jiyoung Nam, Pusan National University, South Korea

The Relationship between Perceived School Support and Teacher's Commitment

Jiyoung Nam**, Pusan National University, South Korea
Chang-nam Hong, Pusan National University, South Korea
Hyejin Kim, Pusan National University, South Korea

The Longitudinal Structure of the Chinese version of Beck Depression Inventory II using a Latent State-Trait Model

Pei-Chen Wu*, National PingTung University of Education, Taiwan, Taiwan

Setting a Target Test Information Fuinction for Assembly of IRT-Based Classification Tests

Kentaro Kato*, Center for Research on Educational Testing, Japan

A Comparison of Item Response Models for A Test Consisting of Testlets

Naoya Toudou*, The University of Tokyo, Japan

Test of Independence by Asymptotic Lambda for Nominal Data using Bootstrap

Yu Hin Ray Cheung*, The Chinese University of Hong Kong, Hong Kong
Lok Yin Joyce Kwan, The Chinese University of Hong Kong, Hong Kong
Wai Chan, The Chinese University of Hong Kong, Hong Kong

A Structural Equation Modeling Approach for The Analysis of Conditional Indirect Effects

Lok Yin Joyce Kwan*, The Chinese University of Hong Kong, Hong Kong
Wai Chan, The Chinese University of Hong Kong, Hong Kong

Sampling Discrete m x n Matrices with Fixed Margins

Kathrin Gruber*,Vienna University of Economics and Business, Austria
Reinhold Hatzinger, Vienna University of Economics and Business, Austria

The Impacts of the Cognitive Components on the Variance of the Item Difficulties for the Quantities Compare Test

Wen Chun Tai*, National University of Tainan, Taiwan

Examination of Reliability, Convergent Validity and Discriminant Validity By Using Multitrait-Multimethod Matrix: Under The Constraint That Sum of The Method Factors Equal Zero in Correlated Trait Correlated Method Model

Saori Kubo*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

Scheffe-type Paired Comparison Models To Examine Correlations Between Preferences for Alternatives

Norikazu Iwama*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

The Relationship between Parenting Styles and Emotional Intelligence of the Gifted Students and Ordinary Students at Elementary Schools

Chieh-Ju Tsao*,National Taichung University, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Yu-Ting Chang, National Taichung University, Taiwan

Sequential and Nonsequential Specification Searches in Testing Factorial Invariance

Myeongsun Yoon*, Texas A&M University, USA
EunSook Kim, Texas A&M University, USA

Practicality of Person Fit Statistics as A Diagnostic Tool in A Computerized Adaptive Testing Setting

Shungwon Ro*, Kenexa, USA
Ji Eun Lee, University of Minnesota, USA

Predictive Data Mining as An Alternative To Standard Regression Modeling in Very Large Data Sets

Hongwei Yang, The University of Kentucky, USA
Ning Liu*, The University of Kentucky, USA

A Procedure To Derive The Response Model For A Polytomous Item

Wenjiu Du*, Southwest University, China
Hanmin Xiao, Southwest University, China

Issues in Testing Scalar Invariance in Structural Equation Modeling

Chansoon Lee*, Sungkyunkwan University, South Korea
Soonmook Lee, Sungkyunkwan University, South Korea

Testing for Measurement Invariance Using Linear and Nonlinear Confirmatory Factor Analysis

Dexin Shi*, University of Oklahoma, USA
Hairong Song, University of Oklahoma, USA
A. Robert Terry, University of Oklahoma, USA

Multilevel Analysis Reveals Increased Proactive Interference Among Low Working Memory Span Individuals

Ye Wang*, University of Florida, USA
David Therriault, University of Florida, USA
James Algina, University of Florida, USA

Long-term Change of Relational Aggression among Mexican American Youth

Xiaolan Liao*, University of Oklahoma, USA
Rand Conger, University of California, Davis, USA
Gary Stockdale, University of California, Davis, USA

The Validation of Measurement Invariance across Gender in Volitional Questionnaire Chinese-version.

Ming-Shan Yang*, National University of Tainan / National Chia-Yi Special Education School , Taiwan
Siou-Ying Wu, National Chia-Yi Special Education School, Taiwan
Yen-Chao Chung, National Chia-Yi Special Education School, Taiwan
Szu-En Pan, National Chia-Yi Special Education School, Taiwan
Chia-Wei Hsiao, National University of Tainan, Taiwan

Psychometric Evaluation of The Italian Version of the QUALID scale: a Contribution to Cross-National Implementation of a Test for QoL in Late-Stage Dementia

Tiziano Gomiero*, ANFFAS Trentino Onlus, Italy
Luc Pieter De Vreese, Health District of Modena, Italy
Ulrico Mantesso, ANFFAS Trentino Onlus, Italy
Elisa De Bastiani, ANFFAS Trentino Onlus, Italy
Elisabeth Weger, ANFFAS Trentino Onlus, Italy

Invariance of Equating Functions Across Gender Groups of the Taiwan Assessment of Student Achievement

Hsuan-Po Wang*,National Taichung University of Education, Taiwan
Yu-Ju Lu, National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan
Chien-Ming Cheng, National Taichung University of Education, Taiwan

Self-Esteem and Individual Adaptability
Huajian Cai*, Chinese Academy of Science, China
Hairong Song, University of Oklahoma, USA

The DFTD Strategy with Likelihood Ratio Test method in Assessing DIF for polytomous items
Guo-Wei Sun*, National Sun Yat-sen University, Taiwan
Hui-Ching Chen, National Taichung University of Education, Taiwan
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

Development of Creative Life Style Check List
Wan-Ying Lin*, National Sun Yat-sen University, Taiwan
Ying-Yao Cheng, National Sun Yat-sen University, Taiwan
Li-Ming Chen, National Sun Yat-sen University, Taiwan
Ya-Hsueh Wang, National Sun Yat-sen University, Taiwan

Test for the Number of Factors in Exploratory Factor Analysis: A Nonparametric Goodness-of-Fit Approach
Kentaro Hayashi*, University of Hawaii at Manoa, USA

Main Conference, Friday, 22 July, 2011

Dissertation Award Talk

Friday, 22 July, 8:30 a.m. -- 9:10 a.m., D1-LP-02

Presenter:

Anna Brown, University of Barcelona, Spain

Chair:

Henk Kelderman, VU University Amsterdam, The Netherlands

Symposium: Modeling Heterogeneity in Dynamical Structures and Processes
Friday, 22 July, 9:20 a.m. -- 10:40 a.m., D1-LP-03

Organizer:

Francis Tuerlinckx, K.U. Leuven, Belgium

Presenters (marked with asterisks):

Fitting Nonlinear Differential Equation Models with Random Effects Using the Stochastic Approximation Expectation-Maximization Algorithm
Sy-Miin Chow*, University of North Carolina at Chapel Hill, USA
Hongtu Zhu, University of North Carolina at Chapel Hill, USA
Andrew Sherwood, Duke University, USA

Modeling Physiological Emotion Specificity with Regime Switching State Space Models
Tom Lodewyckx*, University of Leuven, Belgium
Francis Tuerlinckx, University of Leuven, Belgium
Peter Kuppens, University of Leuven, Belgium
Nicholas Allen, University of Melboune, Australia
Lisa Sheeber, Oregon Research Institute, USA

Exploratory Analysis of Heterogeneous Dynamic Models Using a Multi-sample SEM Algorithm
Lawrence L. Lo*, Pennsylvania State University, USA
Peter C. M. Molenaar, The Pennsylvania State University, USA
Michael J. Rovine, Pennsylvania State University, USA

The Modelling and Efficient Estimation of Locally Stationary Time Series
Sebastien Van Bellegem*, University of Toulouse I & University of Louvain, France

Parallel Session: Multidimensional Item Response Theory - Methodology
Friday, 22 July, 9:20 a.m. -- 10:40 a.m. , D1-LP-06

Presenters (marked with asterisks):

Optimal Item Design in Multidimensional Two-Alternative Forced Choice Tests
Iwin Leenen*, Investigación y Evaluación, Mexico
Jimmy de la Torre, Rutgers University, USA
Vicente Ponsoda, Universidad Autónoma de Madrid, Spain
Pedro Hontangas, Universidad de Valencia, Spain

The Confirmatory Multidimensional Generalized Graded Unfolding Model
Shiu-Lien Wu*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

Pairwise Modeling Method for Longitudinal Item Response Data
Jian Tao*, Northeast Normal University, China
Zhi-Hui Fu, Shenyang Normal University, China
Ning-Zhong Shi, Northeast Normal University, China
Nan Lin, Washington University in Saint Louis, USA

Random Item MIRID Modeling and its Application
Yongsang Lee*, UC Berkeley, USA
Mark Wilson, University of California at Berkeley, USA

Are there any Consequences of using Unidimensional IRT on a Multidimensional Test?
Marie Wiberg*, Umeå University, Sweden

Moderator:

David Thissen, University of North Carolina at Chapel Hill, USA

Parallel Session: Rasch Models - Applications in Ability Measures
Friday, 22 July, 9:20 a.m. -- 10:40 a.m. , D1-LP-07

Presenters (marked with asterisks):

Evaluating the Quality of Rater-Mediated Assessments with a Multi-Method Approach
Amy Hendrickson*, The College Board, USA
George Engelhard, Jr., Emory University, USA

Investigating Item Difficulty Change by Item Positions under the Rasch Model
Luc T Le*, Australian Council for Educational Research, Australia
Van Nguyen, Australian Council for Educational Research, Australia

A Mixed-Methods Approach for Exploring the Accuracy of Writing Self-Efficacy Judgments
George Engelhard*, Emory University, USA
Nadia Behizadeh, Emory University, USA

Implementing a New Selection Model across 27 European Countries
Markus Nussbaum*, European Personnel Selection Office, Belgium
Gilles Guillard, European Personnel Selection Office, Belgium

Rasch Modeling of a Mindful Learning Scale
Zhenlin Wang*, The Hong Kong Institute of Education, Hong Kong
Christine, X. Wang, University at Buffalo, USA

Moderator:

Anton Béguin, Cito Institute of Educational Measurement, The Netherlands

Parallel Session: Structural Equation Modeling - Methodology II
Friday, 22 July, 9:20 a.m. -- 10:40 a.m. , D1-LP-08

Presenters (marked with asterisks):

Transformation Structural Equation Models for Analyzing Highly Non-normal Data
Xinyuan Song*, The Chinese University of Hong Kong, Hong Kong
Zhaohua Lu, The Chinese Univesity of Hong Kong, Hong Kong

Examination of Robustness of Heterogeneity of Residual Variance in Mediation Effect with Categorical Exogenous Variable
Heining Cham*, Arizona State University, USA
Jenn-Yun Tein, Arizona State University, USA

A Poor Person's Posterior Predictive Checking of Structural Equation Models
Taehun Lee*, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

A New Family of Model Fit Indices in Confirmatory Factor Analysis: Information Complexity (ICOMP) Criteria
Hongwei Yang*, The University of Kentucky, USA
Eylem Deniz, Mimar Sinan Fine Arts University, Turkey
Hamparsum Bozdogan, The University of Tennessee, USA

MetaSEM: An R package to Conducting Meta-Analysis using Structural Equation Modeling
Mike W.-L. Cheung*, National University of Singapore, Singapore

Moderator:

David Kaplan, University of Wisconsin-Madison, USA

Parallel Session: Longitudinal Data Analysis
Friday, 22 July, 9:20 a.m. -- 10:40 a.m. , D2-LP-08

Presenters (marked with asterisks):

Power and Robustness Analysis of Multilevel Modeling of Longitudinal Growth
Lihshing Wang*, University of Cincinnati, USA

A Joint Model for Selection Bias and Measurement Error
Chueh-An Hsieh*, National Sun Yat-sen University, Taiwan

Fitting the Linear Mixed Models into the CLS Data with both Static and Dynamic Predictors
Ji Hoon Ryoo, University of Nebraska, USA
Arthur J. Reynolds*, University of Minnesota, USA

Measurement Invariance in Longitudinal Data with a Developmental Latent Trait over Time
Ji Hoon Ryoo*, University of Nebraska, USA

Moderator:

Haruhiko Ogasawara, Otaru University of Commerce, Japan

Parallel Session: Test Development and Validation - Nonability Measures I
Friday, 22 July, 9:20 a.m. -- 10:40 a.m. , D2-LP-09

Presenters (marked with asterisks):

Investigation and Validation of College Student Well-Being Property Scale
Wei-Hao Chiang*, National Sun-Yat-sen University, Taiwan
Zuway-R Hong, National Sun-Yat-sen University, Taiwan

On the Test-Retest Reliability of the 100-item IPIP Scales: Differential Temporal Stability of the Big Five Personality Traits
Luning Sun*, University of Cambridge, UK
Michal S. Kosinski, University of Cambridge, UK
David J. Stillwell, University of Nottingham, UK
John N. Rust, University of Cambridge, UK

Mathematics Anxiety Scale for Filipino Students (MAS-FS): Reliability, Validity, and Bias Detection
Josefina Almeda*, University of the Philippines, Philippines

Development and Validation of College Students Perception toward Parenting Practice Scale
Dong-Ting Zou*, National Sun Yat-sen University, Taiwan
Zuway-R Hong, National Sun Yat-sen University, Taiwan

Text Classification Frameworks for PTSD Screening Using N-Grams
Qiwei He*, University of Twente, Netherlands
Bernard Veldkamp, University of Twente, Netherlands

Moderator:

Keith A. Markus, The City University of New York, USA

Parallel Session: Computerized Adaptive Testing
Friday, 22 July, 9:20 a.m. -- 10:40 a.m. , D2-LP-10

Presenters (marked with asterisks):

Computerized Classification Testing under the Higher-Order Polytomous IRT Model
Kung-Hsien Lee*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

On-line Calibration Design for Pretesting Items in Adaptive Testing
Usama Ali*, Universsity of Illinois at Urbana-Champaign, USA
Hua-Hua Chang, Universsity of Illinois at Urbana-Champaign, USA

Applying Kullback-Leibler Divergence to Detect Examinees with Item Pre-Knowledge in Computerized Adaptive Testing
Hsiu-Yi Chao*, National Chung Cheng University, Taiwan
Jyun-Hong Chen, National Chung Cheng University, Taiwan
Shu-Ying Chen, National Chung Cheng University, Taiwan

Overestimation of Fisher information in Variable Length CATs due to Capitalization on Chance
Juan Ramon Barrada*, Universidad Autonoma de Barcelona, Spain
Julio Olea, Universidad Autonoma de Madrid, Spain
Francisco J. Abad, Universidad Autonoma de Barcelona, Spain

Computerized Adaptive Testing and Adaptive Experimental Design
Yun Tang*, Ohio State University, USA
Jay Myung, Ohio State University, USA
Michael Edwards, Ohio State University, USA
Mark Pitt, Ohio State University, USA

Moderator:

Shu-Ying Chen, National Chung Cheng University, Taiwan

State of Art Talk: The Potential of Recursive Partitioning Methods for Psychological Research

Friday 22 July, 11:10 a.m. – 11:40 a.m., D1-LP-02

Presenter:

Carolin Strobl, Ludwig-Maximilians-Universität München, Germany

Recursive partitioning methods have become popular and widely used tools for nonparametric regression and classification in many scientific fields. Especially random forests, which can deal with large numbers of predictor variables even in the presence of complex interactions, have been applied successfully in genetics, clinical medicine, and bioinformatics within the past few years. However, high-dimensional problems are common not only in genetics, but also in some areas of psychological research, such as in neuropsychology, where only few subjects can be measured because of time or cost constraints, yet a large amount of data is generated for each subject. Random forests have been shown to achieve a high prediction accuracy in such applications. Moreover, they provide descriptive variable importance measures reflecting the impact of each variable in both main effects and interactions. The aim of this talk is to illustrate the potential of recursive partitioning methods for psychological research and outline their rationale as well as potential pitfalls in their practical application.

Chair:

Yue Zhao, The Hong Kong Institute of Education, Hong Kong

State of Art Talk: Modeling Discrete Latent Constructs: Review and Beyond
Friday 22 July, 11:10 a.m. – 11:40 a.m., D1-LP-04

Presenter:

Hsiu-Ting Yu, McGill University, Canada

This talk provides a review of modeling discrete latent constructs in psychological and educational research. The discussion will cover theoretical concepts and methodological techniques of modeling discrete latent constructs as well as the links and relationships to classical continuous latent constructs. With contrasting different conceptual approaches of modeling latent constructs, the cautions and new potentials of discrete latent assumptions are to be addressed. In addition, this talk will also discuss topics on (a) the scenarios and possible solutions of the structural indeterminacy on layers of discrete latent constructs when extending to multilevel structure and (b) different approaches of applying to longitudinal data with discrete latent constructs.

Chair:

Matthew Johnson , Columbia University, USA

Invited Talk: Missing Data and Consistency for a Latent Variable Model Widely Used in IRT and Longitudinal Data Analysis

Friday, 22 July, 11:50 a.m. – 12:30 p.m., D1-LP-02

Presenter:

Anders Skrondal, Norwegian Institute of Public Health, Norway

We consider the impact of missing data mechanisms on the consistency of estimators for a latent variable model that is widely used in IRT and longitudinal data analysis.

Rubin (1976, Biometrika) proposed a classification of mechanisms producing missing data and clarified the conditions for consistent estimation based on maximum likelihood or Bayesian inference. An important extension of Rubin's work was provided by Little (1995, JASA) who explicitly considered the role of covariates and latent variables (random coefficients).

The conditions provided by Rubin and Little apply if the latent variable model is estimated by marginal maximum likelihood (MML). Fortunately, conditional maximum likelihood (CML) turns out to be consistent under considerably more lenient conditions.

Chair:

David Kaplan, University of Wisconsin-Madison, USA

Invited Talk: The G-DINA Model Framework and Some Recent Developments
Friday, 22 July, 11:50 a.m. – 12:30 p.m., D1-LP-04

Presenter:

Jimmy de la Torre, Rutgers, The State University of New Jersey, USA

The first part of the presentation focuses on the development and characteristics of the *generalized deterministic inputs, noisy "and" gate* (G-DINA) model as a general cognitive diagnosis model (CDM) framework. As a model, it is shown that the G-DINA model is equivalent to other general CDMs based on alternative link functions, and subsumes several commonly encountered constrained CDMs; as a framework, the G-DINA model allows procedures such as constrained CDM estimation, general and constrained model comparison, and empirical Q-matrix validation to be carried out more efficiently at the item, rather than test level. The second part of the presentation focuses on some recent developments pertaining to the procedures within the G-DINA model framework. It compares the proposed two-step approach for estimating parameters of constrained models with the traditional one-step procedure, documents the Type I error rate and power of the Wald test for comparing general and constrained CDMs, and lays out the basis for implementing a sequential procedure for Q-matrix validation based on a generalized discrimination index. The presentation concludes with a discussion of the implications of these developments in the practice of cognitive diagnosis modeling.

Chair:

Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

Symposium : Heterogeneity in latent variable models
Friday, 22 July, 1:30 p.m. -- 2:50 p.m., D1-LP-03

Organizer:

Dylan Molenaar, University of Amsterdam, The Netherlands

Presenters (marked with asterisks):

Testing Statistical and Substantive Hypotheses on the Distribution of the Observed Data Within the Generalized Linear Item Response Model
Dylan Molenaar*, University of Amsterdam, The Netherlands
Conor Dolan, University of Amsterdam, Netherlands

A test for cluster bias: Detecting Violations of Measurement Invariance Across Clusters in Multilevel Data.
Suzanne Jak*, University of Amsterdam, The Netherlands
Frans Oort, University of Utrecht, Netherlands
Conor Dolan, University of Amsterdam, Netherlands

Using Factor Analysis to Assess the Number of Factors in Measurements
Mariska Barendse*, University of Groningen, The Netherlands
Marieke Timmerman, University of Groningen, Netherlands
Frans Oort, University of Utrecht, Netherlands

Analyzing Longitudinal Survey Data: A Bayesian IRT Model with Occasion-Specific Item Parameters
Josine Verhagen*, University of Twente, The Netherlands
Jean-Paul Fox, University of Twente, Netherlands

Parallel Session: Multidimensional Item Response Theory - Applications
Friday, 22 July, 1:30 p.m. -- 2:50 p.m. , D1-LP-06

Presenters (marked with asterisks):

Assessing the Response of Sports Training Items Using Within-Item Multidimensional Modeling
Shyh-ching Chi*,National Taiwan Sport University., Taiwan

Measuring Change and Response Format Effects in Large Scale Educational Testing with LLRA
Thomas Rusch*, Vienna University of Economics and Business, Austria
Ingrid Dobrovits, Vienna University of Economics and Business, Austria
Birgit Gatterer, Vienna University of Economics and Business, Austria
Reinhold Hatzinger, Vienna University of Economics and Business, Austria

The Measurement of Civic Knowledge and the Response Process Behind: A Multidimensional Mixture IRT Modeling Approach
Joseph Kui-Foon Chow*, The Hong Kong Institute of Education, Hong Kong
Kuan-Yu, Jin, The Hong Kong Institute of Education, Hong Kong

Modeling the PISA 2006 Science Data by Using Additive MIRT Model
Mingchiu Chang*, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan

The Measurement of Chinese Language Proficiency based on Higher Order IRT Model
Rih-CHang Chao*, National Taichung University, Taiwan
Yahsun Tsai, National Taiwan Normal University, Taiwan
Bor-Chen Kuo, , National Taichung University, Taiwan

Moderator:
Mike W.-L. Cheung, National University of Singapore, Singapore

Parallel Session: Rasch Models - Applications in Nonability Measures
Friday, 22 July, 1:30 p.m. -- 2:50 p.m. , D1-LP-07

Presenters (marked with asterisks):

Psychometric Validation of the Health-related Child Body Questionnaire (HRCBQ) to Assess Chinese Caregiver Body Perception
Christine MS Chan*, The Hong Kong Institute of Education, Hong Kong
Wen Chung Wang, The Hong Kong Institue of Education, Hong Kong

Item Banks of Quality of Life Measures on Young Adult Survivors of Childhood Cancer
I-Chan Huang*, University of Florida, USA
Gwendolyn Quinn, Moffitt Cancer Center, USA
Zhushan Li, Boston College, USA
Elizabeth Shenkman, University of Florida, USA

Teacher Quality of Work Life in Primary School Comparison of Psychometric Properties Using Rasch Model
Nordin Abd. Razak*, Universiti Sains Malaysia, Malaysia
Ahmad Zamri Khairani, Universiti Sains Malaysia, Malaysia
Mahaya Salleh, Teacher Training Institute, Malaysia

A Rasch Analysis of Positive Academic Affect Scale
Jingjing Yao*, The Hong Kong Institute of Education, Hong Kong

Validating an Instrument for Measuring Leadership Responsibilities of Hong Kong Vice-Principals – A Rasch Analysis
Paula Kwan*, The Hong Kong Institute of Education, Hong Kong
Joseph Kui-Foon Chow, The Hong Kong Institute of Education, Hong Kong

Moderator:

Christof Schuster, Univeristy of Giessen, Germany

Parallel Session: Structural Equation Modeling - Applications II
Friday, 22 July, 1:30 p.m. -- 2:50 p.m. , D1-LP-08

Presenters (marked with asterisks):

Fitting Direct Covariance Structures by the MSTRUCT Modeling Language of the CALIS Procedure
Yiu-Fai Yung*, SAS Institute Inc., USA

Testing the Effectiveness of Three Multilevel Modeling Approaches in Addressing Data Dependency with Empirical Data under Structural Equation Modeling Framework
Jiun-Yu Wu*, National Chiao Tung University, Taiwan
Yuan-Hsuan Lee, National Chiao Tung University, Taiwan

Measuring the Effects of School Reading Curriculum on Students Achievements by Using Multilevel Structuring Equation Modeling
Daeseok Kim*, The University of Gerogia, USA
Jongmin Ra, The University of Gerogia, USA

Self-Esteem, Depression and Rebellion in Adolescence: Application of Latent Moderated Structural Equation Model
Jen-Hua Hsueh*, National Taiwan Normal University, Taiwan

Domain-Specific Risk Taking Scale: A Factor-Analytic Study with Chinese University Students
Joseph Wu*, City University of Hong Kong, Hong Kong
Hoi Yan Cheung, City University of Hong Kong, Hong Kong

Moderator:

Tze-ho Fung, Hong Kong Examinations and Assessment Authority, Hong Kong

Parallel Session: Mixture Modeling
Friday, 22 July, 1:30 p.m. -- 2:50 p.m. , D2-LP-08

Presenters (marked with asterisks):

Distinguishing the Signal from Noise with the Binary Latent Type Variable
Levent Dumenci*, Virginia Commonwealth University, USA

Bayesian Inference for Growth Mixture Models with Latent Class Dependent Missing Data
Zhenqiu Lu*, University of Notre Dame, USA
Zhiyong Zhang, University of Notre Dame, USA
Gitta Lubke, University of Notre Dame, USA

How to Find Hopeful Customer using Zero-Inflated Poisson Model with Latent Class
Kotaro Ohashi*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

Model Selection and Evaluation in Factor Mixture Modeling using A Two-Stage ML Approach
Xiaoling Zhong*, The Hong Kong Institute of Education, Hong Kong
Ke-Hai Yuan, University of Notre Dame, USA

The Mixture Item Response Model for Ability Decline during Testing
Kuan-Yu Jin*, The Hong Kong Institute of Education, Hong Kong
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

Moderator:

Roger Millsap, Arizona State University, USA

Parallel Session: Test Development and Validation - Nonability Measures II
Friday, 22 July, 1:30 p.m. -- 2:50 p.m. , D2-LP-09

Presenters (marked with asterisks):

Development and Validation of Students' Attitude toward Math Scale
Hsiang- Chun Wang*,National Sun Yat- sen University, Taiwan
Zuway-R Hong, National Sun Yat- sen University, Taiwan

An Investigation and Validation of Elementary School Students' Positive Thinking Scale
Chia-Jung Lin*, National Sun Yat- sen University, Taiwan
Zuway-R Hong, National Sun Yat- sen University, Taiwan

A Investigation and Validation of College Students Reading Motivation Scale
Tien-Chi Yu*, National Sun Yat-sen University, Taiwan
Zuway-R Hong, National Sun Yat-sen University, Taiwan

Patterns of Evidence in Teacher Observations: The View through Five Lenses
Catherine McClellan*, Educational Testing Service, USA
Steven Holtzman, Educational Testing Service, USA

Ubuntu Game: An Educational Mechanism for Fostering Trust in a Divergent World
Sunday Jacob*, Federal College of Education, Nigeria

Moderator:

Terry Ackerman, University of North Carolina at Greensboro, USA

Parallel Session: Nonparametric Statistics
Friday, 22 July, 1:30 p.m. -- 2:50 p.m. , D2-LP-10

Presenters (marked with asterisks):

Nonparametric Method for Estimating Conditional Standard Error of Measurement for Test Scores
Louis Roussos*, Measured Progress, USA
Zhushan Li, Boston College, USA

Multivariate Nonparametric Two-Sample Tests for Mixed Outcomes
Denis Larocque*, HEC Montreal, Canada
Jaakko Nevalainen , University of Turku, Finland
Hannu Oja, University of Tampere, Finland

A Branch-and-Bound Max-Cardinality Algorithm for Exploratory Mokken Scale Analysis
Michael J. Brusco*, Florida State University, USA
Hans-Friedrich Koehn, University of Illinois at Champaign-Urbana, USA
Douglas Steinley, University of Missouri-Columbia, USA

2 and 2 Equals 4 !
Rudy Ligtvoet*, University of Amsterdam, Netherlands

Assessing Dimensionality through Mokken Scale Analysis: What Happens When Questionnaires Do Not Have Simple Structures?
Iris A.M. Smits*, University of Groningen, Netherlands
Marieke E Timmerman, University of Groningen, Netherlands
Rob R. Meijer, University of Groningen, Netherlands

Moderator:

Yasuo Miyazaki, Virgnia Tech, USA

Presidential Address: Future of Psychometrics: Ask What Psychometrics Can Do for Psychology

Friday, 22 July, 3:00 p.m. -- 3:50 p.m. , C-LP-11

Presenter:

Klaas Sijtsma, Tilburg University, The Netherlands

Modern psychometrics suffers from the gap with psychological researchers and their psychological research problems. The gap is due to the increased complexity of modern psychometric methods. This requires knowledge from psychological researchers that they do not have. As it is unlikely that psychologists will soon develop to become better statisticians, I argue that psychometrics should take up problems that psychological researchers struggle with and solve these problems. It appears there are a large number of important psychometric issues that nowadays fall between psychometrics and psychology and largely remain unaddressed, and I discuss a few: Influence of test length on decision quality in personnel selection and quality of difference scores in therapy assessment, and theory development in test construction and validity research.

Chair:

Jos ten Berge, University of Groningen, the Netherlands

Conference Closing Ceremony

Friday, 22 July, 3:50 p.m. -- 4:20 p.m. , C-LP-11

All participants are warmly invited to attend the Conference Closing Ceremony.

Rundown:

- Speech by Professor Klaas Sijtsma, President of Psychometric Society
- Speech by Professor Mark Wilson, President-Elect of Psychometric Society
- Speech by the 2012 International Meeting of Psychometric Society Local Organizing Committee

Business Meeting

Friday, 22 July, 4:30 p.m. -- 5:10 p.m. , B4-LP-04

This meeting is open to all members of the Psychometric Society. All members are welcome to attend.

Banquet & Best Junior Presenter Award & Best Poster Presentation Award
Friday, 22 July, 6:00 p.m. -- 9:00 p.m. Lake Egret Nature Park

All participants are warmly invited to attend the banquet. Junior Presentation Award and Best Poster Presentation Award will be announced during the banquet.

Coaches are arranged to bring banquet participants to the banquet venue, Lake Egret Nature Park, with address indicated below. Please bring along your banquet ticket.

For the Best Junior Presenter Award and Best Poster Presentation Award, ballots are placed in participates' conference bags which are available for picking up at the conference registration area.

Address:
Lake Egret Nature Park
No. 2 Hung Lam Drive,Tai Po Kau, N.T., Hong Kong.
Phone: (852) 2657 6657
E-mail: icentre@taipokau.org
Website: http://www.taipokau.org

Abstract

Tuesday, 19 July, 2011

Validity Theory
Invited Symposium : Tuesday, 19 July, 11:10 a.m. -- 12:30 a.m., D1-LP-03

How to Think About the Relation Between Constructs and Observations
Denny Borsboom, University of Amsterdam, The Netherlands

The relation between constructs and observables is a crucial element in thinking about test validity. In the past century, several ways of thinking about this relation have been entertained. These include causal relations (where observables are caused by a construct or vice versa), sampling relations (where observables are considered samples from a population of potential observations), and mereological relations (where observables are considered part of a construct). These different conceptualizations result in distinct requirements when thinking about the evidential backup for test-related claims. I will lay out these consequences and introduce some metaphors that are helpful in thinking through the question of whether and how one should address validity.

The Relation between Process Models for Decision Making and Latent Variable Models for Individual Differences
Han van der Maas, University of Amsterdam, The Netherlands

It has been argued that the primary locus for validity evidence lies in investigations that focus on the question how a testing procedure works, i.e., which processes transmit variation among individuals into variation in the item responses (Borsboom, Mellenbergh, & Van Heerden, 2004; Borsboom & Mellenbergh, 2007). It is evident that, in answering such questions, the presence of a theory that links IRT models to information processing
theories is essential. Here we present such a theory. We derive IRT models from the famous diffusion model for two-choice response processes. This leads to a new item response model for accuracy and speed based on the idea that ability has a natural zero point. The model implies fundamentally new ways to think about guessing, response speed and person fit in item response theory.

Method Effects: Concepts and Models
Andrew Maul, University of Oslo, Norway

Valid measurement of an attribute requires that variation in the outcomes of a measurement procedure be produced by variation in that attribute, and not by idiosyncrasies of the particular methods or conditions associated with the procedure. The terms "method effect" and “methods variance” have sometimes been used in reference to the latter source of variation, and various models, including many based on the now- famous multitrait-multimethod matrix, have been proposed to help with detecting, understanding, and/or controlling such variance. Meanwhile, techniques have been developed in the item response theory (IRT) tradition for modeling what is often called local item dependence, (LID), although LID has largely been cast as an issue affecting estimation of measurement precision rather than as a larger validity issue. In this talk, I will attempt to present a conceptual overview of the challenge of differentiating variation in observations that can be interpreted as causally resulting from variation in the attribute of measurement from variation produced by solely by idiosyncratic structural or circumstantial features of the specific choice of measurement procedure. I will briefly discuss how some latent variable models can be used and interpreted as models for method effects, depending on the nature of the psychological theory available. If time permits, I will comment on how the interpretation of a “method effect” changes depending on one’s philosophical stance on the meaning of measurement (realist, representationalist, metaphorical).

The Guttman-Rasch Paradox: Why the Interval Level of Measurement Unparadoxically Goes Poof When Precision Increases

Annemarie Zand Scholten, University of Amsterdam, The Netherlands

Recently, claims of quantitative measurement associated with the Rasch model were questioned due to the paradoxical relation between error and precision in this model (Michell, 2008). If precision increases in Rasch items, they become Guttman items, losing their quantitative properties. Removing error decreases precision. To address this paradox we consider to what extent both models meet the requirements for interval level measurement. This leads us to conclude that the Guttman model cannot simply be considered an error-free version of the Rasch model. Furthermore, we argue that an increase in precision by adding error is not paradoxical per se, by discussing the well-known phenomenon of stochastic resonance. These arguments together lead us to conclude that the paradox disappears when the crucial aspects continuity and measurement level, and not error and precision, are considered.

Score Interpretation: The Goldilocks Model

Keith A. Markus, The City University of New York, USA

The concept of score interpretation figures prominently in test validity theory. Even a thermometer reading can have different interpretations in different testing contexts. The Goldilocks Model comprises six claims about the nature of test score interpretations. The model provides a general method of modeling test score interpretations and individuating distinct interpretations. The model offers guidance in the application to the process of test validation of accepted principles for choosing research questions. The model can help test developers formulate alternative interpretations as rival hypotheses and isolate observations that distinguish between them. While acknowledging the continuity between validation research and basic scientific research into the construct measured by the tests, the model also helps to demarcate boundaries between validation research and basic research. Research that supports premises of Kane's (2006) interpretive argument constitutes validation research. Research that supports or tests further inferences drawn from the conclusions of Kane's interpretive argument constitutes basic research into the construct measured by the test. The latter informs test validity, but only the former directly bears on test validation. Finally, the model offers guidance with respect to the question of how much validity evidence is sufficient. The Goldilocks Model discourages interpretations that are too weak to support the intended test use and also discourages interpretations that are too strong to receive support from the available evidence. Instead, the model encourages bringing the proposed interpretation into alignment with both the intended use and the available evidence. Validation requires sufficient evidence to support such a minimal interpretation.

Issues in Educational Measurement and Examinations
Invited Symposium : Tuesday, 19 July, 11:10 a.m. – 12:30 a.m., D1-LP-04

Using Mixed IRT Models to Compare the Effectiveness of Different Linking Designs: the Internal Anchor Versus the External Anchor and Pre-Test Data

Marie-Anne Mittelhaëuser*, Cito Institute of Educational Measurement/Tilburg University, The Netherlands
Anton Béguin, Cito Institute of Educational Measurement, The Netherlands
Klaas Sijtsma, Tilburg University, The Netherlands

The goal of the current study was to compare a linking procedure for two high-stakes test forms using three different linking designs. The three different linking designs vary in the administration condition of the common items. First, an internal anchor design was used, where the common items are administered in a high-stakes condition. Second, an external anchor design and a pre-test design were used, where the common items are administered in a low-stakes condition. It was hypothesized that the test-taking condition of the common items influences the linking procedure. The results support the hypothesis. A mixed Rasch model

(Rost, 1997) was used to model some examinees as being more motivated than others to solve the items. Next to the application of mixed IRT, aberrant item-score vectors were identified using the l_z person-fit statistic, which attempts to assess the fit of the IRT model at the individual level (Drasgow, Levine, & Williams, 1985). Removal of aberrant item-score vectors or items displaying differential item functioning did not improve the linking procedure.

On the Usefulness of Latent Variable Hybrid Models for Detecting Unobserved Person Heterogeneity and Person Misfit in Educational Testing

Wilco Emons*, Tilburg University, The Netherlands

In this presentation, we discuss the usefulness of latent variable hybrid models, including latent class IRT and IRT mixture models, to detect unobserved qualitative differences in examinee's response patterns and person misfit. Educational researchers may use this information to distinguish substantive individual differences in response behavior from idiosyncratic person-response behavior. Different latent variable hybrid approaches will be discussed for both dichotomous and polytomous exam data. Results from empirical data analysis and simulation studies will be presented and limitations and implications for future research will be discussed.

Complex Decision Rules and Misclassification: Who Should Take A Retest?

Robert Zwitser*, Cito Institute of Educational Measurement, The Netherlands

Decision making based on test scores always holds the risk of misclassification. A well-known intervention for reducing misclassification is increasing the test length. In this study we investigate the role that optional retests can play in the reduction of misclassification. The main question is: which students have to take a retest? In a single examination with a single cut-score it is clear that those students that have a score close to the cut-score have the largest probability of being misclassified. However, in cases with complex decision rules based on multiple scores it is less straightforward to determine which students have to take extra tests. In this study we focus on this selection problem. We take data from a national examination system with multiple courses. We assume a multidimensional item response model and propose an MCMC algorithm for estimating the posterior distributions of the latent variables. Then two different approaches are considered. First, we assume cut-off points on the latent scales and use this posterior distribution in order to study for each score pattern the magnitude of the multivariate density region for "pass" and "fail". Second, we assume a scoring rule and use the posterior distribution to simulate

response patterns and then investigate the observed proportions “pass” and “fail”. Both cases will be illustrated with examples.

Vertical Comparison Using Reference Sets

Anton Béguin*, Cito Institute of Educational Measurement, The Netherlands
Saskia Wools, Cito Institute of Educational Measurement, The Netherlands

In educational assessment often comparisons are made between students with a different educational background. For example if performance levels are defined across students from different grades or across students following a different track of education. To be able to link the assessments vertical equating procedures are defined. These procedures will take into account that for some items the item characteristics differ between groups of students (DIF). In situations where the proportion of items with differences is large the validity of the vertical linking is challenged. This will especially be the case if designated tests are constructed for the different groups of students. In this paper an alternative procedure is introduced and compared with vertical equating. In this procedure a set of items is constructed that will serve as a basis for comparison between the different groups of students. This set of items consist of samples of items from the test for each of the groups of students and is called a reference set. The content of the reference set represents all aspects of the intended construct and is composed in such a way that none of the groups of students is advantaged. For the total reference set data are collected in each of the groups of students. Subsequently, tests for each of the groups of students can be linked to the reference set separately. For each test all score points are linked to scores on the reference set and as a consequence to a common metric.

A Model-Free Approach to Cognitive Diagnosis: Robustness Under Misspecification and Implications for Latent Structure Identification

Parallel Session: Cognitive Diagnosis Modeling - Theory I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Chia-Yi Chiu*, Rutgers, The State University of New Jersey, US

A trend in educational testing is to go beyond unidimensional scoring and provide information on a complete profile of mastered and non-mastered skills. To achieve this, cognitive diagnosis models have been developed and the diagnosis of class membership is the statistical objective of these models. Cognitive diagnosis models are derived under assumptions on which attributes are needed for which items and how the attributes are utilized to construct responses. They recognize that data usually do not correspond to the ideal response pattern, the specific item response pattern that each element indicates whether the examinee possesses all attributes required for answering the particular item. Nevertheless,

the ideal response patterns may well be the most likely response, and classification based on deviations from the ideal responses can be effective, without making any assumption about the parametric form of the model. The aim of this study is to examine the effectiveness of the model-free classification by utilizing appropriate distance measures between observed and ideal response patterns, under a wide variety of possibilities for underlying cognitive diagnosis model responsible for generating the data. The robustness of the model-free method is investigated by comparing with model-based methods given a misspecified item-by-attribute matrix or a misspecified parametric model. The rapid speed at which classifications are obtained using the model-free approach allows for millions of different specifications of the latent structure specified by the item-by-attribute matrix to be compared. This implies that exploratory procedures for identifying the latent structure can be implemented, given a reasonable starting value.

A Cognitive Diagnosis Method Based on Q-Matrix and Generalized Distance
Parallel Session: Cognitive Diagnosis Modeling - Theory I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Jianan Sun*, Beijing Normal University, China
Shumei Zhang, Beijing Normal University,China
Tao Xin, Beijing Normal University,China
Yu Bao, Beijing Normal University,China

In recent years, cognitive diagnosis research has become a hot issue in psychometric measurement and educational assessment. Researchers are always concerning about developing a Cognitive Diagnosis Method (CDM) which can precisely indentify every examinee's knowledge state. This study introduces a new approach called Generalized Distance Discrimination (GDD) for dichotomous IRT models, and it is based on the compliment of Q-matrix theory (Tatsuoka, 1991) by Leighton et al. (2004) and Ding et al. (2009, 2010). In simulation, we compare the classification accuracy for respondents of GDD with that of the two methods: RSM and AHM. Pattern match ratio and averaging attribute match ratio are used as two criterions to evaluate classification accuracy of these approaches. Specifically, the simulated examinees' response data with a sample size of 1000 are generated from DINA model, which is treated as a comparison baseline to check the classification performance of GDD, RSM and AHM. The structure of simulated cognitive tests are designed under 16 different conditions: four Q-matrix from four attribute hierarchical structures used in AHM of Leighton et al. (2004) and four kinds of combination of slip and guess parameters in DINA model. The result shows that GDD and DINA model perform almost equally, and the other two methods perform significantly worse than DINA

model. Besides, the method of GDD can also be developed to treat the data with missing responses and generalized to the cognitive tests with polytomous items.

Mixture Higher-Order DINA Model for Differential Attribute Functioning
Parallel Session: Cognitive Diagnosis Modeling - Theory I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Yoon Soo Park*, Columbia University, USA
Young-Sun Lee, Columbia University, USA

The use of cognitive diagnostic models (CDMs) to classify students into attribute mastery profiles have received increased interest in educational measurement. Among various CDMs developed, the higher-order deterministic, inputs, noisy, "and" gate model (HO-DINA; de la Torre & Douglas, 2004; DeCarlo, 2011) provides diagnostic information about student's attribute mastery. The attractive aspect of the HO-DINA model is that it also provides information about the attribute in terms of attribute difficulty and discrimination as a higher-order factor in addition to information about the guess and slip provided by item parameters. This study extends the framework of the HO-DINA model to incorporate a finite mixture distribution to explore differential attribute functioning among latent subgroups in the data. This study proposes a mixture Higher-Order DINA model (MixHO-DINA), which creates separate item and attribute parameters for latent subgroups of examinees. An analysis using the subtraction-fraction data (Tatsuoka, 1987) showed that the MixHO-DINA model using two latent classes fits better than the HO-DINA model based on information criteria statistics. Furthermore, high prevalence of attribute mastery was mitigated in the MixHO-DINA model. Higher-order attribute parameters resulting from the mixture framework also showed notable differences in attribute discrimination estimates for 4 out of the 8 attributes between latent classes. These results support the use of a mixture finite distribution within the HO-DINA model framework to better understand differences between latent subgroups.

A Hybrid Model of HO-IRT and HO-DINA Models
Parallel Session: Cognitive Diagnosis Modeling - Theory I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Chih-Wei Yang*, National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan
In recent years, some higher-order item response theory (HO-IRT) models and higher-order DINA (HO-DINA) models were proposed. HO-IRT models can provide the overall ability and domain abilities estimators simultaneously. HO-DINA can provide the overall ability and cognitive diagnosis information in the same model.

The purpose of this study is to develop a 3-level DINA model which is a hybrid model of HO-IRT and HO-DINA models. The first level is overall ability and the second level is domain abilities. The third level is cognitive attributes based on DINA model. Using a Markov chain Monte Carlo method in a hierarchical Bayesian framework, the overall ability, domain abilities, and cognitive attributes and abilities' correlations, are estimated simultaneously in this model. The feasibility of the proposed model is investigated by a simulation study and illustrated using actual assessment data.

Research on Factors Influencing Diagnostic Accuracy in AHM and DINA
Parallel Session: Cognitive Diagnosis Modeling - Theory I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Yuanhai Yan*,Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China

Cognitive diagnosis is a product of combining cognitive psychology with modern psychological and educational measurement and it is a core of the new theoretical generation. Various factors, such as test construction (TC) and test-length(TL), type of attribute hierarchy(TOAH), cognitive diagnosis model (CDM), quality of item (QOI), and so on, will affect the accuracy of diagnosis to some extent. Based on two diagnosis models AHM and DINA, affecting degree of different factors to accuracy index is explored in the paper. The results show different factors having varying degree of influence on the accuracy of diagnosis. TL is not the longer the better when TOAH is linear. Different TC has varying degree of influence on the classification accuracy rate (CAR) of models. A cognitive test that contains reachability matrix has a high CAR than that of did not contain. The higher the slip, the lower the pattern and the marginal CAR. And attribute construction with higher degree of loose often has the lower CAR. AHM is more sensitive to attribute construction and sometimes performs much reasonablely than DINA . But, generally speaking, the CAR based on DINA is higher than that based on AHM.

Projective IRT for Purified Constructs
Parallel Session: Item Response Theory - Methodology I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07

Edward Ip*, Wake Forest University, USA
The problem of fitting unidimensional item-response models to potentially multidimensional data has been extensively studied. The focus of the presentation is on response data that contains a major dimension of interest but that may also contain minor nuisance dimensions. Because fitting a unidimensional model to multidimensional data results in ability estimates

that represent a combination of the major and minor dimensions, such a procedure tends to produce ability estimates that cannot be compared across different tests targeting the same construct, or even across different test forms from the same test bank. This work is built upon previous theoretical results in Ip(2010) on the empirical indistinguishability between a multidimensional IRT model and a locally dependent unidimensional IRT model. Here I propose a projective IRT framework that allows the projection of multiple dimensions onto a targeted single dimension that is of substantive interest. Two robust versions of standard error estimate for ability score are also evaluated. An important appeal of the projective IRT procedure is that it allows the direct measurement of a targeted construct and valid inference for test-independent ability scores. In other words, "contaminated" constructs can be "purified" through the projective IRT mechanism. Through simulation studies, I show that the proposed projective IRT procedure effectively recovers ability scores in the targeted dimension. The procedure involves only a small amount of additional computation over conventional IRT and could have potential applications in areas such as computerized adaptive testing.

Model Selection for Tenable Assessment: Selecting a Latent Variable Model by Testing the Assumed Latent Structure

Parallel Session: Item Response Theory - Methodology I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07

David Torres Irribarra*, University of California at Berkeley, USA
Ronli Diakow, University of California at Berkeley, USA

Inferences about a construct of interest are often based on statistical models. These models define a priori the kind of differences that exist between the persons who are being assessed. These differences can be in quality, in order, or in quantity. The nature of these differences is a fundamental theoretical assumption about the structure of the variable that is being studied that often goes unexamined.

This study addresses this issue by proposing a framework for selecting statistical models that imply different assumptions about the structure of the variables.

Specifically, we arrange a set of latent variable models, including latent class models (Lazarasfeld & Henry, 1968), ordered latent class models (Croon, 1990), latent class Rasch models (Formann, 1985) and Rasch models (Rasch, 1960), according to their assumed latent structure such that progressively more stringent monotonicity and scale assumptions are placed on the latent variable.

We illustrate the proposed framework for model selection via a 'blind' simulation study where the data were generated and analyzed by separate people, so that the analyst had no knowledge about the latent structure that generated the data.

The results of the study provide preliminary evidence that model comparison within this framework is able to recover the generating latent structure. The overall error rate was 10% for model identification and 5% for interval scale identification. These general results indicate that the method shows promise and warrants further review.

Optimum Information Bounds for IRT Models
Parallel Session: Item Response Theory - Methodology I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Alexander Weissman*, Law School Admission Council, USA

From the perspective of information theory, marginal maximum likelihood estimation of IRT models by the expectation-maximization (EM) algorithm is equivalent to an alternating minimization of the Kullback-Leibler (KL) divergence, or relative entropy, between two functions: the posterior density of the latent variables given the observed variables, and the joint likelihood of latent and observed variables. A key advantage of the EM algorithm is that it guarantees convergence to a local maximum of the log likelihood function, or equivalently, a local minimum of the KL divergence. However, if parametric constraints on the likelihood function are relaxed while simultaneously preserving the assumptions common to most IRT models (e.g., local independence), convergence to a global optimum is also achievable. Such relaxation leads to an optimal information bound, a fixed point of reference against which other models may be tested. A likelihood ratio test is provided as a means for testing models against this bound, with empirical examples demonstrating the approach.

A New Scaling Procedure Based on Conditional Association for Assessing IRT Model Fit
Parallel Session: Item Response Theory - Methodology I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Hendrik Straat*, Tilburg University, Netherlands
Andries van der Ark, Tilburg University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

The ordinal, unidimensional latent variable model assumes unidimensionality, local independence, and monotonicity, and implies the general property of conditional association between sets of items. We specialized conditional association into three observable consequences useful for practical scaling. In a previous stage of this project, we investigated whether these observable consequences were negative or nonnegative under violations of IRT

model assumptions. In this presentation, we introduce new results by implementing the three observable consequences in a new scaling procedure that we coined CA scaling. CA scaling aims at identifying items that are inconsistent with the unidimensional latent variable model, removing those items from the initial item set, and producing a subset of items that is consistent with the unidimensional latent variable model. We compared CA scaling with the scaling procedures DETECT and Mokken scale analysis, and found that CA scaling produced longer scales consistent with the unidimensional latent variable model.

Variational Bayesian Approximation Method for Inference in Item Response Model
Parallel Session: Bayesian Methods in Item Response Theory; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Pattarasuda Sudsaen*, The University of New South Wales, Australia

Parameter estimation has drawn attention in IRT for a long time. In likelihood approach, the Marginal maximum likelihood (MMLE) can resolve the inconsistency problem of other estimation techniques but still has some limitations such as failure to compute the ability estimate in extreme response patterns. Moreover, MMLE relies on highly accurate integration which is not always feasible in high-dimensional problems. In Bayesian setting, full Bayesian estimation overcomes the inconsistency problem. However, in its MCMC implementation, it is computationally intensive, often lacks reliable convergence criteria and requires appropriate choice of the priors. To overcome these difficulties, we focus on the Variational Bayes (VB) approximation. It approximates the posterior by using simpler tractable density, to reduce the computational intensity of MCMC and yet delivers reasonable accuracy of estimation. The advantages of VB include less computational time, availability of a lower bound on the marginal likelihood to check convergence and a reasonable accuracy of the estimates of item parameters. We outline the VB method for inference in the two-parameter IRT model. We also discuss multifactor extensions of the method. We demonstrate its good convergence by monotonically increasing the value of the lower bound during the iteration process which makes the convergence check very easy. VB's item parameter estimators perform well and even better than Bayesian estimators in smaller sample sizes and when non-informative prior on the item parameters is applied. For informative priors, VB and Bayesian estimation are comparable when small to moderate samples are used but VB uses much less computing time.

Bayesian Person Fit Evaluation: A Non-Parametric Approach
Parallel Session: Bayesian Methods in Item Response Theory; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Herbert Hoijtink*, Methods and Statistics/University Utrecht, Netherlands

Sebastien Beland, Universite Du Quebec a Montreal, Netherlands

This paper introduces Bayesian person fit evaluation in the context of double monotonous IRT models for dichotomous item response data. It will be shown that the approach proposed allows
a flexible specification of hypotheses with respect to the response process. It will also be shown how the Bayes factor can be used to evaluate the hypotheses of interest. The performance of
the approach proposed will be evaluated, and avenues for further research will be sketched.

Extensions and Applications of Higher-Order Item Response Theory Models
Parallel Session: Bayesian Methods in Item Response Theory; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Chi-Ming Su*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

The study generalized unidimensional second-order IRT models to multidimensional higher-order IRT models and developed CAT algorithms. Due to high dimensionality of the new models, we proposed to use Bayesian MCMC methods for parameter estimation. The results of simulations show that the parameters can be recovered fairly well using the computer WinBUGS. Furthermore, both the PsBF and the DIC were sensitive in model comparison across a variety of conditions. The CAT algorithms of the new models were successfully developed. The simulation results indicate that the progressive method and the alpha-stratified method, although increasing bank usage, did not always maintain item exposure rates at a prespecified level, whereas the Sympson and Hetter online freeze method did. In practice, it is recommended that both the progressive method and the Sympson and Hetter online freeze method are implemented to maintain both item exposure and bank usage.

Impacts of Prior Distributions in Testlet IRT model
Parallel Session: Bayesian Methods in Item Response Theory; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Jongmin Ra*, The University of Georiga, USA
Seock-Ho Kim, The University of Georgia, USA

The purpose of this paper is to examine impacts of different prior distributions in the Testlet IRT models. Once Bradlow, Wainer, and Wang (1999) suggested a two parameter normal testlet model so as to include the testlet effect in the model, subsequent studies (Bradlow et al., 1999; Wainer, Bradlow, & Du, 2000;Wang, Bradlow, &Wainer, 2002) showed that testlet

models effectively account for local dependence existing among items sharing the same stimulus and also yield accurate model parameter recovery. Then, a large volumes of following research regarding testlet effects mainly focuses on ability and item parameter estimation, estimation accuracy, and test reliability. Nonetheless, impacts of prior and hyper-prior distributions on testlet IRT models have not been paid enough attention.
The focus is on investigating various prior and hyper-prior distributions and comparing them with respect to practical sense. The impacts of prior distributions will be evaluated using both real and a simulated data.

The Exploration and Comparison of the Ability Estimation Methods for Multidimensional Test

Parallel Session: Bayesian Methods in Item Response Theory; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08

Yue Wang*, Beijing Normal University, China
Hongyun Liu, Beijing Normal University, China

Several approaches to estimate multidimensional ability parameter can be found in the literature. This research explores the recovery of different multidimensional ability estimation approaches: NCCTT based on CTT, Bayesian estimation based on MIRT, NCMIRT, NCH, NCMIRTa and NCHa based on both MIRT and CTT. A Monte Carlo simulation study is conducted to compare the different estimation methods under varies of conditions of test length, sample size, test structure and correlations between dimensions. Results indicate that: (1)MCMC methodology is the most accurate method with the smallest RMSE, followed by NCHa. But NCHa is much easier and faster than MCMC. (2)The precision of the ability estimators for all these methods is increased as the length of the test increases, but it is not influenced by sample size, although some other researches indicated. (3)The differences of ability estimators between different methods are moderated by test structures. They are much bigger in within-item multidimensionality tests than that of in between-item multidimensionality tests. (4)In within-item multidimensionality tests, the higher the correlations between dimensions are, the smaller the difference of estimation accuracy between different methods is. When the correlations between dimensions reach 0.8, similar results can be found from all these methods. However, in between-item multidimensionality tests, as the correlations between dimensions increasing, the difference of estimation accuracy between different methods slightly increases. When the dimensions are highly correlated, those simple methods estimate a little poorly. The authors conclude with considerations for choosing appropriate estimation methods and give some advice for applied researchers.

Rotation to Higher Order Invariance In Dynamic Factor Analysis
Parallel Session: Multivariate Data Analysis I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Michael Browne*, The Ohio State University, USA
Guangjian Zhang, The University of Notre Dame, USA

The theory of higher order factorial invariance in dynamic factor analysis has been introduced by John Nesselroade. According to this theory differences between persons occur at the measurement level so that differences in factor loadings from one person to another are to be expected. On the other hand, intra-personal processes, possibly rooted in physiology, should vary little from one person to another. This would be reflected in similarities between persons in their latent time series and consequently in their latent factor autocorrelation matrices at lags 0, 1, 2,…
In the initial exploratory stages of research it is appropriate to rely on exploratory factor analysis with rotation. After realistic hypotheses have been suggested at the exploratory stage they may be tested by confirmatory analyses on new data. This presentation will be concerned with the exploratory stage of higher order factorial invariance. It will provide an oblique factor rotation procedure in dynamic factor analysis so as to yield similar latent autocorrelation matrices for different persons without requiring any similarity between factor matrices. Examples of the use of the rotation procedure will be provided.

Analysis of Brand Switching Among Sliced Cheese by Asymmetric Multidimensional Scaling
Parallel Session: Multivariate Data Analysis I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Akinori Okada*, Tama University, Japan
Tsurumi Hiroyuki, Yokohama National University, Japan

The brand switching matrix among nine sliced cheese brands was analyzed by asymmetric multidimensional scaling based on singular value decomposition. The asymmetric multidimensional scaling provides us the outward tendency and the inward tendency along each dimension. The outward tendency of a brand shows the degree of the switching from that brand to the other brands. The inward tendency of a brand shows the degree of the switching to that brand from the other brands. The singular value decomposition of the brand switching matrix represents left and right singular vectors and the singular values. The left and singular vectors give the outward and inward tendencies respectively. One set of the outward tendency and one set of the inward tendency are obtained along each dimension. The two-dimensional result was chosen as the solution, because that Dimension 3 shows only

small amount of information from the standpoint of the marketing of sliced cheese brands, and that the scree criterion of the ratio of the accumulated sum of squared singular values to the sum of all nine squared singular values or sum of all squared elements of the brand switching matrix. The result is shown by a plane spanned by the left and right singular vectors along each dimension. Dimension 1 shows brands made by three makers severely compete each other. Dimension 2 shows there are two groups of brands. The brand switching within a group is large, while that between group is small.

Maximum Entropy Procedure, A Univariate Discrete and Continuous Distributions Simulating Procedure with the Parameter Constraints
Parallel Session: Multivariate Data Analysis I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Yen Lee*, National Cheng Kung University, Taiwan
Chung-Ping Cheng, National Cheng Kung University, Taiwan

When conducting the robustness researches about normality assumption with Monte Carlo method, a procedure for simulating non-normal distributions is needed. Some procedures for simulating continuous distributions have been proposed, but there isn't any procedure for simulating discrete distributions of ordered categorized variables (e.g., Likert-Type scale) which we met mostly in practice. Therefore, a procedure called Maximum Entropy Procedure (MEP) which could simulate discrete and continuous distributions with 2 parameters constraints of skewness and kurtosis or 4 parameters constraints of added mean and variance is purposed in this research. With the constraints satisfying, the probability distributions chosen by MEP would be the one with the greatest number of ways to achieve and hence a reasonable choice. The procedure has been programmed in R and demonstrated excellent agreement (smaller than 10-10) between specified and generated parameters.

Nonsingular Transformation of Tucker2 Solutions for Representing Stimulus-Response Relationships by Sparse Networks
Parallel Session: Multivariate Data Analysis I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Adachi Kohei*, Osaka University, Japan

Three-way component analysis solutions for data arrays of stimuli by responses by individuals are represented by the networks linking stimuli to responses by way of the two layers of components. In this paper, I propose a method for transforming initial Tucker2 solutions so that transformed solutions are represented by sparse networks. This method simultaneously attains the three purposes; [1] matching component matrices to known simple

targets, [2] matching the extended core arrays associated with individuals to a partially unknown target core array, and [3] allowing this target array to summarize individuals' core arrays. One feature of the method is that transformation matrices to be obtained are unconstrained except for their non-singularity, which differs from those in orthogonal and oblique rotation. The proposed method is illustrated with a data array of semantic differential ratings.

On the Extended Wedderburn-Guttman Decomposition
Parallel Session: Multivariate Data Analysis I; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Yoshio Takane*, McGill University, Canada

Let X denote an n by p (data) matrix, and let M and N be matrices such that M'XN can be formed. Takane and Yanai discussed the necessary and sufficient condition under which rank(X - XN(M'XN)-M'X) = rank(X) - rank(XN(M'XN)-M'X) to hold. This condition along with the rank formula is called the extended WG theorem. The theorem implies a decomposition of X of the form X = XN(M'XN)-M'X + (X - XN(M'XN)-M'X), which we call the extended Wedderburn-Guttman decomposition. In this talk, we discuss several important properties of the decomposition, including an expression of the second term as a single matrix (rather than a difference between two matrices).

Test Length and Decision Making in Psychology: When Is Short Too Short?
Parallel Session: Classical Test Theory - Reliability Issue; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09
Peter Kruyen*, Tilburg University, Netherlands
Wilco Emons, Tilburg University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

To efficiently assess multiple psychological attributes and to minimize the burden on patients, psychologists increasingly use shortened versions of existing tests. Meanwhile, the importance of psychological testing has increased. For example, patients are routinely measured to monitor their progress in the course of a therapy and to evaluate treatment programs. These measurements are not only used to evaluate changes in the individual patient, but they are also used by insurance companies to make financial decisions on whether or not to reimburse certain treatment programs. However, the shortened tests are less reliable compared to long tests and may therefore substantially impair reliable decision-making.
In this study, we reviewed recent trends in the use of short tests and examined the impact of test length reduction on individual decision-making. First, we present the results of a

literature review on the use and validation of abbreviated tests in psychology. Second, we present the results of simulation studies comparing the risks of making incorrect decisions for the long and abbreviated tests. These simulations showed that the number of items needed to take decisions about patients depends on various factors including the application envisaged. For some applications five to ten items are sufficient, whereas in other applications one needs at least twenty items.

An Empirical Comparison of Methods for Estimating Reliability
Parallel Session: Classical Test Theory - Reliability Issue; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09
Kensuke Okada*, Senshu University, Japan

Many former studies have reported the tendency of Cronbach's alpha to underestimate the true reliability. Recently, separate studies have reported the better performance of McDonald's omega (omega_h and/or omega_t), or of reliability estimation using structural equation modeling (SEM) technique. However, to the best of the authors' knowledge, these two approaches have not been directly compared. Therefore, in this study, we compared the performance of these two methods to estimate reliability by a Monte Carlo study. The following factors are manipulated: generation model structures (tau-equivalent, congeneric and bifactor), path coefficient values, number of observations, and number of items. Artificial data are generated from the model, and then analyzed to estimate reliability. The quality of a reliability estimate is evaluated by computing relative biases and efficiencies. The results can be summarized as follows. (1) While basically no estimation problems are found in calculating omega, SEM estimation encounters a few problems. (2) Small sample sizes result in larger biases. (3) Omega_t with three specific factors sometimes result in biased estimates. (4) While SEM estimates from the true model structure give satisfactory performance, they result in larger biases if the model structure is misspecified. (5) On the whole, SEM estimation with tau-equivalent and congeneric models and omega (total) with one specific factor reveals good performance.

Cronbach's Coefficient Alpha Reliability for Scale Scores of Dichotomous Items Test
Parallel Session: Classical Test Theory - Reliability Issue; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09
Rashid Al-Mahrazi*, Sultan Qaboos University, Oman

Cronbach's coefficient alpha (or Kuder-Richardson formula-20) is the commonly-used coefficient for estimating internal consistency reliability of raw scores of dichotomous items test under tau-equivalent forms assumption. However, most test users prefer transforming

total raw scores to scale scores with either linear or nonlinear transformation for better test score interpretation. Although the estimate of reliability for test raw score is equal to estimate of reliability for linearly transformed scale scores by definition, this estimate is not necessarily equal to estimate of reliability for nonlinearly transformed test scale scores. However, there is no existing method to estimate Cronbach's coefficient alpha reliability for test nonlinear scale scores. There is an approximation method to get an estimate of internal consistency reliability of test scale scores through estimating the individual conditional error variance. There are number of methods to estimate individual conditional error variance such as Feldt and Qualls (1998), Kolen, Hanson, & Brennan (1992). This approximation method of estimating reliability for scale scores defines the error variance as the average of individual error variance assuming random responses with binomial distribution or any true score distribution. However, Conbach's coefficient alpha defines error variance differently as error variance of examinees across tau-equivalent forms.
The paper will demonstrate the proposed method to give exact estimation of Cronbach's coefficient alpha for any transformed scale scores of dichotomous items test. Then this estimate of reliability for test scale scores will be compared with other existing approximated methods with different types of commonly-used scale scores using real data set.

Estimating the Reliability of Aggregated and Within-Person Centered Scores in Ecological Momentary Assessment
Parallel Session: Classical Test Theory - Reliability Issue; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09
Po-Hsien Huang*,National Taiwan University, Taiwan
Li-Jen Weng, National Taiwan University, Taiwan

A procedure for estimating the reliability of test scores in ecological momentary assessment (EMA) is proposed. The proposed procedure considers several characteristics of EMA measurements. The momentary response in EMA is treated as the sum of the typical response and the deviation from the typical response. Two types of test scores are identified for further reliability analysis. The aggregated score (AGGS) is the arithmetic average of the composite score for a given person. The within person centered score (WPCS) is the deviation score from the AGGS for a given person at some time. The AGGS and the WPCS are the test scores that can be used for representing the typical response and the deviation from the typical response respectively. Under the framework of multilevel factor model with serial correlation structure, the reliability coefficients for AGGS and WPCS are derived. The point estimates and confidence intervals for these coefficients can be obtained by using the software Mx (Neale, Boker, Xie, & Maes, 2003). A simulation study shows that the empirical

performance of the proposed procedure is acceptable. Strengths and limitations of the proposed procedure are discussed.

Generalizability Analysis of Constructed-Response and Hands-On Performance Tasks in Home Economics

Parallel Session: Classical Test Theory - Reliability Issue; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09

Chiao-Ying Wu*, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan

In Taiwan, the new educational program makes students and their parents not only care about traditional paper-and-pencil tests but also the scores of these performance assessments. Given this trend, the current study investigates score generalizability of the performance assessment including paper-and-pencil tasks and manual tasks. For this purpose, a univariate generalizability analysis and a multivariate generalizability analysis are used to investigate the effect of both the task and rater facets on score reliability. In addition, a comparison of three different rating conditions is presented—all raters scoring each task without rubrics, with rubrics, and after receiving rater training.
The researcher collected 384 samples from 96 students who from four different classes taught by the four different raters completed two paper-and-pencil and two manual tasks. Under each rating condition, let the four raters score the four tasks of eight students of each class individually. GENOVA 2.1(Brennan, 1983) and mGENOVA 2.1 (Brennan, 2001) were used to analyze the study data.
The results of G-study are expected to answer these questions: 1) What's the differences between the effect of rater and task facet on score reliability under the three rating conditions? 2) Which type of the tasks score or the composite score generalizability is better? 3) Dose the score reliability of the performance assessment changed if the raters are not professional? Furthermore, we expect the results of D-study find out what's the composite of the number of tasks and raters under which rating condition will work most efficiently.

Rasch Trees: A New Method to Detect Differential Item Functioning in the Rasch Model

Parallel Session: Differential Item Functioning - Advanced Method; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10

Carolin Strobl*,LMU Munich, Germany
Julia Kopf, LMU Munich, Germany
Achim Zeileis, Universität Innsbruck, Austria

Differential item functioning (DIF) can lead to an unfair advantage or disadvantage for certain subgroups in educational and psychological testing. A variety of statistical methods has been suggested for detecting DIF in the Rasch model. Most of these methods are designed for the comparison of pre-specified focal and reference groups, such as males and females. Latent class approaches, on the other hand, allow to detect previously unknown groups exhibiting DIF. However, this approach provides no straightforward interpretation of the groups with respect to person characteristics. In this talk we propose a new method for DIF detection based on model-based recursive partitioning that can be considered as a compromise between those two extremes. With this approach it is possible to detect groups of subjects exhibiting DIF, which are not pre- specified, but result from combinations of observed covariates in a data-driven way. These groups are directly interpretable and can thus help understand the psychological sources of DIF. The talk outlines the statistical methodology behind the new approach as well as its practical application by means of an illustrative example.

Applying the Mixture Rasch Model with Covariate to Explore Potentially Differentiating Functioning Items

Parallel Session: Differential Item Functioning - Advanced Method; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10

Yunyun Dai*, University of California at Los Angeles, USA

Starting from the early 1990's, Mixtures of item response theory models have been proposed as a technique to explore response patterns in test data related to cognitive strategies, instructional sensitivity, and differential item functioning (DIF) . More recently, Mixture Rasch Model with Covariate (MRMC) was recommended (Cohen and Bolt 2005, Samuelsen 2008) and was systematically investigated by simulation studies (Smit et al 1999, Dai 2009). The estimation of MRMC proved challenging due to difficulties in model identification and questions of effect size needed to recover underlying structures. As such, researchers recommended that application of this model to empirical data should be regarded as exploratory in nature rather than confirmatory. Meanwhile, the literature lack application of MRMC on empirical data.

In this research study, we apply the MRMC model to study assessment items. Students' background variable is incorporated to explore the potential DIF items. We expect the addition of auxiliary information will help locate the plausible cause of DIF and obtain more accurate parameter estimates. The modeling of MRMC is under Bayesian estimation using Markov Chain Monte Carlo (MCMC) method.

In our analysis, we use student's gender as covariate in MRMC and selected a random sample of 1000 students with complete data. The source of data is a large-scale formative assessment

project, called POWERSOURCE. It was developed and implemented by the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA.
In our two latent class specification in MRMC, about 30% of the 1000 students are classified into one latent class while the rest of the 70% were classified into the other latent class. The average latent ability with the smaller group is lower than that for the larger group with the difference equivalent to one standard deviation. Subsets of items are easier for one group of student versus the other. This calls for experts' reviews of certain items. In addition, MRMC with other student background variable (e.g., parents' education) as covariate will be further investigated.

Detection of Differential Item Functioning Based on Multilevel Rasch Model
Parallel Session: Differential Item Functioning - Advanced Method; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Hui Liu*, South China Normal University, China
Ming-Qiang Zhang, South China Normal University, China
Xiao-Zhu Jian, Jinggangshan University, China
Muhui Huang, South China Normal University, China

Most techniques to detect differential item functioning (DIF) before are based on classical test theory and item response theory. Multilevel item response theory can not only detect the items with DIF, but also identify the causes of DIF. In this paper, multilevel Rasch model is used to detect DIF with a comparison of Rasch model. The results from both methods show very close agreement on the exact items with DIF, and the results from multilevel Rasch model also indicate the student and school causes of DIF.

Integrating Bootstrap technique with Hierarchical Generalized Linear Model to Perform DIF Detection for Small Size Sample
Parallel Session: Differential Item Functioning - Advanced Method; Tuesday, 19 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Jing-Jiun Lin*, National Chung Cheng University, Taiwan
Ya-Hui Su, National Chung Cheng University, Taiwan

In the past, limited researches on differential item function (DIF) have done for the small size sample, and they found the power was very low (Fidalgo, Ferreres, & Muniz, 2004). Hence, they adjusted the Alpha value for hypothesis testing to improve power, and this led to high type I error rate. In recent years, the Bootstrap technique (Efron, 1979) is widely integrated with many different fields (Davison & Hinkley, 1997;Tsai, 2006; Victor, Nam, and Raphael, 2009) to provide a better approximate estimate by using re-sampling method when small

sample size is encountered and distribution is unknown. This study integrated the bootstrap technique with hierarchical generalized linear model (HGLM, Kamata, 2001) and Mantel-Haenszel (MH; Holland & Thayer, 1988) procedure for small size sample to detection DIF. Four independent variables were manipulated in this study: (a) DIF detection method (2 levels; HGLM and MH), (b) sample size (3 levels; 50,250, and 500), (c) item length (2 levels; 30 and 60), and (d) DIF percentage (6 levels; 0%, 10%, 20%, 30%, 40%, and 50%). The results showed that this new approach performed better than the ones without bootstrapping on the DIF detection while sample size is small.

Special Models with Special Solutions: Statistical Issues in Hierarchical Item Factor Models
Invited Symposium: Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-03

The Lord-Wingersky Algorithm After 25+ Years: Version 2.0 for Hierarchical Item Factor Models
Li Cai*, University of California at Los Angeles, USA

Lord and Wingersky's (1984) recursive algorithm for creating summed score based likelihoods or posteriors has proven to be a useful tool in unidimensional item response theory (IRT) applications. Variations of the basic algorithm can handle polytomous responses, produce (weighted) summed score to IRT scale score translation tables, item level goodness-of-fit indices, and summed score based tables for test linking. Extending the recursive algorithm to handle multidimensionality is relatively simple, especially with fixed quadrature because the recursions can be defined on the grid of direct products of quadrature points. However, the increase in computational burden remains exponential in the number of dimensions of integration, making the implementation of the recursive algorithm far less straightforward for truly high dimensional models. In this paper, a dimension reduction method that is specific to the Lord-Wingersky recursions is developed. This method can take advantage of the restrictions implied by hierarchical item factor models, e.g., the bifactor model (Gibbons & Hedeker, 1992) or the two-tier model (Cai, 2010), so that a generalized version of the Lord-Wingersky recursive algorithm can operate on a dramatically reduced set of quadrature points. For instance, in a bifactor model, the dimension of integration is always equal to 2, regardless the number of factors. The new algorithm is illustrated with real data based examples on IRT scoring, testing item fit, and linking.

Limited-information Goodness-of-fit Testing of Hierarchical Item Factor Models
Mark Hansen*, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

In applications of item response theory (IRT), it is critical to ascertain the fit of the IRT model. Recently limited-information goodness-of-fit testing has received increased attention in the psychometrics literature. In contrast to full-information test statistics such as Pearson's X^2 or the Likelihood Ratio G^2, these limited-information tests utilize lower-order marginal tables rather than the full contingency table. A notable example is Maydeu-Olivares and colleagues' M_2 family of statistics based on univariate and bivariate margins. When the contingency table is sparse, tests based on M_2 retain better Type I error rate control than the full-information tests and can be more powerful. While in principle the M_2 statistic can be extended to test hierarchical multidimensional item factor models (e.g., bifactor or two-tier models), the computational and implementation burden is non-trivial. To obtain M_2, a researcher has to compute (thousands of) marginal probabilities, derivatives, and weights. Each piece must be approximated with high-dimensional numerical integration. We propose a new dimension reduction method that can take advantage of the hierarchical factor structure so that the integrals can be approximated far more efficiently. We also propose a new statistic for ordinal items that can be substantially better calibrated and more powerful than the original M_2 statistic for realistic test lengths. We use simulations to demonstrate the performance of our new methods and illustrate their effectiveness with applications to large-scale assessment data.

Calibration, Scaling, DIF, and Projection: A Common Framework Using Multidimensional IRT

Moonsoo Lee*, University of California at Los Angeles, USA
Mark Hansen, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

We develop a common statistical framework for concurrent calibration, vertical scaling, differential item functioning analysis, and calibrated projection (see Thissen et al., in press, for details on calibrated projection). It is shown that the underlying model is a confirmatory multidimensional item response theory (IRT) model, potentially with a two-tier structure to allow for residual dependence among items. Instead of pursuing the various disparate methods using multiple-group analysis, we show that additional groups can be equivalently represented using extra latent variables. We analytically and empirically explicate the identification conditions and restrictions that lead to each known special case, and we explore their ramifications on data collection designs. We connect the different methods to highlight that with flexible multidimensional IRT modeling, the traditional boundaries among calibration, scaling, and projection have become blurred. We conclude with a discussion of some potential extensions.

A Multilevel Item Bifactor Model

Ji Seung Yang*, University of California at Los Angeles, USA
Scott Monroe, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, US

Data sets from large scale educational surveys have become increasingly important in educational research, providing rich information on trends, benchmarks, and comparisons. The design of these assessments, however, can be quite complex. Take the Program for International Student Assessment (PISA) for example. Within a country, a two-stage stratified sampling is typically used. As such, students are naturally nested within schools, which are sampled first. On the other hand, the student surveys usually consist of a large number of clusters of items organized into testlets. The items are then assembled into forms based on randomized blocks designs. Cai, Yang, and Hansen (in press) have recently proposed the use of item bifactor models to scale student outcomes for such data sets. On the other hand, there is a line of work on multilevel models in the IRT literature, mostly using Bayesian techniques. However, few have attempted to address the multilevel nature of the data within an item bifactor analysis framework. The key benefit of such a multilevel item bifactor model lies in the efficiency of dimension reduction. We show that maximum marginal likelihood estimation of this model can be accomplished efficiently with 3-dimensional integration regardless of the number of latent variables at the student level. Both simulated and real data examples will be used to illustrate our new model.

Analysis of Missing Data and Causal Inference
Invited Symposium : Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m., D1-LP-04

Estimation and Use of Mean and (Co)Variance with Monotonic Missing Data

Keiji Takai*, Kansai University, Japan

In analysis of data, mean and (co)variance are basic and important statistics. However, estimation of them can be difficult when the data contain missing values. In this talk, we give a method to estimate and use the mean and (co)variance of multivariate data in a monotonic missing pattern with a regression model. First, we show that under the MAR assumption the mean of the variable can be consistently estimated by use of the regression model. It is presented that more than one estimator can be constructed. We show that consistent estimators for covariance are constructed with the mean estimators. The variance of the variable can also be consistently estimated. Second, we propose a test method to examine the assumption of MAR. The test uses the mean estimators that are consistent under

the MAR assumption. Two tests are constructed for the respective cases where the linear and nonlinear regression models are considered. Third, we consider the case where the proposed test rejects the null hypothesis that the data are MAR. In such
a case, the estimators are generally inconsistent. A conventional but practically difficult method to produce a consistent estimator is modeling the missing-data mechanism. We propose a method to avoid such a difficulty by using auxiliary variables. We show that adding the auxiliary variables satisfying some conditions reduces the bias of the estimators derived under the assumption of MAR in the sense of the absolute value.

Missing not at Random versus Misspecified Distributions: Bias and the Role of Auxiliary Variables

Ke-Hai Yuan*, University of Notre Dame, USA

Normal-distribution-based maximum likelihood (NML) is the most widely used procedure for missing data analysis although real data seldom follow a normal distribution. Recent results indicate that NML estimates (NMLEs) are still consistent for nonnormally distributed populations as long as the variables are linearly related. However, NMLEs are generally not consistent when the nonnormality in the population is created by nonlinear relationships among some underlying latent variables. Similarly, NMLEs are generally not consistent when data are missing not at random (MNAR). It is well-known that including proper auxiliary variables mitigates the biases in MLEs caused by MNAR mechanism. In this talk we show that the biases in NMLEs due to nonnormality created by nonlinear relationships are also mitigated by including auxiliary variables. In particular, our analytical results indicate that the NMLEs of the substantive variables are still consistent when proper auxiliary variables are included. Our empirical results indicate that proper auxiliary variables also mitigate the biases in NMLEs at small sample sizes even when they are consistent. Our results also imply that the biases due to nonnormally distributed populations can be a lot greater than those due to MNAR mechanism. How to choose auxiliary variables in practice is also discussed.

Mixture Modelling of Treatment Effects with Multiple Compliance Classes and Missing Data.

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Randomized experiments are the gold standard for drawing causal inferences. A fundamental parameter of interest is the intent to treat estimand (ITT), which measures the impact of offering the treatment. Researchers design the treatments to affect mediators lying along presumed pathways to the outcome, and they typically also want to know the effect of the

treatment itself. The ITT does not measure this because some subjects (always takers and never takers) treatment status does not depend on treatment assignment. Per-protocol and as-treated analyses do not solve this problem. More recently, statisticians have focused attention on estimating effects for the latent subpopulation of subjects (compliers) who will comply with their treatment assignment. In many experiments, there may be little reason to believe that the mediators targeted by the treatment produce
effects for all such subjects. We assume the compliers are composed of an effect class, in which treatment affects the outcome, and a zero effect class. Of interest are the average effect in the effect class and the proportions of compliers in each of these two classes. Missing data further complicate estimation of both the ITT and the average effect in the complier effect class. We consider and present estimates for these parameters under a variety of assumptions, including the assumption that the missing outcome data are missing at random and the assumption that outcomes are independent of missingness, given observed covariates and subject's latent compliance status.

Bias of the Direct MLE for NMAR Missingness: Theoretical Approach
Yutaka Kano*, Osaka University, Japan

The method of direct maximum likelihood (DML), without use of missing-data mechanism, can produce consistent estimators for parameters of interest if the missing-data mechanism is MAR. The DML generally causes biased estimators for NMAR missingness. The model specification and the MAR assumption may not be correct in practice. Yuan (2007, JMVA) studied unbiasedness of the MLE when the model is misspecified but the MAR holds. In this talk, we are concerned with sensitivity analysis of the DLM when the MAR assumption is violated. More spesifically, we shall develop a new method which can theoretically evaluate magnitude of the bias of the DMLE caused by NMAR missingness. The method is used to evaluate whether addition of auxiliary variables can reduce the bias of the DMLE when a missing-data mechanism is NMAR.
The MAR is a set of equality conditions among conditional probabilities of missing indicators given observed variables. The NMAR is negation of the set of these equality conditions. There has been no approach to evaluation of NMARness, i.e., degree of NMAR. We shall propose to define the NMARness as magnitude of the bias of the DMLE.

Statistical Inference of the Q-matrix in Diagnostic Classification Models
Parallel Session: Cognitive Diagnosis Modeling - Theory II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Jingchen Liu*, Columbia University, USA
Gongjun Xu, Columbia University, USA

Zhiliang Ying, Columbia University, USA

The Q-matrix, which specifies the item-attribute relationship, is a key quantity of the diagnostic classification models, which become popular for cognitive assessment in recent years. Suppose that there are m items that are potentially associated with k attributes. The Q-matrix is an m by k matrix with binary entries indicating if a certain item requires a certain attribute. In this talk, we present the estimation problem of the Q-matrix. We setup a framework under which the theoretical properties may be discussed. Due to the potential non-identifiability issues, we need to first provide a sensible definition of the learnability of a Q-matrix. Then, we establish a set of sufficient conditions to ensure that the Q-matrix is learnable based on the data. In particular, we present one consistent estimator and develop its statistical properties. The estimator is represented in the form of the minimizer of an objective function, which can be evaluated efficiently. The discussion further proceeds to a more general situation when the number of necessary attributes k is unknown. For this problem, we include an additive penalty function (on the number of attributes) to the original objective function. Similar consistency results can be obtained.

Examining Attribute Classification Accuracy with General and Specific CDMs When Sample Size Is Small
Parallel Session: Cognitive Diagnosis Modeling - Theory II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Guaner Rojas*, Autónoma University of Madrid, Spain
Julio Olea, Autónoma University of Madrid, Spain

In this work, the attribute classification accuracy (ACA) in cognitive diagnosis models (CDM) is investigated. We propose a study in order to demonstrate that general CDM can produce higher ACA compared to specific models when the true model is unknown and the sample size is small. It is acknowledged that when the sample size is small, estimates of the item parameters can be inaccurate particularly when the involved model is quite general. However, even if parameter estimates are unstable, general CDM such as the G-DINA (de la Torre, 2011) model can produce better ACA than specific CDMs when the underlying CDM is not known and particularly when the test is long. In the current work, a simulation study has been carried out in order to compare the ACA of the general and specific CDMs. The ACA and attribute vector levels were computed. The findings show that, when the true model is unknown and the test is long, the G-DINA model produces higher ACA. Furthermore, the G-DINA model produced similar results in terms of attribute vector levels.

A Simulation Study of FCA for Identifying Attributes in Cognitive Diagnostic Assessment

Parallel Session: Cognitive Diagnosis Modeling - Theory II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Wenyi Wang*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China
Lihong Song, Jiangxi Normal University, China

Correct attribute specification is a fundamental step for cognitive diagnostic assessment. Attributes are usually identified by analyzing think-aloud verbal protocols and performing statistical test and item analyses. The processes cannot guarantee that the attributes associated with test items be all correctly speciﬁed. So de la Torre (2008) proposed an empirically based method of validating a Q matrix. In this paper the formal concept analysis (FCA) is introduced to aid attributes identifying on an existing test. To address this concern, firstly, the study explains the reason why FCA can be used to identify attributes from the data of existing test and gives the method to indentify attributes, and secondly a simulation study was conducted to verify the accuracy of the method of attributes identifying. In the simulation study, the deterministic-input, noisy “and” gate (DINA) model is used to generate the response data. The four hierarchical structures using six attributes, such as linear, convergent, divergent and unstructured hierarchy (Leighton, Gierl, & Hunka, 2007), three sample sizes and two levels of guessing and slip parameters are in our consideration. Results and implications of this study will be addressed.

Estimating Classification Consistency and Accuracy for Cognitive Diagnostic Assessment

Parallel Session: Cognitive Diagnosis Modeling - Theory II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Ying Cui*, University of Alberta, Canada

Cognitive diagnostic assessments (CDAs) are designed to classify test takers into a set of partially ordered latent classes or states, often called attribute patterns, which are defined in term of the mastery or non-mastery of a set of binary attributes (e.g., knowledge and skills) being measured by the test. This paper introduces procedures for the computation and asymptotic statistical inference for classification consistency and accuracy indexes specifically designed for CDAs. The new classification indexes can be used as important indicators of the reliability and validity of classification results produced by CDAs. For tests with known or previously calibrated item parameters, the sampling distributions of the two new indexes are shown to be asymptotically normal. We use hypothetical tests and simulated

data to illustrate the computation and statistical properties of these indexes and to evaluate their performances. Four factors were manipulated, including the quality of test items, total number of attributes measured by the test, dependency among the attributes, and sample size. Results indicate that two new indexes perform well with simulated diagnostic tests in that higher values of the two indexes are found from tests with higher discriminating items, smaller number of attributes and more dependencies among the attributes. Furthermore, the findings from the simulation study also suggest that the asymptotic normal theory of the new classification indexes may be safely applied even when sample size is small or moderate (e.g., 100 to 500).

Cognitive Diagnosis Models with Longitudinal Growth Curves for Skill Knowledge
Parallel Session: Cognitive Diagnosis Modeling - Theory II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Elizabeth Ayers*, University of California, Berkeley, USA
Sophia Rabe-Hesketh, University of California, Berkeley, USA

In recent years, a number of cognitive diagnosis models have become a popular means of estimating student skill knowledge. However these models treat responses as though they are from a single time point. When data is collected throughout a school year, we expect student skill knowledge at different times to be dependent within students and the probability of skill mastery to increase over time as students learn. We have developed longitudinal cognitive growth curve models to account for the within-student dependence, as well as understand the variability in learning and how this depends on explanatory variables. The relationship between the latent binary skill knowledge indicators and the item responses is modeled as a DINA model (Junker and Sijtsma, 1997; Rupp, Templin, and Henson, 2010). A logistic regression model is specified for the latent skill knowledge indicators with student characteristics and time as covariates and with a student-level random intercept and random slope of time. In addition, we explore the use of a fixed effect of number of previous exposures of the same skill. When incorporating time there are several possibilities, one can use each observation of a skill as a unique time, or count all observations in a day or week as coming from the same time. The model is estimated using Markov chain Monte Carlo in WinBUGS. Simulation studies show good parameter recovery. The model is also being applied to data from the ASSISTment tutor, an online mathematics tutor used by eighth graders in Massachusetts.

A Comparison of Estimation Methods for Decision Consistency Indexes
Parallel Session: Item Response Theory - Methodology II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07

Zhen Li*, Beijing Normal University, China
Tao Xin, Beijing Normal University, China

Decision consistency is an important index for measuring the quality of criterion-based test. So far, researchers have proposed dozens of estimating methods based on classical test theory or item response theory. The purpose of this study is to compare the accuracy and robustness of IRT-based estimating methods for decision consistency, a new one developed recently, to those of traditional CTT-based methods, LL method and compound multinomial methods. Both simulation study and empirical study are employed. The results of simulation study show that those new IRT-based methods can provide more accurate estimates for decision consistency indexes, p and Kappa coefficient, while the CTT-based methods provide more stable estimates, with much lower standard deviations. Moreover, the test length and the location of cut scores also have a significant influence on decision consistency estimation. The estimates of decision consistency get larger as the test length gets longer. The same trend is found when the cut score gets further away from the mean of students' score distribution. Meanwhile, the accuracy gets higher as the test length increases. Empirical data shows that all these models are well fit with test results, and IRT-based model provides higher estimates for decision consistency indexes.

Estimation of Abilities Using the Globally Optimal Scoring Weights under Polytomous IRT Models

Parallel Session: Item Response Theory - Methodology II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07

Sayaka Arai*, The National Center for University Entrance Examinations, Japan
Shin-ichi Mayekawa, Tokyo Institute of Technology , Japan

Under item response theory (IRT), the ability parameter for each individual is estimated, in most cases, using either the MLE or EAP method from the response patterns to the test items. However, because these estimation methods are complicated, it is almost impossible for a layman to comprehend how the scores are calculated.
On the other hand, it is possible to estimate the IRT abilities on the basis of the observed weighted total score (e.g., Thissen (2001)). The weighted total score is easy to calculate, although statistical properties of the score depend on the weights.
Mayekawa (2008) developed the globally optimal scoring weights, which maximize the expected test information, and showed that the globally optimal weights reduced the posterior variance when evaluating the posterior distribution of the ability given the weighted total score under three-parameter logistic model and graded response model.

In this study, we extend globally optimal scoring weights to more general IRT models: partial credit model and generalized partial credit model. We also apply these weights to a quick scoring method, which provide IRT ability estimates based on the weighted total scores, and compare the efficiencies.

Log-linear Item Response Models for Polytomous Data
Parallel Session: Item Response Theory - Methodology II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Zhushan Li*, Boston College, USA

Item response data can be treated as multi-way cross tables where each cell is a response pattern. Log-linear models are standard methods to deal with cross tables, and it has been shown that certain families of log-linear models are equivalent to item response theory (IRT) models for dichotomous data and thus can be used to obtain IRT solutions.
In this paper I will present log-linear models for polytomous item response data, and show that the models are equivalent to polytomous IRT models such as the partial credit model and models with covariates. These polytomous IRT models are unified under the framework of log-linear models and can be fit by fitting the proposed log-linear models. Historically, a significant barrier to the application of log-linear models in analyzing item responses has been the high computational cost of maximum likelihood estimation when the number of items is large. To solve this problem, Pseudo-likelihood estimation is used and it dramatically reduces the computational cost. The effectiveness of the developed models and the pseudo-likelihood estimation method is demonstrated by a series of simulation studies and application to real datasets.

Effects of Using The Reciprocal of the Number of Choices as Lower Asymptote Parameters of the 3PL Model
Parallel Session: Item Response Theory - Methodology II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Yasuko Nogami*, The Japan Institute for Educational Measurement, Inc., Japan
Natsuko Kobayashi, The Japan Institute for Educational Measurement, Inc., Japan
Norio Hayashi, The Japan Institute for Educational Measurement, Inc., Japan

Since Birnbaum (1968) introduced the three parameter logistic (3PL) model, it has been one of the most popular models to be applied to a test consisting of multiple choice items. However, since the number of examinees required for item calibration under the 3PL model is considerably larger than that for the simpler 2PL and 1PL models, practitioners sometimes have to choose those simpler models instead. In order to solve this sample size problem on

item calibration under the 3PL model, this study examines the effects of using the reciprocal of the number of choices as the lower asymptote parameters of the 3PL model. Using real and simulated data with several sample size conditions, the 3PL model with fixed lower asymptote parameters and the 2PL model are compared in terms of item calibration stability and closeness of the test properties under the ordinal 3PL model with estimated lower asymptote parameters. The results suggest that fixing lower asymptote parameters to the reciprocal of the number of choices could be an effective solution for sample size reduction; however, several problems with using the reciprocal of the number of choices were also found.

A Three Parameter Item Response Theory Model with Varying Upper Asymptote Effects
Parallel Session: Item Response Theory - Methodology II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Hong Jiao*, University of Maryland, USA
George Macready, University of Maryland, USA
Jianjun Zhu, Pearson Educational Measurement, USA
Weitian An, University of Maryland, USA

This paper proposes a three-parameter item response theory (IRT) model with an upper asymptote effect, a simplified version of the four-parameter IRT model proposed by Barton and Lord (1981). The utility of the proposed new model is demonstrated by comparing the proposed model with three standard unidimensional item response theory models including the one-parameter, two-parameter, three-parameter, and four-parameter models on several dichotomous item response data sets from real testing programs. The impact of choosing a standard item response model vs. the proposed model on ability estimation and examinee classification is demonstrated using both real data and simulation data. The study demonstrates the limitations of the standard item response theory models. The results generally support the exploration of models with upper asymptote effects.

A Semiparametric Bayesian Latent Trait Model for Multivariate Mixed Type Data
Parallel Session: Bayesian Methods and Applications I; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Jonathan Gruhl*, University of Washington, USA
Elena Erosheva, University of Washington, USA
Paul K. Crane, University of Washington, USA

Parametric latent trait models provide one method for the analysis of multivariate mixed type outcomes that may combine binary, categorical, count and continuous data. These models require the specification of a conditional distribution for each outcome given the latent trait. In cases where the focus is on estimation of the relationship between a unidimensional latent trait and a scientifically important covariate, the specification of this conditional distribution is of little interest by itself, may be time-consuming, and is susceptible to misspecification. We propose a semiparametric Bayesian latent trait model for multivariate mixed type data that does not require specification of a conditional distribution for each outcome. We draw on the extended rank likelihood method by Hoff (2007) and estimate the semiparametric latent trait model using Markov chain Monte Carlo methods. We illustrate the semiparametric Bayesian latent trait model on data from a study of subcortical ischemic vascular dementia. We investigate the association between cognitive outcomes and MRI-measured regional brain volumes and compare results from the semiparametric analysis to those obtained from a parametric latent trait approach for mixed type data.

Bayesian Estimation in Ideal Point Discriminant Analysis
Parallel Session: Bayesian Methods and Applications I; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Lixing Zhou*, McGill University, Canada
Yoshio Takane, McGill University, Canada

Ideal Point Discriminant Analysis (IPDA) proposed by Takane et al. is a method for discriminant analysis based on the idea of unfolding analysis. As such, it is also useful for the analysis of contingency tables. In this method, cases (subjects) and criterion groups are both represented as points in a multidimensional Euclidean space. The subject points are assumed to be linear combinations of predictor variables. The probabilities of subjects belonging to particular criterion groups are stated as decreasing functions of the distances between them. The method allows detailed model evaluations as well as spatial representations of subjects and criterion groups. In this talk, we discuss Bayesian estimation of parameters in IPDA by the MCMC methods. Examples offered illustrate the usefulness of the Bayesian estimation and provide test cases for comparison with more traditional estimation methods.

A Two-Step Approach for Bayesian Propensity Score Analysis
Parallel Session: Bayesian Methods and Applications I; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
David Kaplan*, University of Wisconsin-Madison, USA
Jianshen Chen, University of Wisconsin-Madison, USA

This paper presents a review and comparison of traditional and Bayesian approaches to propensity score analysis as a means of estimating causal effects in observational studies. Traditional approaches examined in this paper include propensity score weighting, optimal matching, and subclassification. The Bayesian approach can explicitly encode prior knowledge through the specification of the prior distribution, and thus naturally incorporates uncertainty in the propensity score equation. Two simulation studies are presented to elaborate the proposed two-step Bayesian propensity score approach. Results of the simulation studies reveal that greater precision in the propensity score equation yields better recovery of the frequentist-based causal effect. A small advantage is shown for the Bayesian approach in small samples. Results also reveal that greater precision around the wrong causal effect can lead to seriously distorted results. However, greater precision around the correct causal parameter yields quite good results, with slight improvement seen with greater precision in the propensity score equation. Consistent with Bayesian theory, the case study reveals that credible intervals are wider than the frequentist con fidence intervals when priors are non-informative.

Comparison of Simple Mediation Analysis: Distribution of the Product, Bootstrap and MCMC Method

Parallel Session: Bayesian Methods and Applications I; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08

Jie Fang*, South China Normal University, China
Min-Qiang Zhang , South China Normal University, China

Recent researches on test mediation effect reveal that distribution of product method (M method) and bootstrap outperform the traditional Z test. Yuan and Mackinnon (2009) proposed Bayesian method (Markov chain Monte Carlo, MCMC) to analyze mediation effect, and then they evaluated the performance of MCMC and M method by simulation study. The purpose of this study is to compare the performance of M method, percentile bootstrap, bias-corrected percentile bootstrap, MCMC with normal prior (MCMC NOR), and MCMC with noninformative prior (MCMC NIN) respectively. The results indicate that (1) the mean square error of MCMC NOR is smaller than other methods; (2) MCMC NOR method has greater power than others; (3) all these methods have minimal bias. Only when small sample (N=25) is taken, the bias of MCMC NOR is minimum; (4) Compared to other methods, the 95% confidence interval coverage rate of MCMC NOR, which is larger than 95%, achieves the maximum. The MCMC NOR method has greater biased confidence interval than other methods; The 95% confidence interval coverage rate of zero mediation effect is larger than that of nonzero; (5) MCMC NOR has the lowest rate of type 1 error, which is much less than

the nominal values of 0.05 except in large sample (N=1000); (6) The performance of MCMC NIN is very close to that of M method and bootstrap in all aspects.

Simulation Study on the Use of Hierarchical Bayesian Modeling in Expert Judgment for School Based Assessment (SBA) Moderation
Parallel Session: Bayesian Methods and Applications I; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Tze-ho Fung*, Hong Kong Examinations and Assessment Authority, Hong Kong

Expert judgment is one of the common methods that could be employed for SBA moderation of a subject. A representative sample of student works is obtained from each school, which will then be re-assessed by experienced independent assessors. The average score of the re-assessed student works could be used to reflect the school performance level on SBA. Due to a number of reasons, only few samples could be obtained from a school for re-assessment; while each school may have many candidates. On the other hand, a large number of schools could be involved. To improve the assessment accuracy on SBA performance level of schools, one of the common statistical techniques is to share information across different schools by establishing a hierarchical Bayesian model.
In 1955, Charles Stein shocked the statistical world with his proofs that MLE (i.e., simple averages) was no good under a setting, where k different groups' means are to be estimated using values sampled respectively from each of them. An estimator, known as James–Stein estimator can be shown to outperform the MLE by borrowing information across different groups. Following the same line of thought, estimates based on hierarchical Bayesian modeling are fully developed later.
In this paper, we conduct a simulation study according to the empirical summary statistics on SBA performance of schools in order to gauge the actual benefits (in terms of error reduction) by using hierarchical Bayesian modeling. The findings of the simulation study are encouraging that the total squared error, on average, is reduced by 30% when comparing the Bayesian estimates with the direct use of simple averages of re-assessed scores.

Fitting Mixed Multi-Dimensional Beta Distribution To Scored Data
Parallel Session: Multivariate Data Analysis II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Tomoya Okubo*, The National Center for University Entrance Examinations, Japan
Shin-ichi Mayekawa, Tokyo Institute of Technology, Japan

In this presentation, we will describe the development of a distribution named mixed multi-dimensional beta distribution. In addition, we will present a maximum-likelihood

solution that can be used to fit the distribution to scored data, and will apply it to actual data. In classical test theory, the scores of test takers are distributed from 0 to full score. When we analyze the distribution of the scores to identify its features, we often fit a probability function to the scores to understand the distribution of the scores well. Generally, beta distribution is employed for such a fitting because beta distribution ranges from 0 to 1. It is suitable to apply beta distribution to scored data because such data are usually distributed from 0 to full score. The Dirichlet distribution is considered as a form of multi-dimensional beta distribution; however, it cannot calculate the correlation coefficient between two variables because it has an open standard (K−1)-simplex structure. Therefore, we will introduce a multi-dimensional extension of the beta distribution that is different from the Dirichlet distribution; the domain of the proposed distribution is 0 =< x =< 1 and 0 =< y =< 1, whereas that of the Dirichlet distribution is 0 =< x + y =< 1. In addition, we will extend the distribution to a finite mixture model. Then, we will present a maximum likelihood solution that can be used to fit the distribution to scored data.

Simple Slops are Not as Simple as You Think
Parallel Session: Multivariate Data Analysis II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Xidan Chen*, University of North Carolina at Greensboro, USA
Douglas Levine, University of North Carolina at Greensboro, USA

Thousands of studies have used the simple slope methodology to evaluate moderator or interaction effects in multiple linear regression models but there is a serious problem with the methodology as described in the quantitative literature and as used by researchers. Typically simple slope analysis proceeds by testing the slope of the predictor on the outcome at different values of the moderator (usually one standard deviation below and one SD above its mean). In usual practice, the derivation of the variance of the simple slopes {v(ss)} assumes, that the conditional value of moderator is fixed. However, adopting the convention of choosing the conditional value of moderator at one SD below and one SD above its mean, indicates the moderator is actually a random variable. Consequently the usual equation for v(ss) is technically inappropriate when z is a random variable. Because psychologists routinely use this variance estimator, we ask the question, “Is the bias associated with this estimator small?” In other words, does the inappropriate use of usual v(ss) result in variances that are much smaller than would be obtained had the appropriate estimator been applied? Using Monte Carlo simulations we evaluated the variance of the simple slope under a variety of conditions. We show that the usual standard error used in post hoc probing for interaction effect is a biased estimator of the population standard deviation when moderator is a random

variable. We also demonstrate under what circumstances the usual practice yields an “almost” unbiased estimator.

Estimates of Sparse Data Variance Components in the Generalizability Theory Framework
Parallel Session: Multivariate Data Analysis II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Xiaolan Tan*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Missing data are easily find in psychological surveys and experiments. For example, in performance assessment, a certain group of raters rated a certain group of examinees. By this token, the data from performance assessment compose a sparse data matrix. Researchers are always concerned about how to make good use of the observed data. Brennan(2001) provided the estimating formulas of p×i design of sparse data. But in practice, there are always more than one factor which effect the experiment. This article provided the estimating formulas of p×i×r design of sparse data, which are on the basis of the estimating formulas of p×i design of sparse data provided by Brennan(2001). This article also used matlab7.0 to simulate data which were usually encountered in examination, then used GT theory to estimate variance componence. We found that: These formulas could provided a good estimation of variance components. The estimated variance compoences approach to set values. The accury rates of item and rater were highest. The accury rates of interaction of student and item was low. The maximum bias of interaction could reach 1.5. The number of items had the most important effect on the estimation. The number of item incresed only a littlle, the accuracy rate would increased by a big margin. These formulas could provided a good estimation when the amount of item was moderate. We also found that these formulas could used in either small or large amount of data.

Comparing Methods to Evaluate Predictor Importance in Lexicographical Models
Parallel Session: Multivariate Data Analysis II; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Razia Azen, University of Wisconsin - Milwaukee, USA
Shuwen Tang*, University of Wisconsin - Milwaukee, USA
David Budescu, Fordham University, USA

Lexicographical models are a class of non-compensatory models that are often invoked in multi-attribute decision problems. The decision maker's choice or rating (Y) is based on the sequential processing of a series of ordered predictors (X1 > X2 > ... > Xp) and a set of

corresponding thresholds. For example, if a case is above the threshold on the most salient criterion (X1), Y is assigned the highest possible value without considering all other predictors. If the case is below the threshold on X1 the process moves on to X2, and if the case is above the threshold on X2 then Y is assigned its second highest value. In general, the decision process continues until a predictor is encountered for which a case achieves the threshold, and if no predictor reaches the threshold then Y is assigned its lowest value. We simulate a lexicographical model with a known ordering of predictor variables (manipulating the values of the variances of, and correlations among, these variables), analyze the results using multiple regression, and compare the ability of several measures of predictor importance to recover the original rank ordering of the predictors. Preliminary results suggest that in some circumstances dominance analysis (Azen & Budescu, 2003) or relative weights measures (Johnson, 2000) may be superior to more traditional measures (e.g., the bivariate correlation, the regression coefficient, or the product of these two) in recovering the order of importance. Results will provide some guidelines on the utility of various relative importance measures under different conditions.

Proposal of Evaluation Model of Teaching, Integrating Difference in Importance of Criteria and Various Student Ratings
Parallel Session: Classical Test Theory - Rater Effects Issue; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Kazuya Ikehara*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

Student rating is widely administered as one of useful ways to improve teaching. However there have been some negative comments from teacher, we need to consider the student' and teacher' opinion in order to evaluate the teacher' performances from several points of view. In addition, we should take into account the fact that rating scale method widely used in student rating is susceptible to the effect of response bias. Furthermore we should consider each student evaluates different courses.
We propose student evaluation model which integrate student' and teacher' opinion, by extending Group AHP method which is insusceptible to the effect of response bias. Using AHP method, we could consider difference in importance of criteria between student and teacher. We also develop an improved model which can be applied in situation where each student evaluates different courses. Results of our analysis showed that there was difference in importance of criteria between student and teacher, but there was a little difference in comprehensive evaluation.

The Effect of the Rater Replacement Procedure on the Measurement Error of Ratings
Parallel Session: Classical Test Theory - Rater Effects Issue; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Yoav Cohen*, National Institute for Testing & Evaluation, Israel

It is a common practice in large assessment programs to score work samples by employing two independent raters. It is known that under the assumptions of classical test theory, by averaging the ratings given by two independent raters, the variance of the error of measurement is markedly reduced. In addition to using double-rating, some testing programs, especially in the context of high stakes testing, employ additional quality control measures to ensure the reliability of the scores.
One of the quality assurance measures is Rater Replacement Procedure, by which the two ratings which are given to each work sample (essays) are compared, and if they differ by more than a given criterion, a third reader is asked to rate the essay. The third rating is then combined with one of the original ratings, most typically the one which is closest to it. This procedure ensures that the overall inter-rater correlation, which is a common index for inter-rater agreement, is kept above a set criterion; however, contrary to common beliefs, it

is shown in this work that the measurement error of the average ratings is not necessarily reduced by the replacement procedure, and in some cases it is even increased by a substantial amount.
In this paper the replacement procedure is investigated and shown to be robust under different assumption about the shape of the error distribution. Alternative replacement procedures are suggested and the implications for practical application are discussed.

Should first impressions count? Examining Scoring Performance of Raters Who Initially Failed Certification
Parallel Session: Classical Test Theory - Rater Effects Issue; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Kathryn Ricker-Pedley*, Educational Testing Service, USA

Certification is a test prospective raters take to qualify to be scheduled to score performance assessments (essays, speech, artwork, teaching performance, etc.). This initial procedure generally involves self-training on a typical prompt and scoring guide, then scoring a set of 20-50 responses. The rater's assigned score is compared to the pre-determined correct score for each prompt to gauge their scoring accuracy. Usually, the pass/fail criterion is a minimum exact/maximum discrepant agreement. Raters are often allowed two attempts at certification to pass and be included in the rater pool.
Anecdotally, raters who require two certification attempts are weaker raters, are more likely to fail daily calibration (therefore not allowed to score) (Ricker-Pedley, 2011), and require more monitoring/support during scoring than raters who certify on the first try. From a logistical and financial prospective, these factors make scoring less efficient and more expensive (as raters are paid for any time spent training/calibrating, or scoring).
Are raters who take two attempts to certify generally weaker raters? Data from a large, high-stakes testing program (n=160 new raters) will be examined to see if there are differences between raters who certified on a first attempt versus a second attempt at certification with respect to calibration and validity scoring accuracy, inter-rater agreement, as well as measures of productivity. The implication for large-scale testing programs, particularly those who must recruit and retain a large pool of certified raters, is potentially significant cost-savings, or reassurance that the initial investment in allowing a second attempt at certification is worthwhile.

Investigating the Agreement Among Statistical Measures of Inter-Rater Agreement: Simulations and Some Empirical Applications
Parallel Session: Classical Test Theory - Rater Effects Issue; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Guangming Ling *, Educational Testing Service, USA

Inter-rater agreement is a measurement property that is highly desirable but difficult to realize in psychological and educational assessment with constructed response items. Many statistical measures are used to quantify the rating agreement between two sets of human raters (double-score design), including the proportion of exact agreement or joint probability of agreement (Fleiss, et al, 2003), Cohen's Kappa and weighted Kappa (Cohen, 1960, 1968; Fleiss, et al., 1969; Shoukri , 2010), intraclass correlation (Shrout & Fleiss, 1979), root mean square deviation or RMSD (Ling, et al., 2009), and the Pearson product-moment correlation or polychoric correlation. However, the inferences that could be made from these measures don't always agree with each other (Gwet, 2002; Ling, et al., 2009; Von Eye & Mun, 2004), which could lead to inconsistent or sometimes contradictory interpretations.

This study is aimed to compare these five categories of statistics using both simulated and empirical scoring data of construct responses. Dirichlet distribution (Broemeling, 2009) will used to simulate rating data (two-way contingency table) with two to seven score levels separately. To make the simulation more realistic, a set of conditions with fixed proportions of exact agreement and adjacent agreement will be manipulated. The five measures will be computed and compared based on each of these simulated data sets and the real data sets. Preliminary results suggest that the common practical interpretations of the Cohen's Kappa, correlation, and the joint probability of agreement could be misleading, while the RMSD measure is more objective and more stable.

The Formation and Control of Neutralization in Subjective Rating
Parallel Session: Classical Test Theory - Rater Effects Issue; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Bo Wang*, the Chinese University of Hong Kong, Hong Kong

In recent years, the widely used online scoring system provided an easy control over the errors occurring in the subjective rating procedure. However, the results of an analysis of one large-scale personnel selection writing test shows that the score distribution of examinees presents an obvious trend of neutralization. The multivariate generalizability analysis of the random sample data testifies the fact that the raters give too conservative scores in the course of maintaining the scoring consistency. It is also found that the conservative scoring is an 'acquisition' process. Because the consistency is generated from the conservativeness, the consistency among raters is overrated.

The reason for this neutralization lies in the scoring method, raters' cognitive process, the irrational error threshold settings for controlling the scoring consistency, and the

inappropriate monitoring indices. In order to regulate this neutralization, (1) the benchmark scoring paper can be inserted to monitor the rating processes and errors, or (2) a multistage rating augmentation pattern can be used to control the process, which can decrease the trend of neutralization to some extent, and on condition that the consistency of scoring is guaranteed, the accuracy of scoring is further improved. Both methods are proved effective by empirical studies. More monitoring indices are developed and the optimized combinations of those indices are proposed.

A Method for Detecting Differential Item Functioning Using the Bayes Factor
Parallel Session: Differential Item Functioning - New Strategies; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
YoungKoung Kim*, The College Board, USA
Matthew Johnson, Columbia University, USA

In the absence of a single gold standard procedure, many studies suggest the use of multiple methods to investigate differential item functioning (DIF). The Bayesian approach has become popular as the complement of traditional DIF detection techniques. The major drawbacks of the Bayesian approach are either too computationally intensive to detect DIF for all test items in one model, or involve multiple steps. As an alternative method of assessing DIF, which can resolve these drawbacks, the present study provides a simple, yet, comprehensive method to assess DIF within a Bayesian framework that can easily be used with other traditional methods. The study proposes a method of assessing DIF by using the Bayes Factor (BF), which has been used as a Bayesian model selection technique on the basis of the posterior probability of the model given the data. In particular, a model indicator variable that represents the BF is included as a model parameter in the Markov Chain Monte Carlo sampling. Using simulations, the proposed method is compared with traditional DIF detection methods. In addition, the proposed method is applied to data from a large-scale assessment.

Iterative MIMIC for DIF detection in Polytomous Items with Small Samples and Many DIF Items
Parallel Session: Differential Item Functioning - New Strategies; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Shuyan Sun*, University of Cincinnati, USA

Multiple indicators multiple causes (MIMIC) confirmatory factor analysis has been used to detect uniform differential item functioning (DIF) in dichotomous items (e.g., Finch, 2005; Shih & Wang. 2009; Wang, Shih & Yang, 2009). Recently Wang and Shih (2010) adapted

MIMIC to detect DIF in polytomous items and proposed an iterative MIMIC method using DIF-free-then-DIF strategy. The iterative MIMIC first selects a set of DIF-free items as a pure anchor then assesses DIF in unselected items using the pure anchor. It is a potentially useful tool for DIF assessment. Wang and Shih (2010) demonstrated its application with only one replication because the implementation is complicated and no stand-alone software is available.
This study extended Wang and Shin (2010) by investigating the accuracy of iterative MIMIC for detecting DIF in polytomous items, especially when sample sizes are small, unbalanced and the test contains many DIF items. A SAS program that automates SAS/IML and Mplus was successfully developed to implement iterative MIMIC. It allows easy application in both real data analysis and Monte Carlo simulation by plugging in data or simulation parameters. A Monte Carlo simulation with manipulated factors total sample size (300, 600, 1000), ratio of reference group size and focal group size (1:1, 4:1), percentage of DIF items (10%, 20%, 40%), examinee ability (both N(0,1), reference N(1,1) vs. focal N(0,1)), amount of DIF (0.2, 0.6) and test length (10, 30 and 50 items) will be conducted to assess power and Type I error rate with 500 replications in each condition.

Differential Item Functioning Detection Using Logistic Regression with SIBTEST Correction and DIF-free-then-DIF strategy
Parallel Session: Differential Item Functioning - New Strategies; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Tien-Hsiang Liu*, National Chung Cheng University, Taiwan
Yeh-Tai Chou, National Chung Cheng University, Taiwan
Ching-Lin Shih, National Sun Yat-Sen University, Taiwan

Logistic Regression (LR) uses raw score as matching variable to match people with similar ability between groups when detecting differential item functioning (DIF). However, when there are group differences in ability, people from different groups match on the raw score are unlikely to match on true ability, which lead to inflated Type I error rates. Simultaneous item bias test (SIBTEST) procedure implemented a so-called linear regression to adjust matching true score on matching raw score and found successfully controlled Type I error inflation due to group ability differences. In this study, adjusted SIBTEST true score was substituted for raw score in LR procedure to diminish the influence of impact on DIF detection. Afterward, an iterative LR procedure with SIBTEST correction is proposed to select a small set of DIF-free items to serve as anchor and its performance was assessed.
It was found the LR and LR-SIB performed almost identically when there were no group ability differences. Nevertheless, when there was one standard deviation between mean ability of groups, LR and LR-SIB began to yield an inflated Type I error rate when the test

contained 30% and 40% DIF items, respectively. The differences of Type I error rate between these two procedures were increased as the percentage of DIF item increased. In general, the LR-SIBPA procedure outperformed other two procedures in maintaining expected Type I error rates around .05 in all conditions.

The Performance of DIF-Free-Then-DIF Strategy in MIMIC method
Parallel Session: Differential Item Functioning - New Strategies; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Chu-Chu Tsai*, National Sun Yat-sen University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

To control Type I error rates in assessing differential item functioning, constant item (CI) method was proposed in literature. The performance of CI method was found highly correlated to the anchor items. The strategy to select several items as anchor first and then assessing DIF for other items in the test was called DIF-free-then-DIF strategy (DFTD; Wang, 2008). It was found the more DIF-free items in the anchor test, the better performance of DFTD strategy. However, in Wang and Shih (2010), the anchor items were DIF-free by design. To implement the DFTD strategy into practice, the anchor should be selected and the performance of DFTD strategy can be better assessed with the selected anchor.
In this study, the performance of DFTD strategy was assessed in the MIMIC method through simulation study. Four independent variables were included in this study: sample size, percentage of DIF items in the test, DIF assessment method, and anchor item selection method. Our findings and conclusions will be given in details in the presentation.

How Many Anchor Items Should be Selected in DIF-Free-Then-DIF Strategy?
Parallel Session: Differential Item Functioning - New Strategies; Tuesday, 19 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Hsuan-Chih Chang*, National Sun Yat-sen University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

To control Type I error rates in assessing differential item functioning, constant item (CI) method was proposed in literature. The performance of CI method was found highly correlated to the number of anchor items, and several studies suggested four anchor items should be used when assessing DIF (Shih & Wang, 2009; Wang & Yeh, 2003). The strategy

to select several items as anchor first and then assessing DIF for other items in the test was called DIF-free-then-DIF strategy (Wang, 2008).
However, for short test, especially usually the case for the test with polytomous items, four anchor items might not be all DIF-free, and therefore the performance of DFTD strategy method could be fluctuated. In this study, "how many anchor items should be selected in DFTD strategy for polytomous items" was investigated within MIMIC method through simulation study. Four independent variables were included in this study: sample size, percentage of DIF items in the test, anchor item selection method, and number of anchor items. Our findings and conclusions will be given in details in the presentation.

Multiple imputation and Missing Data
Invited Symposium : Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-03

A Comparison of Two Multiple Imputation Methods for Categorical Data: Multivariate Imputation by Chained Equations and Latent Class Imputation
Daniël van der Palm*, Tilburg University, The Netherlands
L. Andries van der Ark, Tilburg University, Netherlands
Jeroen K. Vermunt, Tilburg University, Netherlands

We studied four methods for handling incomplete categorical data in statistical modeling: (1) maximum likelihood estimation of the statistical model with incomplete data (MLID), (2) multiple imputation using a loglinear model (LLMI), (3) multiple imputation using a latent class model (LCMI), (4) and multivariate imputation by chained equations (MICE). Each method has advantages and disadvantages, and it is unknown which method should be recommended to practitioners. We reviewed the merits of each method and investigated their effect on the bias and accuracy of parameter estimates in logistic regression. We found that LCMI using a latent class model with many latent classes and MICE using predictive mean matching were the most promising methods for handling incomplete categorical data.

Multiple imputation and (repeated measures) analysis of variance
Joost R. van Ginkel*, Leiden University, The Netherlands
Pieter M. Kroonenberg, Institute of Education and Child Studies, Netherlands

Multiple imputation has become a well-established method for handling missing data. By estimating the data multiple times several complete versions of the incomplete data set are created, which are all analyzed by a standard statistical procedure. After analyzing the data sets, the results of these analyses are pooled into one analysis, taking into account the extra uncertainty due to the missing data. Strangely enough, no explicit rules for pooling the

results of (repeated measures) analysis of variance have been defined. However, pooling rules for analysis of variance may directly be derived from existing rules by using effect coding of the predictors. The proposed procedure will be explained and illustrated using empirical data examples.

Some explorations of the local and global measures of missing information
Victoria Savalei*, University of British Columbia, Canada

Fraction of missing information (FMI) is considered useful measure of the impact of missing data on the quality of estimation. This measure can be global (computed on the entire model) or local (computed for individual parameters). Mathematically, the local measures of FMI are one minus the ratio of the asymptotic variances of the parameter under complete vs. incomplete data, and reflect the relative loss of efficiency. While it has been recommended that FMI estimates be routinely reported, FMI measures have been studied very little. Global measures of FMI based on the comparison of the entire information matrices under complete vs. incomplete data, e.g., the largest fraction of missing information {Rubin, 1987 #548}, remain almost completely unexplored. This work studies both the local and the global measures of missing information under a variety of conditions. Many interesting properties are discovered and summarized. It was found that the local measures of FMI are extremely model-dependent, even when all models fit to data are saturated, changing in some cases from 10% to 45% under different parameterizations. Their usefulness may thus be limited. In contrast, it is shown that the global measures have the advantage of being invariant to model parameterization. A surprising property of global measures, however, is their lack of dependence on the covariance structure of the data; they are primarily functions of the structure of the missing data patterns. Other findings and a discussion of whether global FMI measures can be useful in describing missing data concludes the presentation.

Robust Two-Stage Approach Outperforms Robust Full Information Maximum Likelihood with Incomplete Nonnormal Data
Carl Falk*, University of British Columbia, Canada
Victoria Savalei, University of British Columbia, Netherlands

This talk will report on the research that evaluated a statistically justified two-stage (TS) approach for fitting SEMs with incomplete nonnormal data. The TS approach first obtains saturated maximum likelihood (ML) estimates of the population means and covariance matrix and then uses these saturated estimates in the complete data ML fitting function. Standard errors and test statistic are then adjusted to reflect uncertainty due to missing data.

The present work presents an extension of the TS methodology to nonnormal incomplete data (robust TS) and conducts an empirical evaluation of its performance relative to the FIML approach with robust standard errors and a scaled chi-square statistic. The results indicate that the TS and FIML parameter estimates are equal in efficiency, but the TS approach performs better than FIML when it comes to coverage rates and the performance of the scaled chi-square across a wide variety of conditions, including different missing data mechanisms, degrees of nonnormality, number of missing data patterns, percent missing data, and sample sizes. Its wide implementation and further study are encouraged.

Structured Component Analysis
Invited Symposium : Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m., D1-LP-04

The Generic Subspace Clustering Model
Marieke E immerman*, University of Groningen, Netherlands
Eva Ceulemans, Katholieke Universiteit Leuven, Belgium
Kim De Roover, Katholieke Universiteit Leuven, Belgium

In the case of high-dimensional data, a subspace clustering model can be used to achieve a proper recovery of the clusters and to obtain an insight into the structure of the variables relevant to the clustering. In such a model the objects are assigned to mutually exclusive classes in low dimensional spaces. In this paper, we present the Generic Subspace Clustering Model. As will be shown, this model encompasses a range of existing (subspace) clustering techniques as special cases. The specific properties of the model variants will be discussed. An algorithm for fitting the Generic Subspace Clustering Model is presented and its performance is evaluated by means of a simulation study. The value of the model for empirical research is illustrated with data from psychiatric diagnosis research.

Functional Multiple-set Canonical Correlation Analysis
Heungsun Hwang*, McGill University, Canada
Kwanghee Jung, McGill University, Canada
Yoshio Takane, McGill University, Canada
Todd S. Woodward, McGill University, Canada

We propose functional multiple-set canonical correlation analysis for exploring associations among multiple sets of functions. The proposed method includes functional canonical correlation analysis as a special case when only two sets of functions are considered. As in classical multiple-set canonical correlation analysis, computationally, the method solves a matrix eigen-analysis problem through the adoption of a basis expansion approach to

approximating data and weight functions. We apply the proposed method to functional magnetic resonance imaging (fMRI) data to identify networks of neural activity that are commonly activated across subjects while carrying out a working memory task.

Three Kinds of Hierarchical Relations among PCA, Nonmetric PCA, and Multiple Correspondence Analysis

Kohei Adachi*, Osaka University, Japan
Takashi Murakami, Osaka University, Japan

A purpose of this paper is to present a three-methods by three-formulations matrix (table) containing least squares loss functions, where the three methods (i.e., row entities) are PCA (principal component analysis), NCA (nonmetric PCA), and MCA (multiple correspondence analysis), whereas the three formulations (column ones) are [1] minimizing the loss of homogeneity, [2] approximating quantified data by the products of scores and loadings, and [3] performing correspondence analysis for the data regarded as contingency tables. The hierarchy PCA < NCA < MCA in Formulation [1] and that of PCA < NCA in [2] have already been known, where X < Y expresses a method X being a constrained version of Y, though it has not yet been known that MCA can be formulated as [2]. We thus prove this and show the hierarchy PCA < NCA < MCA in Formulation [2]. Further, to complete the above 3 x 3 matrix, we formulate PCA and NCA as [3], though it may not be useful for applications. It is also discussed that properties of minimum loss function values of MCA are different among Formulations [1], [2], and [3].

An Equal Components Result for Indscal with Orthogonal Components

Jos M.F. ten Berge*, University of Groningen, Netherlands
Mohammed Bennani, University of Groningen, Netherlands
Jorge N. Tendeiro, University of Groningen, Netherlands

The use of Candecomp on scalar product matrices in the context of Indscal is based on the assumption that, due to the symmetry of the matrices involved, two components matrices will become equal when Candecomp converges. This paper considers Indort, which is Candecomp applied to symmetric matrices with an orthonormality constraint on the component matrices. When the data matrices are positive semidefinite, or have become positive semidefinite due to double centering, and the saliences are nonnegative -by chance or by constraint-, the component matrices resulting from Indort are shown to be equal under weak nonsingularity assumptions. Because Indort is free from so-called degeneracy problems, it is a highly attractive alternative to Candecomp in the Indscal context.

Application of Mixture IRT to Multiple Strategy CDM Analysis
Parallel Session: Cognitive Diagnosis Modeling – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Young-Sun Lee*, Columbia University, USA
Yoon Soo Park, Columbia University, USA

When solving mathematics problems, students may select among several competing strategies (Mislevy, 1996; de la Torre & Douglas, 2008). Although it would be favorable to know which strategy students applied, researchers often only see students' item responses and not their strategies (von Davier, 2010). If instructors can identify which strategy a student used, it can be used to provide better diagnostic information to help students improve. This study aims to classify students according to their strategy usage and to identify whether a student classified to strategy group was able to master specific skills required to solve the problems, thereby providing strategy-specific diagnostic information. This study combines the approach taken in both mixture item response theory (IRT) and cognitive diagnostic models (CDMs). The fraction subtraction data (Tatsuoka, 1987) was used to group examinees into two latent subgroups using a two class mixture 3PL IRT model; this was done to divide the students by the strategy or approach they used to solve the problems. Subsequently, based on different strategies, the DINA model was applied to identify which strategy was preferred among the two latent subgroups and examined to determine skill masteries of students. This study demonstrates a method to link mixture IRT and CDM that are grounded in separate applications. Further studies on this subject can lead to a greater understanding of how students apply multiple strategies and the type of feedback that can be more tailored to their strategy usage.

Cognitive Diagnostic Assessment on Primary School Students' Mathematics Word Problem Solving
Parallel Session: Cognitive Diagnosis Modeling – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Chunhua Kang*, Beijing Normal University Zhejiang normal university, China
Tao Xin, Beijing Normal University, China

In the study of cognitive diagnostic assessment. cognitive model should be based on the Priori analysis of cognitive theory, and the cognitive diagnostic test should be a top-down design based on the attribute hierarchy. However, the primary limitations of most cognitive diagnostic assessment is that the cognitive model and the Q matrix is post-hoc, that is, A post-hoc approach is limited because the attributes must be associated with existing test items procducing an item-based hierarchy rather than an attribute-based hierarchy. In this

study, we took primary school mathematics word problems as an example, first, we identified the attributes and their hierarchy through cognitive analysis , then the cognitive model was validated by having a sample of students think aloud as they solved each item. Second, Based on the cognitive model, we developed a cognitive diagnostic test of primary school mathematics word problems, then applied Grade Rule Space model to a sample of 1240 fifth-grade students to assess their cognitive structure. The results suggested that the cognitive attribute and model were property. The adequacy of the Q matrix was assessed by predicting the item difficulty by the Q matrix, The squared multiple correlation is .811, The path analysis of the attribute probabilities showed that the GFI and AGFI were .986 and .974. Cognitive diagnostic assessment also had a good internal validity, the overall classification rate was 99.6%, IM statistics also showed that the difference between the master and non-master on the average score of all items have achieved a significant level.

An Innovative Class-Based Cognitive Diagnostic BW Model and Its Applications
Parallel Session: Cognitive Diagnosis Modeling – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Tsai-Wei Huang*, National Chiayi University, Taiwan

Recently teacher-made tests have been paid more attentions because of their function of formative assessment on students' learning. However, due to reasons of complex estimation processes or big sample size requirements, most of teachers are not acquainted with or fear to use modern cognitive diagnostic models. Based on the S-P chart rationales, a class-based cognitive diagnostic BW model can easily be understood by teachers in classroom. Four kinds of response indices provided by the BW model are the capable index (CW), the inefficient index (MB), the guessing index (B), and the careless index (W). Integrating indices from ITEM and PERSON aspects, a person-item probability model, in which the probability of a student answered an item correctly, can be estimated. Moreover, based on a Q matrix proposed by teachers, a person-concept mastery probability matrix can be made. In this study, a teacher-made test on the unit of fraction and decimal that contained 22 items on five concepts was taken by 32 students in an elementary mathematics class. Results showed the probabilities of students answering items correctly might decline along with person capability decreased and along with item difficulty increased. All ICCs plotted by the differences between students' abilities and item difficulty could reflect the levels of item discrimination. The concept of equivalent fraction was most mastered by students, but the concept of unit transformation least. Through a line-bar plot of the four indices, teachers can also diagnose students' performances and response habits, especially for guess and carelessness.

Application of Rule Space Model in Intelligence Tests
Parallel Session: Cognitive Diagnosis Modeling – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Min-Qiang Zhang*, South China Normal University, China
Xiao-Zhu Jian, South China Normal University Jinggangshan University, China

The cognitive diagnosis theory diagnoses the cognitive structure and cognitive processes of test-takers. Nowadays cognitive diagnosis models have been developed. Rule Space Model (RSM) proposed by Tatsuoka, is the important one of the models. With statistical pattern recognition and classification techniques, RSM infers test-takers' response rules according to their actual response patterns，and classifies them into different attribute-mastery patterns, which describe the knowledge structure respectively. Raven's Standard Progressive Matrices is one of the excellent intelligence tests. Basing on the attributes of R.SPM, this study puts forward a hypothesis that R.SPM included a total of 10 attributes, and those belong to the same series are conjunctive relations. The author uses RSM to diagnosis more than 800 test-takers, ultimately get 76 ideal response patterns, which category these test-takers into 76 typical response patterns. It showed that 78.54 percent test-takers' cognitive status were mainly concentrated in the seven attributes master model. Test-takers were poor at combination of transitions, combination of Latin square, combination of addition and subtraction. 24.70% of the subjects mastered the first 9 properties, except the combination of addition and subtraction, so the subjects are lack in the ability for abstract though. 23.86% subjects mastered 8 property, except the combination of Latin square and addition and combination of addition and subtraction, so the subjects are bad at thinking in images. Diagnosis with the rules-space model can obtain qualitative differences of subjects refer to Cognitive status objectively. Educators can make quantitative evaluation more objectively, and also take appropriate remedial measures.

Evaluating the Quality of A Cognitive Model in Mathematics Using the Hierarchical Attribute Method
Parallel Session: Cognitive Diagnosis Modeling – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Cecilia, B. Alves*, University of Alberta, Canada
Mark, J. Gierl, University of Alberta, Canada
Hollis Lai, University of Alberta, Canada

Cognitive diagnostic assessment (CDA) has been recognized as an important way to improve the quality and the validity of score interpretation, and it is also one of the great challenges for the field of measurement and evaluation (Pellegrino, Chudosky, & Glaser,

2001). CDA is an approach where the psychology of learning and statistical models are gathered together for the purpose of making inferences about students' specific knowledge structures and processing skills. By establishing a profile of students' cognitive strengths and weaknesses, the instructor has the means to remediate students' unique needs. This study proposes the investigation of the quality of a cognitive model on a diagnostic assessment program in mathematics. Our study is among the first applications of a cognitive diagnostic model to non-retrofitted data from an operational testing program. Using the Hierarchy Consistency Index (HCI), the fit of the cognitive models were evaluated using students' response data collected over the past two years. The HCI assesses the degree to which an observed examinee response pattern is consistent with the attribute hierarchy. Attribute reliabilities were also used to evaluate the consistency of the decisions about the examinees' attribute mastery. Results suggest that these procedures provide useful information about the quality of the cognitive model. The key findings and the implications from the present study, as well as the directions for further research will be presented in the paper.

Towards Cognitive Response Theory for Today's CAT Practice
Parallel Session: Item Response Theory - Applications in Ability Measures; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Quan Zhang*, Jiaxing University, China

This paper, based on the author's decades' research, puts forward proposals incorporated with principles regarding cognitive science with CAT. In the author's opinion, today's technology of computer programming as well as multiple media making are highly advanced. This makes it feasible for the current practice of CAT to be reshaped under Cognitive Response Theory. What characterizes such a cognitive-based CAT practice is inherent in two aspects: the first is that jumbled word (JW) test form, based on the declarative knowledge and procedural knowledge, is used as a promising alternative for multiple choice (MC) question format; the second is that 'adaptive' is achieved not by changing test item difficulties but by providing hints (if required by test takers). The significance here is that language point being tested keeps consistent, while in the case of changing item difficulty, the language point to be tested becomes inconsistent, because the next item to be presented is randomly displayed. Once this is done, it will bring computer-based language testing into an innovative change which will dramatically alter the face of the ongoing practice of computer-based language testing. The research presented here calls for feedback from a larger community of experts of language testing and psychometricians and is held as a good basis for further research improvement towards computerized cognitive testing. The author believes that cognitive-based CAT can achieve

and monitor reliability of diagnostic inferences and the relevant diagnostic feedback can also be communicated to language learners significantly better than the on-going practice of CAT.

A Paradox in the Study of the Benefits of Test-Item Review
Parallel Session: Item Response Theory - Applications in Ability Measures; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Wim J. van der Linden*, CTB/McGraw-Hill, USA
Minjeong Jeon, University of California, Berkeley, USA
Steve Ferrara, CTB/McGraw-Hill, USA

According to a popular belief, test takers should trust their initial instinct and retain their initial responses when they have the opportunity to review test items. More than 80 years of empirical research on item review, however, has contradicted this belief and shown minor but consistently positive score gains for test takers who changed answers they found to be incorrect during review. This study reanalyzed the problem of the benefits of answer changes using IRT modeling of the probability of an answer change as a function of the test taker's ability level and the properties of items. Our empirical results support the popular belief and reveal substantial losses due to changing initial responses for all ability levels. Both the contradiction of the earlier research and support of the popular belief are explained as a manifestation of Simpson's paradox in statistics.

Comparing IRT and CCT by Examining Their Estimates for Competency
Parallel Session: Item Response Theory - Applications in Ability Measures; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Lun Mo*, FWISD and The University of Memphis, USA
Xiangen Hu, The University of Memphis, USA

Individuals' competency and item's characteristics (difficulty and discrimination) can be estimated in Item Response Theory (IRT). Comparatively, individuals' competency and items' consensus answers can be estimated in Cultural Consensus Theory (CCT). The CCT is particularly useful when there is no answer key for the question and a constraint on sample size. Another concern is that data structure in these two models is different: IRT aggregates responses across items, and CCT aggregates responses across people. To demonstrate how CCT can be developed as a new measurement tool in educational and psychological measurement practices, a school climate survey is used to compare the estimates for individual competency between these two models.

Comparing Test Difficulties of NCT English Examiations using Non-linear Factor Analysis
Parallel Session: Item Response Theory - Applications in Ability Measures; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Tatsuo Otsu*, The NCUEE and JST CREST, Japan
Takamitsu Hashimoto, The NCUEE and JST CREST, Japan

The authors compared difficulties of English examinations of the NCT, a nationwide university entrance examinations conducted by the NCUEE in Japan, in consecutive two years. They used a nonlinear-factor analysis (NLFA) model, which was adapted to missing values under MAR (Missing At Random) condition, for an analysis of the ``monitor experiments'' of the NCT. The participants of the experiment were freshmen of national universities in Tokyo Metropolis. The authors designed an English supplemental examination of NCT to be an anchor variable. And they compared two usual examinations of English. Participants of the experiments achieved rather higher scores than participants of the NCT on average. Although the marginal distributions were different from each other, the proposed method generated good estimations on relative difficulties of the examinations, where information of common participant was not available. Although NLFA generated rather good estimates, it could not surpass estimates based on 2PL IRT, where responses of test items were used for estimation. Biases of NLFA estimates were larger in upper and lower bounds of scores compared to IRT estimates.

Examining Gender Differences in Mathematics Performance Across Grades, Subscales, Racial/Ethnic Groups and Achievement Spectrum
Parallel Session: Item Response Theory - Applications in Ability Measures; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Yvette Beersingh*, Morgan State University, USA

The purpose of this research was to evaluate the presence and magnitude of gender differences in mathematics performance on the National Assessment of Educational Progress (NAEP). Researcher suggests that girls' performance continues to be lower than that of boys even though the gap is closing. Boys are more likely to select advanced placement (AP) mathematics courses than girls. These disparities can have implications for the continued underrepresentation of women in careers related to science, technology, engineering and mathematics (STEM). The current study compared gender difference in mathematics performance on the 2005 and 2009 Restricted Use National Assessment of Educational Progress (NAEP). Subjects were 168,000 students in grade four, 161,000 in grade eight and 21,000 in grade 12. Males and females were disaggregated by grade, NAEP

subscales and race/ethnicity. Four analytic approaches were applied at each grade level and across subscales: significance test, effect size, comparison of percentile ranks to the national public school score distribution, and comparison of mean scores across the achievement spectrum. Results indicate that gender gaps favored males in four of the five subscales in grades four and eight. When disaggregated, gender gaps were reversed for Blacks in two subscales in grade four and three subscales in grade eight. The findings from this study indicate that gender gaps are small. Further investigation of the gaps and contributing factors is warranted.

The Effect of Informative Priors on Estimating the Variability of Estimated Variance Components for MCMC procedure

Parallel Session: Bayesian Methods and Applications II; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08

Guangming Li *, South China Normal University, China
Min-Qiang Zhang , South China Normal University, China

MCMC procedure is a mobile Monte Carlo method and can be used to estimate variance components which are constrained by sampling. However, these estimates are, like any statistic, subject to sampling variability. They are likely to vary from one sample to another. Therefore, estimating the variability of estimated variance components needs to be further explored in order to ensure the dependability of estimated variance components. The study adopts Monte Carlo data simulation technique to explore the effect of informative priors on estimating the variability of estimated variance components for MCMC procedure based on normal distribution data. This study shows that MCMC with informative priors(MCMC inf）is more precise than MCMC with non-informative priors(MCMC non-inf) for standare error of estimated variance components, but when item sample is bigger, the trend decrease. This study also shows that MCMC inf is equivalent to MCMC non-inf for confidence interval of estimated variance components, but when item sample is bigger, the trend is still same.

A Bayesian Person-Fit Evaluation For Polytomous Response Data

Parallel Session: Bayesian Methods and Applications II; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08

Sebastien Beland*, Universite du Quebec a Montreal, Canada
Herbert Hoijtink, Utrecht University, Netherlands
Gilles Raiche, Universite du Quebec a Montreal, Canada
David Magis, Université de Liège, Belgium

Studies about Person-fit are generally produced under a frequentist approach. For example, Meijer & Sijtsma (2001) discussed many parametric and non-parametric indexes in their review on this topic. However, it exists also few papers about the investigation of person-fit in a Bayesian context (e.g. Glas & Meijer, 2003; Van Der Linden & Guo, 2008).
In this talk, we present a new method based on the evaluation of informative hypotheses using the Bayes factor. This approach is non-parametric in nature and can be applied to a large variety of situations and many types of data. Here, we focus on the use of Bayesian person-fit methods that can be used with polytomous response data.
This presentation is divided in two sections. First, we present the technical aspects of this approach by discussing some hypotheses of interest, the nature of the prior and the nature of the posterior. Second, we present results from a real data matrix. The first analysis shows that Bayesian person-fit evaluation is efficient and can be easily applied to small data matrices.

Bayesian Analysis of Random Coefficient Dynamic Factor Models
Parallel Session: Bayesian Methods and Applications II; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08
Hairong Song*, University of Oklahoma, USA

Dynamic Factor Model (DFM) has been used in the past few decades to model dynamics of psychological processes (e.g., emotion) typically using data collected from single individuals. As a single-individual based approach, DFMs are limited to study inter-individual differences in dynamical systems when multivariate time series data are available from multiple individuals. In this study, we proposed Random Coefficient Dynamic Factor Models (RC-DFM) to analyze multiple multivariate time series simultaneously, thus disclosing intra-individual dynamics as well as inter-individual differences in intra-individual dynamics.
The core RC-DFMs have a form of Q latent factors underlying manifest times series and L lags in the multivariate autoregressive structure of factor series, denoted by RC-DFM (Q, L). Let $y_{ijt}(i = 1,\ldots,N, t = 1,\ldots,T, J = 1,\ldots,J)$ denote a random variable for person i measured on variable j at time t. A general RC-DFM (Q, L) can be written as

$$y_{ijt} = \sum_{q=1}^{Q} \lambda_{jq} f_{iqt} + \varepsilon_{ijt}$$

where Q is the number of latent factors. The factor score iqtf has an autoregressive structure

$$f_{iqt} = \sum_{l=1}^{L} \sum_{q=1}^{Q} f_{iq(t-l)} \phi_{iql} + \omega_{iqt}$$

We allow dynamics parametersiqlφ to vary across individuals so that

$$\phi_{iql} = \phi^{*}_{0lq} + \sum_{p=1}^{P} \phi^{*}_{plq} x_{ip} + e^{(a)}_{iql}$$

where , p = 1,..., P are time invariant covariates used to explain the inter-individual differences in dynamics parameters.
The Bayesian method was used to estimate the parameters of RC-DFMs. We carried out a series of simulation analyses to evaluate the performance of RC-DFMs with the Bayesian estimation procedure. The results show that the Bayesian estimation of RC-DFMs works well regarding to recovering both fixed and random effects under a variety of the experimental conditions.

Integrating Concepets of Profile Analysis and Person fit: An application to the Computerized Test System of the German Federal Employment Agency
Parallel Session: Bayesian Methods and Applications II; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08
Safir Yousfi*, German Federal Employment Agency, Germany

The analysis of differences between scaled scores plays an important role for the interpretation of test results in counseling and placement contexts. However, practitioners tend to interpret even minor differences that can be attributed to measurement error. On the other hand, extreme patterns of test score difference might raise doubts about the validity of the scaled test scores. Extreme patterns of scaled test scores can also be interpreted as an indication of a lack of person fit for models that justify the aggregation of scaled scores to a composite score. In order to facilitate the adequate interpretation of a pattern of test scores, elements of profile analysis and person fit analysis were integrated in the output of the computerized test system of Psychological Service of Federal German Employment Agency. The respective statistical tests analyze if the pattern of scale score differences can be explained by measurement error and if the magnitude the respective differences is extraordinarily high. Both hypotheses are analyzed by global test statistics and, in case of a significant global test, by subsequent statistical tests that analyze the difference of each scale score from the profile level. The method for analyzing if scaled score differences can be attributed exclusively to measurement error are straightforward. The extremity of scaled score differences is assessed by methods that rely on principal component analysis and a Bayesian approach. The conceptual relationship to the concept of person fit is discussed and illustrated by simulation studies.

Evaluating Latent Monotonicity Using Bayes Factors

Parallel Session: Bayesian Methods and Applications II; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08

Jesper Tijmstra*, Utrecht University, Netherlands
David J. Hessen, Utrecht University, Netherlands
Herbert Hoijtink, Utrecht University, Netherlands
Peter G. M. van der Heijden, Utrecht University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

Both parametric and nonparametric item response theory models for dichotomous data are typically characterized by the assumption of latent monotonicity for all items on a test, stating that the probability of observing a positive response to an item is non-decreasing over the latent variable. This assumption is crucial in obtaining the monotone likelihood ratio property, which ensures that respondents can be stochastically ordered based on their responses. Since virtually all applications of item response theory aim to obtain at least an ordinal level of measurement, determining whether the assumption of latent monotonicity can be maintained is highly relevant.
A Bayesian approach to evaluating latent monotonicity is proposed, which makes use of Bayes factors to determine the amount of support that competing hypotheses concerning monotonicity receive. With this procedure, previous null hypothesis testing approaches to evaluating latent monotonicity can be extended with informed alternative hypotheses, since Bayes factors can be used to compare a wide variety of hypotheses and are not limited to comparing the null hypothesis versus its complement. The usage of informed alternative hypotheses would enable researchers to investigate the extent and nature of possible violations of monotonicity, as well as potentially improving the power to detect violations of this important assumption. The application of the procedure will be illustrated using empirical data.

Assessing Win-or-Loss Team Performance in Playoff Competitions by Diffusion Algorithm of Network Analysis

Parallel Session: Multivariate Data Analysis III; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08

Nan-Yi Wu*,National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

The paper proposes a diffusion algorithm of network analysis in assessing win-or-loss team performance in playoff sports competitions. The win-or-loss systems in all competitive sports tournaments severely violate the critical i.i.d. (identically independent distributed) statistical assumptions. The study employs a diffusion algorithm using a directed and

weighted network (Radicchi, 2011) to assessing and evaluating overall team performance without the iid assumptions. The proposed network analysis is to be evaluated by Monte Carlo experiments to establish feasibility and reliability. In addition, empirical illustrations analyze playoffs matches of National Basketball Association (NBA) in the United States from years of 1950 to 2010. The most elite NBA playoff team in these years will be assessed and ranked by the network analysis. Results of the newly proposed ranking and evaluating method will also be compared with historical score books. The study is concluded by providing guidelines for analyzing the class of mutual exclusive and intercorrelated datasets often seen in the sports science.

Rank Based Polychoric Correlation
Parallel Session: Multivariate Data Analysis III; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08
Johan Lyhagen, Uppsala University, Sweden
Petra Ornstein*, Uppsala University, Sweden

The purpose of this paper is to propose a version of the polychoric correlation which is robust against nonnormality. The standard polychoric correlation has been developed to derive Pearson's product moment correlation between two hypothesized underlying continuous
variables, when all that is observed is a contingency table. The weakness of the method is that it depends on the assumption that the underlying variables follow a bivariate normal distribution, an assumption which is often violated. We propose fitting the polychoric correlation using the theoretical relationship between the Spearman rank correlation and the Pearson product moment correlation. Performing a Monte Carlo simulation study, we find that our statistic performs almost identically well to the polychoric correlation when the assumptions hold, and well outperforms it in the case of skewness. Deriving its properties from the Spearman rank correlation for discrete variables with finite support, we show that our version of the polychoric correlation is consistent and asymptotically normal.

Modeling Group-Mean Differences of Emotion Factors by Parafac2
Parallel Session: Multivariate Data Analysis III; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08
Sungjin Hong*, University of Illinois at Urbana-Champaign, USA

Parallel factor analysis (Parafac) can provide a unique solution for a parsimonious description of a three-way (or n-way) data. As a relaxed variant of the Parafac model, Parafac2 allows one of the data modes to be incomparable across levels of another mode.

One example that Parafac2 can be useful for is multiple-group data where subjects are nested in groups. With this relaxed model condition, Parafac2 can provide a uniquely interpretable solution for an invariant factor structure across distinctive groups. In the multiple-group Parafac2 analysis, however, there may be alternative grouping variables (e.g., ethnicity, age, etc.) with no particular grouping preferable than others. In such cases, it will be misleading to choose one grouping as the best only based on the model fit, since a suboptimal grouping would fit not only the intended Parafac2 variance but also nested groups' mean differences of factor scores. Alternatively, a bootstrap test has been developed to find the grouping that provides the most reliable factor loadings. An application will be presented, using self-reported emotion data which can be grouped by nationality, age, gender, or household wealth. With the cross-nationally grouped data, Parafac2 produced the most reliable solution. This finding is particularly interesting in that there has been a long debate on the orientation of emotion factors: valence and activation axes vs. positive- and negative-affect axes. The most reliable Parafac2 factors were oriented in-between these two systems and slightly closer to the former than latter. For cases when no grouping variable is available, an alternative model to Parafac2 is Hidden Parafac2, which finds model-implied unknown membership for grouping and fits Parafac2 to the accordingly grouped data in an alternating and iterative manner. It will be also shown using the same data whether the grouping that provided the most reliable factor structure can be found without knowing any grouping information.

Sampling Distribution's Effect on the Significance Result and Effect Size
Parallel Session: Multivariate Data Analysis III; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08
Can Jiao*, Shenzhen University, China
Min-Qiang Zhang, South China Normal University, China

Effect size is the significance result supplement in psychological ststistics.Effect size provide the size of the differences and experimental effect. Researchers consider that the invariance is a crucial property of effect size, since it is unaffected by the sample size,but no literature suggested the effect of sample distribution or the combination of sample size and distribution. In this study ,we identified it by simulation study in the frame of one-sample t test and independent t test.The simulation condition of sample distribution include:(1)standard normal distribution;(2)skewness coefficients is zero;(3)kurtosis coefficients is zero.Each condition consist of 6 kinds of sample size:10,20,30,50,100,200.And d and g are treated as the index of effect size. These samples come from a normal distribution population,so we suppose that the significance result is p->1 and the effect size is d or g->0 .The simulation results demonstrate that significance

result and effect size are all sensitive indicators,that is,when sample distribution slightly deviate from the normal distribution,we can easily obtain significance and big effect size.Hence we must check the normality of the sample before subsequent analyse in order to get correct research results.

A Comparison of Item Exposure Methods in Computerized Adaptive Testing
Parallel Session: Practical Considerations of Computerized Adaptive Testing; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Ming-Yong Li*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Xiao-Zhu Jian, South China Normal University, China

This study uses Monte Carlo simulation approach to compare properties of four item exposure algorithms in computerized adaptive testing. The four algorithms are: Sympson-Hetter method, restricted method, item-eligibility method and multiple maximum exposure rate method. In this study, the authors try to compare their performance in three aspects, these are different test lengths, different item bank sizes, and different maximum exposure rates. This paper will discuss the advantages and disadvantages of each method focusing on MSE and bias, test overlap rate, utilization rate of item bank and test information and so on. The results of no control group are regarded as the base line of comparison. Our results show that there is a clear trade-off in all these methods. In other words, the greater emphasize on exposure control, the greater costs of the measurement accuracy. Considering various indexes, multiple maximum exposure rate method performs the best.

Using the Information-Stratified Method to Control Item Exposure in Computerized Adaptive Testing
Parallel Session: Practical Considerations of Computerized Adaptive Testing; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Yung-Tsai Chien*, National Taichung University, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Hsiao-Chu Chen, National Taichung University, Taiwan

Item exposure control is a critical issue for ensuring test fairness. Without controlling the exposure of items, the security and fairness of the test might not be maintained. When the item bank was used by examinees with similar ability, the problem of over-exposure of items can be expected.

A new item exposure control method, named information-stratified method, is proposed in this study. In the early stage of the ability estimation with examinees is instable, and the large test information is not applicable except the test becomes more accurate and stable. The information-stratified method is to make the item selection information when the amount of phases expected to increase gradually.
For evaluating the performance of proposed method, four item exposure control methods, maximum information, information-stratified, Nearest-Neighbor and A_stratified with b blocking, were compared in a simulation study.
It was found when the distribution of item difficulty was matched to the distribution of student ability, information-stratified method and Nearest-Neighbor method performed quite similarly, and the highest exposure rate under information-stratified method was lower than that under Nearest-Neighbor method.
When the distribution of item difficulty compares with the ability distribution is unmatched, the information-stratified method resulted in lower RMSE of ability estimates, and given well-controlled on the item exposure.

How would Mixed Item Selection Approach Work with Weighted Deviation Model and Shadow Test Assembly for Constrained Adaptive Testing?
Parallel Session: Practical Considerations of Computerized Adaptive Testing; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Chi Keung Eddie Leung*, The Hong Kong Institute of Education, Hong Kong

This study aims to investigate how a recently developed mixed item selection approach would work with two advanced models in tackling complex non-statistical constraints in computerized adaptive testing. The mixed item selection approach (MX) is developed to capitalize on the strengths of two conventional item selection methods, namely the maximum information method (MI) and the b-matching method (BM). The MI method is good at providing efficient estimation of ability but poor at item security and pool utilization, whereas the BM method is less efficient in ability estimation but good at item security and pool utilization. The mixed approach has demonstrated to be efficient at ability estimation and item pool utilization for computerized adaptive testing by allowing first half of the test items to be selected by BM and then the next half by MI at later stages when ability estimate is close to its true value.
In this study, the performance of mixed selection approach is further examined under complex constraints on several factors including content area, cognitive level, answer key position, enemy items and testlet. Two prevalent models, namely the weighted deviation model (WDM) and shadow test assembly (STA), are integrated with the mixed selection approach to tackle complex constraints. Performances of the integrated methods are evaluated on estimation efficiency, item security and item pool utilization. Preliminary

results indicate that (a) MX is a better choice than MI and BM for long test (40-item) and (b)MX-STA outperforms MX-WDM in terms of test validity (satisfying constraints) and estimation efficiency.
(This study is supported by the General Research Fund of Hong Kong; Project Number: HKIEd841909.)

Integrating the Stocking and Lewis Conditional on Ability Procedure with the Maximum Priority Index in Computerized Adaptive Testing
Parallel Session: Practical Considerations of Computerized Adaptive Testing; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Yan-Lin Huang*, National Chung Cheng University, Taiwan
Ya-Hui Su, National Chung Cheng University, Taiwan

The maximum priority index (MPI; Cheng & Chang, 2009) method was proposed to consider several non-statistical constraints simultaneously, such as item exposure and content balancing during item selection in computerized adaptive testing (CAT). It was found the MPI method successfully kept all items from being overexposed; however, it left almost half of the items in the pool unused. Cheng, Chang, Douglas, and Guo (2009) implemented the MPI with a stratified method to increase the item pool usage. In the first study, the MPI with a stratified method had high item exposure and test overlap rates while examinees were at extreme ability levels. In the second study, an adaption of the MPI with Stocking and Lewis conditional on ability (SLC; Stocking & Lewis, 1998) method was proposed to monitor item exposure rates at each ability level. Three independent variables were manipulated: (a) item exposure control method (3 levels; MPI, MPI with a stratification, and MPI with SLC), (b) ability distribution (2 levels; standard normal distribution and uniform distribution), (c) item exposure rate (3 levels; 0.1, 0.2, and 0.3), and (d) ability estimate method (3 levels; MLE, EAP, and MAP). Through a serial of simulations, the proposed method performed better than the MPI or the MPI with a stratified method in terms of item exposure rates for examinees at extreme ability levels.

Improving the Efficiency of Stratification Procedures in Computerized Adaptive Testing
Parallel Session: Practical Considerations of Computerized Adaptive Testing; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-10
Jyun-Hong Chen*,National Chung Cheng University, Taiwan
Shu-Ying Chen, National Chung Cheng University, Taiwan

To improve test security in computerized adaptive testing (CAT), items are stratified into several strata according to their properties before item selection is conducted. Given the

item-pool stratification, the efficiency of CAT can be improved by administering high quality items at later stages, where trait estimates are precise. Accordingly, Chang and Ying (1999) proposed the a-stratified method to stratify an item pool based on item discrimination parameters. Even though more item properties (e.g., item difficulty and contents) were taken into account in pool stratification to meet practical needs, determining the number of strata for a given item pool is crucial in the stratification procedures.
This study provided four guidelines for pool stratification. First, the number of strata should be equal to test length. Second, items from previous strata should be reconsidered for the rest of item selection. Third, item properties considered for pool stratification should be agreed with the employed item response model (e.g., item discrimination and item difficulty should be considered when two-parameter logistic model is employed). Lastly, each stratum should be capable of being adjusted on the fly to improve item usage. Based on these four guidelines, a stratification procedure based on dominance curves (MDC) was proposed and thoroughly investigated in this study. Results indicated that the MDC procedure performed better than the other methods considered in this study in trait estimation while maintained required level of test security.

The Functional Equivalence of the PISA 2006 Science Assessment between Hong Kong and Mainland Chinese Students
Parallel Session: Differential Item Functioning – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Xiaoting Huang*, Peking University, China

In recent decades, the use of large-scale international assessments has increased drastically as a way to compare the quality of education across countries and areas. In 2006, mainland Chinese students took part in PISA for the first time, providing valuable basis for comparison with their peers around the world. In order to make valid comparisons, it is critical to ensure the measurement equivalence between different versions of the assessments. In this study, we investigated the validity equivalence of the PISA 2006 Science assessment between Hong Kong and mainland Chinese students using both unidimensional and multidimensional differential item functioning (DIF) detection methods. Furthermore, potential causes of DIF were explored via detailed content analysis to bring up possibilities to eliminate item bias in the future. Our results showed that a large proportion of items displayed DIF. The number of DIF items reduced significantly when we changed from a unidimensional to a multidimensional approach. Even though items had good fit, unidimensional model can cause "false positives". It was more suitable to apply multidimensional methods as the Science assessment was intrinsically and empirically

multidimensional. The substantive analysis revealed that differential curriculum coverage may be the most important cause of the remaining DIF.

A Comparison of Methods for Investigating Longitudinal Measurement Invariance in the Study of Growth over Time
Parallel Session: Differential Item Functioning – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Betsy J. Feldman*, University of Washington, USA
Katherine E. Masyn, Harvard University, USA
Shubhabrata Mukherjee, University of Washington, USA
Paul K. Crane, University of Washington, USA

Many researchers in social sciences and medicine study change over time in latent constructs. A critical assumption of these models is that the relationship between the items and the construct they measure are invariant across time, and when groups are involved, across groups as well. We use simulated categorical item-level data, based on a study of medication adherence in patients with HIV, to test several proposed methods for investigating longitudinal measurement invariance.
IRT methods are well developed for assessing differential item functioning (DIF) between two groups. These methods have been adapted for longitudinal data by randomly selecting a single timepoint for each individual and investigating DIF across pairs of adjacent waves of data (or across age groups). We test two such approaches: iterative ordinal logistic regression and likelihood-ratio models.
Continuous-data longitudinal invariance-testing approaches in structural equation modeling have been adapted for use with categorical data. These methods allow simultaneous testing of item parameters across groups and multiple timepoints, but questions remain about the order in which parameters are tested and the best placement of the identifying constraints required by the models for testing.
Finally, multilevel models can be estimated with Bayesian methods, permitting item parameters to be random across individuals. Both time (at Level 1) and covariates (at Level 2) can be tested to assess their effects on item parameters, controlling for theta.
We compare these approaches on the basis of their success in finding and correcting non-invariance, bias in parameter estimates (especially growth parameters), and standard-error bias.

Investigating Socially Desirable Responses Using DIF
Parallel Session: Differential Item Functioning – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10

Priyalatha Govindasamy, University Science Malaysia, Malaysia
Saw Lan Ong*, University Science Malaysia, Malaysia

The purpose of this study is to examine the differential response pattern of those who answer in socially desirable manner and to identify items and constructs that are more susceptible to respond in socially desirable manner. An experimental design is adopted where the respondents answer the same International Personality Item Pool twice. Altogether, 521 Form 4 students from two secondary schools took part in the study. During the first administration, the respondents were asked to respond honestly. Three weeks later, they were given the same inventory but were told to answer in such a manner to enable them to secure a scholarship for further education opportunity. The response patterns for the two situations were compared by analyzing differential item functioning (DIF) at item level using item parameters based on Rasch's Model and Liu Agresti Cumulative Common Log Odds Ratio. Six items flagged as exhibiting DIF from both methods were further investigated for Differential Step Functioning (DSF). Two of the items demonstrated convergent pervasive DSF while the other four were non-pervasive DSF with higher steps for DIF. Three of the items exhibited DIF are from the construct "Openess" while two from "Neurotism" and one item from "Conscientiousness".

A DIF and Facets Analysis of a Chinese as Second Language Course Test
Parallel Session: Differential Item Functioning – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Keling Yu*, The Hong Kong Institute of Education, Hong Kong

Studies of Teaching Chinese as Second Language (TCSL) remain focus on Chinese Language, teaching approaches, and Chinese Proficiency Test (HSK). Few literature about course test, particularly for the DIF and Facets analysis, was found. 149 students with a diversity of nationality, language and culture backgrounds in Beijing Language and Culture University took the final examination of the course "Intensive Chinese Reading". Two experienced specialists in TCSL were assigned to rate the writing items in the test.
This study uses IRTLRDIF v.2, which is based on the likelihood ratio test, for detecting Gender Differential Item Functioning(DIF) and Chinese language background DIF. The Facets computer software was used to conduct Facets analysis.
The analysis shows that there are a few DIF items favor the students with Chinese backgrounds and the female students. The results of Facets analysis shows that the two raters' severity are almost same.

Are Tes Analogi Verbal (TANAVA) Free from Gender Bias?

Parallel Session: Differential Item Functioning – Applications; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10

Aries Yulianto*, University of Indonesia, Indonesia

Verbal analogy tests often use for selection in Indonesia, for example, in selecting high school students or government staffs. Tes Analogi Verbal (TANAVA) or test of verbal analogy, which consisting of 30 multiple choice items, was developed to become one of alternative verbal analogy tests in Indonesia. Before we use it for selection, it is important to check whether TANAVA free from bias. Purpose of this study to is investigate Differential Item Functioning or DIF (based on gender) on TANAVA. DIF is an internal method for identifying item bias (Camilli & Shepard, 1994). Assessment of DIF is essential to the maintenance of test fairness and validity (Wang, W.-C., Shih, C.-L., & Yang, C.-C., 2009). DIF occurs when two groups of examinees with equal ability show a differential probability of a correct response (Camilli & Shepard, 1994). Data were collected from 250 students in some Faculty of Psychology, in Jakarta, Indonesia. Mantel-Haenszel and Logistic Regression were used as DIF detection methods. Some interesting results were found in this study.

Organizational work passion for workers' behavior and attitude—the moderating role of organizational commitment

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Xiaopeng Li*,South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

There is different work passion for different organizations for the diverse deposit and professional persons. This article researched organizational work passion for worker's behavior and attitude to work. We invested the worker's passion and then aggregate to the organizational level. Workers' performance, employee voice behavior, organizational citizenship behavior and workers' satisfaction were chosen as the dependent variables. We selected organizational commitment as the moderator of the relationship between passion and workers' behavior and attitude. Organizational commitment was selected as moderator by large amount of other researchers. The result shows, different work passion on different organizations; Passion remarkably impacted workers' behavior and attitude; Organizational commitment played moderator role, when the workers' commitment higher, work passion affected dependent variables more significantly. In contrast, there is no important influence. On those grounds, we suggest that, organizations should increase workers' commitment to improve their satisfaction and behavior when they try to enhance the organizational work passion. If not, work passion didn't work well.

Empirical Study of Organizational Commitment about Victoria, Chinese bilingual teachers

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Guixiong Liu*,Xinjiang Normal University, China
Min-Qiang Zhang, South China Normal University, China

Among Victoria, Chinese bilingual teacher's organizational commitment 之 the primary dimension is normative commitment,not emotional commitment. Higher and lower rank and title, its organizational commitment is higher, middle level teachers, its organizational commitment is lower. The Higher education, the lower the level of organizational commitment. Higher levels of organizational commitment in urban schools, but rural schools is lower.

Research on the Relationship between Personality and Social Network Positions of high school students

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Shao qi Ma*,South China Normal University, China

Min-Qiang Zhang, South China Normal University, China
Nan nan Zhang, South China Normal University, China
Can Jiao, Shenzhen University, China

To explore the relationship of students' personality traits to their social network positions , we plan to make a survey on several high school classes in Guangzhou City by using simple version of Big Five Personality Inventory (NEO-FFI) and practical whole social network questionnaire. Based on the existing research, the class social network of students can be divided into emotional relation network, academic consultation network, information exchange network and hostile relation network. We use standardized in-degree and out-degree centrality as the position indicator of emotional relation network, academic consultation network and hostile relation network. Standardized betweenness centrality is considered as the position indicator of information exchange network. Expected result is that different personality traits have different relations with positions on the four social networks.

The Influence of Test Development on the Accuracy of KS - P Model
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Yuna Han*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Xiao-Zhu Jian, South China Normal University, China

Based on probability theory and knowledge space theory, KS-P cognitive diagnostic model considers not only the precondition cognitive relationship between the items also considers guessing and mistakes. KS-P cognitive diagnostic model can not only get the level of competence of participants, also can give the knowledge structure of the subjects, so it is better than conventional scored methods which give only a score. This research verifies the influence of test development on the accuracy of KS - P Model, and explores how to develop a test in order to get higher accuracy. The results showed that: The accuracy of KS-P cognitive diagnostic model is influenced by cognitive structure of items, number of items, guess parameter of items and slip parameter of items. (1) If every key knowledge point has its alone corresponding item, the diagnostic accuracy of the test based on KS-P model is higher; if not, lower. (2) The number of items increases, the accuracy of KS - P model becomes higher. (3) The guess parameter of items decreases, the higher accuracy of KS - P model becomes. (4) The lower slip parameter of items, the higher accuracy of KS - P model becomes.

Psychometric assessment of the Patient Activation Measure Short Form (PAM-13) in rural settings

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Man Hung*, University of Utah, USA
Matthew Samore, University of Utah, USA
Marjorie Carter, University of Utah, USA

The Patient Activation Measure Short Form (PAM-13) is a 13-item survey instrument designed to measure patients' knowledge, skills and confidence in managing their personal health (Hibbard et al., 2004, 2005). It has been previously validated on subgroups of the US general population using a Rasch measurement model. However, there lacks study to examine its validity and reliability amongst patients in the rural areas. As such, our current research aims to investigate the performance of PAM-13 in rural settings.
A computer assisted telephone survey was administered to 812 patients in four US primary care rural clinics during the year 2010. The sample consisted of 62% female; 36% were under the age 45; and 63% had at least some college experiences. We applied a Rasch model to examine the survey's reliabilities and validities. Items seemed to have adequate infit and outfit statistics. There were slight deviations from unidimensionality, however. Given the multifacet nature of the items, such deviations were inevitable. In general, PAM-13 performs well among rural patients.

College Students' Perception of a Gender Course in Taiwan: Test of Gender and Age Variables

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Su-Fen Liu*, National Pingtung Institute of Commerce, Taiwan

The purpose of this study was to identify students' perception of class atmosphere and assessment criteria in a general education gender course in Taiwan with focus on the analysis of gender and age variables. A total of 312 college students completed questionnaires and data were merged for statistical analyses. Results showed that students measured by a semantic differential scale felt relaxed, interested, willing to talk, encouraging, happy, and cheerful during the class. Gender is a significant factor ($p<.05$) impacting how students felt on four of the six measures with males less positive than females. Age is also a significant factor ($p<.05$) on five of the six measures with freshmen and sophomores less positive than juniors and seniors. Since the instructor is a female, students were asked if the instructor was a male, how differently they would perceive the course. Chi-square analyses revealed that male and female students agreed to three of the ten statements differently, although age was not a significant variable. As for students'

assessment criteria, the instructor assigned 20% for attendance and discussion participation; 30% for film reflection report; 20% for mid-term examination, and 30% for final report. More students preferred to increase the weight for "attendance and discussion participation" and reduce the weight for "final report". When asked whether gender attitudes should be a part of students' performance assessment, gender and age made no difference. The discussion speculation was on why and how gender and age impacted students' perception of a gender course.

Analysis of a Mediated (Indirect) Moderation Model
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Geert van Kollenburg*, Tilburg University, Netherlands
Marcel A. Croon, Tilburg University, Netherlands

The main purpose of the research reported here is to investigate the integration of mediation and moderation. When the effect of X on Y is moderated by Z, one can ask whether this moderating effect still exists if one includes another moderator M, which is related to Z. In the model considered here the moderating effect of Z itself is actually mediated by M. Checking whether this is the case requires a sequential procedure in which it is shown that Z is a moderator when M is not included in the analysis, but fails to remain a moderator when M is included. A four-step decision tree is proposed for guiding the user through the steps of the regression analyses in order to infer or refute mediated moderation. To investigate the statistical performance of this decision strategy, data were simulated and analyzed using 'R', manipulating parameters which were expected to be relevant. Implications of the results of this simulation study for practical applications in the behavioural sciences will be discussed.

Bayesian Analysis of Change in Educational Testing using Generalized Linear Mixed Model with Dirichlet Process
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Keng-Min Lin*, National Taiwan Normal University, Taiwan
Rung-Ching Tsai, National Taiwan Normal University, Taiwan

We proposed a nonparametric Bayesian approach to model change in educational testing. The linear logistic test model within Rasch family was regarded as generalized linear mixed model and Dirichlet process was used to account for heterogeneity in the ability distribution. Simulations were conducted to investigate the performance of the proposed method and empirical data were analyzed for illustration.

Evaluation of Mean and Covariance Structure Analysis Model in Detecting Differential Item Functioning of Polytomous Items
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Rung-Ching Tsai*, National Taiwan Normal University, Taiwan
Ming-Jin Ke, National Taiwan Normal University, Taiwan

In this study, we evaluated the efficacy of using the multiple-group mean and covariance structure analysis (MG-MACS) model, in comparison with two nonparametric DIF indices, Poly-SIBTEST and Generalized Mantel-Haenzel (GMH) methods, in detecting differential item functioning (DIF) for polytomous items. Five-category items were generated from MG-MACS models where threshold parameters of DIF items were specified to differ between the focal and reference groups. Five factors were manipulated: test length (10, and 20), sample size (500, 1000, and 3000), equality/inequality of latent trait distributions, size ratio of the focal and reference groups (80/20, 70/30, 60/40, and 50/50), and percentage of DIF items. Each condition was replicated one hundred times to facilitate Type I error and Power calculations. Our results suggested that the scaled chi-square difference approach (DIFFTEST) under MG-MACS had the smallest overall Type I error and comparable or higher Power than GMH and Poly-SIBTEST in all conditions for DIF detection. When polytomous data were generated under the MG-MACS model, the DIFFTEST procedure was viable for DIF detection even for tests with as few as ten items.

The Impact of Brand Equity on Cost of Borrowing
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Byron Y. Song, Concordia University, Canada
Jooseop Lim*, Concordia University, Canada
Jeong Bon Kim, City University of Hong Kong, Hong Kong

Debt financing through bank loans is the most important source of external financing for most firms. Financial institutions impose different interest rates, determine different maturity periods, and allow different amounts of loans based on borrowers' financial or non-financial characteristics. One of the ways of improving non-financial characteristics is to increase visibility and familiarity through branding. Marketing researchers believe that higher visibility and familiarity among consumers can lead to an important strategic tool that will improve long-term performance. In this context, marketing academics paid particular attention to the impact of brand equity on financial measures to investigate how marketing strategies can impact financial performances. To our knowledge, however, no previous research has investigated the spill-over effect of brand equity nurtured through product market strategies on consequences in the debt capital market. The focus of this

paper is on the multi-periods lagged relation between the cost of borrowing from institutional lenders and brand equity that was built through product market strategies. Based on OLS, Probit, and Poisson regressions, we found that higher brand equity (1) lowers the all-in spread, (2) leads to longer maturity periods, (3) leads to relaxation on the requirement of collateral, (4) associates with a lower number of financial and general covenants included in a loan contract, and (5) leads to more lenders in a loan syndicate. Also, the interaction effects between the brand value and the level of competition within an industry are examined.

Using Structural Equation Modeling to Estimate Composite Reliability in Hierarchical Modeling

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Jinlu Tu*, Shanxi Normal University , China
Xuqun You, Shanxi Normal University , China

In the psychology measurement, Coefficient alpha is usually used to estimate composite reliability. But it equals composite reliability only in the τ-equivalent or parallel tests. Using structural equation modeling methodology, the limitation can be broken through. In the Former studies, Forner and Larcker's congeneric measures composite reliability formulation and Raykov's noncongeneric measures composite reliability formulation can be found. But those don't solve the hierarchical modeling composite reliability. In this article, we used the second-order modeling, and tried to deduce the high-order factor's composite reliability formulation and extended it to the level of first order correlative factors. We think that the method can be used to provide more information about the hierarchical modeling composite reliability.

A Comparison of the Different Developmental Trajectories of the Perception of Mental Health Problems in Taiwanese Adolescents

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Sieh-Hwa Lin*,National Taiwan Normal University, Taiwan
Pei-Jung Hsieh, National Academy for Educational Research, Taiwan

Previous studies have shown that depression and academic achievement were significantly correlated. Therefore, the present study aimed to compare the different developmental trajectories of adolescents' perceptions of their own mental health problems in terms of different Basic Competence Test (BCTEST) scores. The sample was drawn from a five-wave longitudinal data set of 1,137 adolescents ranging from grade 7 to 11 of the Taiwan Youth Project (TYP), a panel study conducted at the Institute of Sociology,

Academia Sinica. These samples were assigned into a low score group (N = 822) and a high score group (N = 315) according to the overall sample mean of the BCTEST scale score (M = 214.07). The data analysis proceeded in two steps. First, a proposed piecewise growth model with one intercept growth factor and two slope growth factors was applied to represent different phases of development and to capture nonlinear growth during junior and senior high school. Second, multiple-sample latent growth modeling analysis was employed to estimate the developmental trajectories of the two groups from the proposed model. The results provided supporting evidence for the proposed piecewise growth model. In addition, there were significant group differences when the intercept growth factor and the two slope growth factors were simultaneously viewed. These results recommend that researchers consider differences in academic achievement while studying the development of mental health problems among adolescents.

Undergraduate Students‘ Attitudes Toward Statistic
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Fitri Ariyanti *, Padjadjaran University, Indonesia
Ratna Jatnika, Padjadjaran University, Indonesia

Statistic is one of the subject given in undergraduate program of psychology. Statistic is given in three semesters. In the first semester and the second semester, the student will learn about descriptive inferensial statistic including parametric and non parametric statistic, and in the third semester they were tought subject in the first and the second semester, but using statistical software, SPSS. Although most of the student in Psychology comes from science program in their high school, but most of the students didn’t like statistic and they were nervous when facing the examination. This paper investigates the attitude toward statistic in the undergraduate student who are learning statistics. The aim of this research is to gather accurate assessment about students attitude toward statistic, so teacher can improve learning approach and method when teaching statistic. Using survey method, 81 undergraduate psychology students in the third semester were given the (Survey of Attitudes Toward Statistic), developed by Schau (2003). consist of six aspects; affect (students’ feelings concerning statistics), cognitive competence (students’ attitudes about their intellectual knowledge and skills when applied to statistics), value (students’ attitudes about the usefulness, relevance, and worth of statistics in personal and professional life), difficulty (students’ attitudes about the difficulty of statistics as a subject), interest (students’ level of individual interest in statistics) and effort (amount of work the student expends to learn statistics). The result showed the mean of each sub aspect as follow: affect (x=4.6), cognitive(x=4.84), value (x=5.03), difficulty (x=3.08), interest =(x=4.84) and effort (x=6.25).

A Bayesian Parameter Simulation Approach to Estimating Mediation Effects with Missing Data

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Fairchild Amanda*, University of South Carolina, USA
Enders Craig, Arizona State University, USA

The evaluation of mediating mechanisms has become a critical element of behavioral science research, not only to assess how and why interventions achieve their effects, but also to understand the etiological roots of behavioral change more broadly. As the wide appeal of mediation analysis continues to drive its use, methodologists can facilitate appropriate application of the models by refining and developing methods to investigate mediation hypotheses with varying data types familiar to substantive researchers. Methodologists have explored mediation analysis in a variety of situations with broad ranging data types, including logistic and longitudinal outcomes. However, methods for estimating mediating mechanisms with missing data have been understudied. This study extends Yuan and MacKinnon's (2009) work on Bayesian mediation analyses to the missing data context. Specifically, we outline a Bayesian parameter simulation approach for assessing mediation effects with missing data using a Markov chain Monte Carlo algorithm known as data augmentation to generate an empirical distribution of the mediation effect. Our presentation provides a brief review of both the single mediator model and Bayes' theorem. In particular, we describe the application of Bayesian estimation to a covariance matrix, as our proposed procedure uses the elements in Σ to define the mediation effect. Following this review, we present results of a computer simulation study that evaluates statistical efficacy of the new method and apply the technique to a substantive data example. The parameter simulation approach that we demonstrate is straightforward to implement in popular statistical packages such as the MI procedure in SAS.

A study of the factors related to mathematics achievement and literacy on Large-Scale Assessment

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Shin-Huei Lin*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

The purpose of this study is to investigate the relationships between the learning strategies, mathematics anxiety, self-concept, mathematics achievement and mathematical literacy. In this study, mathematics achievement is defined as the Taiwan students' mathematical performance on the Taiwan Assessment of Student Achievement (TASA), and the

mathematical literacy is defined as the students' performance on the Programme for International Student Assessment (PISA). The learning strategies, mathematics anxiety, self-concept, are defined as the students' reported on the PISA 2003 Student Questionnaire. The learning strategies consist of the rehearsal strategies, the elaboration strategies and the control strategies. Multiple regression analysis showed that the control strategies have the most explanation for both of the mathematics achievement on the TASA and literacy in PISA 2006, and the three learning strategies are all the validity predictors.
Otherwise, we still analyzed the relationship between the academic achievement data using multi-level regressions of Rasch-estimated test scores and other multiple predictors. The results will be discussed, and expected to be the relative resources for the future educational practice and studies.

A Study of the Relationship between Mathematics Learning Disposition and Achievement of Sixth Grade Students
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Yi-Chun Cheng*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

The goals of Taiwan Grade 1-9 mathematics curriculum expect that students can learn core competences of mathematics to prepare for the future life and math-related curriculum after completing basic mathematics learning. In order to function within a complex society, individuals must possess a disposition toward mathematics that enables them, when necessary, to make decisions based on different information (Wilkins, 2000). Therefore, how to improve the endurance of students' mathematics learning should be one of the important issues of mathematics education. The purpose of this study was to investigate the relationship between mathematics achievement and learning disposition. The data of the sixth graders' mathematics achievement and mathematics learning dispositions were collected simultaneously. Students' mathematics learning disposition means one unique habits of mind or thinking type, including the characteristics of dispositions, the performance of cognitive, and the learning action in situation (Chen, 1996). Through responses of the investigating problems such as "preparing for the future test"," hope to perform much better on mathematics", and "if I had to face the test again, the self-expectation of mine…" and so on to be the indicator of students' mathematics learning dispositions. Based on the characteristics of two kinds of tests, we adopted difference calibration models to analyze the data. The achievement metric was developed with concurrent calibration under Three-Parameter-Logistic Item Response Theory, and the disposition metric was developed based on Rasch Model. The results and the implications were also discussed in this study.

The Longitudinal Study of the Relationships between the Goal Orientations and Mathematics Achievements

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Chang-Sheng Wang*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

Although many studies have focused on the students' motivation to learn mathematics, there are many reasons to investigate: first, the results that show the gender differences on the changes of mathematical motivation remain inconsistent because certain authors obtain results which favor boys, while others maintain that the distinctions between the students of both genders tend to become negligible (Roch & Normand , 2008). Second, it is still unclear whether the mathematical motivation declines, stabilizes, or increases while students transfer from elementary to junior high school. These questions need to be answered by longitudinal studies. Therefore, this study investigates the relationship between the learning achievements of students and the changes of mathematics motivation from elementary to junior high school.

In the aspect of motivation, the researcher developed a questionnaire to measure goal orientation in mathematics in a longitudinal cohort-sequential research design. On the other hand, the researcher also collected the mathematics achievements of students from grade 6 to grade 7. There were 1000 participants in this study. The IRT software, BILOG, was adopted to perform concurrent calibration to obtain the abilities of students. In order to measure the relationships between mathematics achievements and motivations across two years, the study used hierarchical linear modeling (HLM) to analyze the data.

The effect of exposure control in testlet-based CAT

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Wen-Shin Lin*, The University of Tainan, Taiwan
Chiou-Yueh Shyu, The University of Tainan, Taiwan

The computerized adaptive testing (CAT) is one of the popular topics in psychometrics. CAT estimates examinee's ability based on item response theory (IRT). With the improvement of computer techniques, CAT is more efficient in estimating an examinee's ability. However, CAT still has disadvantages. For example, test construction and security issues are the main concerns to the CAT researchers. Item exposure was explored with single item in the past, but testlet based CAT has been frequent used recently. Using testlet would face the violation of local independence, a fundamental assumptions of IRT. It is more reasonable to estimate an examinee's ability with Testlet response theory (TRT). TRT

is developed as a relatively new measurement model designed to measure testlet-based tests. Testlet exposure controlling still need to be considered. However, few researches investigated this issue. The purpose of this research is to modify some item exposure controlling methods in constructing testlet-based CAT.
Five testlets selecting strategies are used (FI. FII. FIP. KLI. KLP.), and two item exposure controlling methods are considered (SHO. MLV.) in this research. The results will be compared under different combination of item exposure controlling methods and testlet selecting strategies.

The Predictive Effects of Cognitive Components for Item Difficulty Variance of ASAP-ENG

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Pei-Ju Sung*, National University of Tainan, Taiwan
Pi-Hsia Hung, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

Education equality is the target which countries all over the world devote to. The practical way to realize education equality is to shrink achievement gap –the huge difference in academic performance between students from different economic circumstances and racial backgrounds. In Taiwan, the government implements a program- After School Alternative Program (ASAP) to remedy academic achievement of elementary school and junior high school students with low economic status and low academic achievement. To translate the statistic information into teaching practice adjustment, teachers usually need some professional supports. In this study, an analysis framework of cognitive components, including task type, plausibility of distractors, steps for inference and novelty on English listening comprehension items was proposed and implemented. The data used in this study was derived from the norm of the ASAP English test item pool (ASAP-ENG) of the fifth- and sixth-grade students, totally 1459 participants. We develop a common metric with concurrent calibration under Three-Parameter-Logistic Item Response Theory. There were three raters to rated the cognitive components for each item. The results indicate that the four cognitive components are significantly relates to item difficulty. The framework can predict around 46% of the difficulty variance. The results could provide reference for teachers who participate in English listening test proposition and remedial instruction for ASAP students. The implications of these results for the English teachers will also be discussed.

The Contribution of Dynamic Assessment to Screen Mathematics Learning Disabilities

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Li Jin Zhang*, Ningxia University, China
Zhen Feng Zhang, Ningxia University, China

This study aimed to use dynamic assessment to explore whether dynamic indictors could distinguish "backward children" from "deficit children" in mathematics on the basis of traditional identification of mathematics learning disabilities. Sixty children (30 mathematics learning disabilities selected by traditional measurement and 30 intellectual matched children) were participated in this experiment in order to explore and compare information processing capacity of two types of children. Four sub-tests from Swanson Cognitive Processing Test (S-CPT) were used by dynamic paradigm of "pretest–intervention–posttest–delayed posttest". The pretest tapped auditory and visual cognitive processing capacity without help, the assists based on serial position effect were provided in intervention phase, the posttest was the highest level, and the delayed posttest meant internalization. Three important findings were as follows: (a) In addition to traditional measurement, "capacity earned" of dynamic indictors could account for additional 18.1% uniquely; (b) Dynamic indictors could distinguish backward children (53%) from deficit children (37%) in mathematics. Furthermore, the "capacity earned" scores of deficit children's were significantly lower than the control group ($t = -7.874$, $p < 0.01$), whereas there was no difference between "backward children" and the control group ($t = -0.479$, $p > 0.05$); (c) The "backward children" got higher improvement scores than "deficit children" in same school term.

The Development of the Statistical Literacy Assessment and the Scale of Statistical Attitudes for College Students in Taiwan

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Yu-Ning Chao*, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

Statistical literacy is a key competency expected of citizens in information-laden societies, and it is often viewed as a necessary component of adults' numeracy and literacy. College students should be prepared with statistical literacy to make reasonable judgments and form balanced opinions in their future lives.

Student attitudes and beliefs toward statistics affect the ways which students develop statistical thinking skills, whether they will apply what they have learned to outside of the classroom, and whether students will choose to enroll in further statistics courses (Gal, Ginsburg, & Schau, 1997).

The purpose of the study is to develop a statistical literacy assessment (SLA) and a scale of attitudes toward statistics (SAS). Given the purpose, the testing materials in SLA are derived from various media information, including online news, market survey, newspapers, TV and radio, which reflect accessible information in daily lives. The item format of SLA is composed of multiple choice and constructed-response items which are divided into three aspects: understanding, communication, and critical skill. The items in SAS are adopted four-point response scale and are divided into three aspects: affect, cognitive competence, and value. The Rasch model is applied to the testing results of SLA.
The study examines Taiwan college students' statistical literacy, attitude toward statistics, as well as the relationship between statistical literacy and attitude. Finally, the findings are expected to be indications for the future studies.

A Model of Cognitively Diagnostic Base on Q Matrix——Classifying Model of the Probability of Attributes' Mastery
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Jinxin Zhu*, Fuyong Secondary School, China
Shumei Zhang, Beijing Normal University, China
Tao Xin, Beijing Normal University, China

My study proposes a method of estimating the attributes mastery probabilities and a model of cognitive diagnosis based on Q-matrix.
Through experiments upon the responses on the items and the previously specified Q-matrix, one's proportion of correct response on each attribute can be obtained. The proportion is regarded as the temporary attribute mastery probability. It is assumes that, in the study, an item can be answered correctly if and only if all the attributes involved in the item have been mastered. Then responses on different items more or less show the mastery of the attributes. Regarding the correct response probability of each item as its contribution rate, the study amends the proportion and gets the final estimation.
The ideal attributes mastery patterns can be determined as soon as the Q-matrix is fixed. Then the final estimation can be classified into one of the patterns with the method of closeness degree, which is lead from the Fuzzy Pattern Recognition Theory and can describe the similarity of the patterns. The classification is what we finally want to get from the cognitive diagnosis model.
Lastly, simulations with Matlab and an example are provided and show the application scope and feasibility of the method and model.

A study of identifying response fake using person fit indexes
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Sunghoon Kim*, Yonsei university, South Korea
Hee-Won Yang, Yonsei university, South Korea
Guemin Lee, Yonsei university, South Korea

In many cases of psychological testing, the examinees showed socially desirable attitude in responding to test items. Precious studies focused on this problem and developed the social desirability scales (SDS) or person-fit indexes to identify examinees who have excessive social desirability. This study was designed to investigate the performance of several person-fit indexes for this purpose.
Ferrando and Chico (2001) argued that the parametric person-fit were not powerful enough to detect dissimulation, whereas the SDS performed much better. Unlike parametric person-fit indexes, nonparametric person-fit indexes do not require a parametric assumptions about the data.
In this study, both the nonparametric and parametric person-fit indexes are investigated and evaluated in identifying person with abnormal response patterns
Three nonparametric person-fit methods (number of guttman errors, normed number of guttman errors, generalized u3 person-fit statistic) and one parametric person-fit method (the parametric standardized log-likelihood statistic) are examined with polytomous items of the Korean Inventory of Character Strength (Kwon, 2010). It was composed of 240 items to measure 24 character strengths and 10 items to measure social desibility.
The MSP (Molenaar & Sijtsma, 2000) computer application program and R package are used for computing nonparametric and parametric person fit indexes. Analyses are being conducted and the results will be available by the end of April.

Applying Cognitive Diagnosis Modeling (CDM) To Psychological Diagnostic Test; For More Information.
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Yoon Jung Kwon*,Sungkyunkwan University, South Korea

Cognitive Diagnosis Modeling is a measurement model which can provide latent variable profile of respondents along with diagnostic information of items and suited for dealing with complex multidimensionality in items. Adult Pathological Internet Use Inventory (S. Lee et al., 2005) is a psychological diagnostic test in Korean which is divided into two scales: A-Scale (Adult Scale) and B-Scale (Behavior Scale). “A-Scale” is a self-report scale consisting of items for measuring four factors representing pathological internet use, while “B-scale” is an observer rating scale consisting of items about various behavioral symptoms caused by internet addiction (e.g. “He/She skips to take meals, rest, and even bathroom breaks for continually using internet.”) and evaluated by an observer such as a therapist, a

family member, a friend, and an acquaintance of an internet addict. “B-scale” is a very useful tool when a potential addict can't realize his/her own problem and resists taking an evaluation. Since the reason mentioned right before, if “B-scale” could provide more specific and customized profiles of latent variables underneath the behavioral symptoms of the respondent (in this case, the one who reported by the observer) then it would be a great resource of information for therapeutic intervention. Therefore, in this study, I would like to make Q-matrix of the items and analyze the data gathered while developing the inventory with C-RUM (Hartz, 2002; Templin, 2006).

Principal Instructional Leadership Framework in China
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Qian Zhao*, Beijing Normal University, China
Gang Li, Beijing Normal University, China

Although Principal Instructional Leadership has been research for 30 years in the world, research in china just begin with policy focusing on education quality recently. What is Chinese Principal’s Instructional Leadership hasn’t explained in research area. This paper will explore the definition, structure and influencing factor of Chinese Principal’s Instructional Leadership.
Method: This paper used individual interview and focus group interview , analysised quantitative data to definition behavior and cognition of Chinese Principal’s Instructional Leadership. We interviewed 154 principals, other managers in school and government. According to the result of interview , tentative scale was developed, 93 themes included. The scale was administrated to 743 subjects including all principals and managers in primary and secondary school of Zhongshan China. Influencing factor questionnaire was also developed. The scale and questionnaire was modified and then will be sent out to more principals, managers and teachers all over China. Factor analysis and regression analysis will be used then.
We suppose that Chinese Principal’s Instructional Leadership include four dimensions: to guide the organizing of teaching and learning, to plan the instructional activities, to provide the instructional conditions and to supervise the process of teaching and learning. This paper will be proved it.

The development and implementation of the assessment of hierarchical intrinsic and extrinsic motivation for mathematics
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Li-Yu Lin*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

According to the PISA 2006, 2009 research reports, the students in Taiwan have a good performance in the mathematics. Rather than the most other top countries, the standard deviation of the students in Taiwan is the largest, showing that the individual differences in Taiwan are important issues. In addition, in the TIMSS 2003, 2007 results also showed the same phenomenon and also remind us the fact. In the various studies of explore the variation of learning, learning motivation has been one of the possible causes. In order to have much deeper understanding of the role that motivation plays in the process of students' mathematics learning, and to help students to be more active and independent learners, this study adopted Vallerand's(2007) hierarchical model of intrinsic and extrinsic motivation to develop an assessment for students' mathematical intrinsic and extrinsic motivation. There were three aspects of motivational information to be collected: processes, contents, and situations. This study was targeted at sixth- graders' mathematics learning motivation and achievement. The IRT software, Conquest, was adopted to calibrate the students' motivation. The results did not only show the relationship between the students' mathematical motivation and achievement, but the influences of different background factors were also the further discussing issues. The results of this study would be a stimulus and reference resource to attract more attention and engagement of the researchers and educators who have ever concerned about this kind of important issues.

Effectiveness of CATSIB on Computer Adaptive Sequential Tests
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Hollis Lai*, University of Alberta, Canada
Johnson Ching Hong Li, University of Alberta, Canada
Mark, J. Gierl, University of Alberta, Canada

A test item with Differential Item Functioning (DIF) may reveal bias in the item responses for members of a specific group of examinees. Many procedures are currently available to detect DIF. However, the majority of these procedures are designed for pencil-and-paper tests. Recently, computer-adaptive sequential tests (CAST) have become a popular computer adaptive testing (CAT) approach for licensure exams. With many large-scale exams migrating to a computer-based platform, few studies have explored ways to detect DIF on different types of CAT. The difficulty with identifying DIF in CAT is twofold. First, as each student receives a different set of items based on their ability, comparing DIF between groups is a complicated process. Second, as item banks are much larger in CAT, DIF detection needs to be accurate to avoid large, and potentially unnecessary, item reviews. The purpose of this study is to evaluate the effectiveness of CATSIB, a modification of SIBTEST, for identifying DIF items on testlets in a CAST environment. A CAST

simulation was created to provide student responses to determine the effectiveness of CATSIB. Three factors affecting DIF detection were manipulated: 1) group sample sizes (n = 100, 200, 400), 2) group differences in sample size, and 3) three item difficulty levels. Our results suggest a set of minimum sample sizes for using CATSIB with CAST, and found no significant difference in detection across item difficulty levels. We also highlight the complexities of, and future directions to, analyzing DIF in adaptive testing environments.

Perceived family support moderates the association between affiliate stigma and depression among caregivers of children with developmental delay

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Chia-Wei Hsiao*, National University of Tainan, Taiwan
Chien-ho Lin, Chimei Medical Hospital National University of Tainan, Taiwan
Pi-Hsia Hung, National University of Tainan, Taiwan

Caregivers of children with developmental delay pay lots of efforts to help their children. They may experience huge mental impact, which could increase the risk of depression, during help seeking. One of the psychological effects during help seeking is affiliate stigma, which refers to the extent of self-stigmatization among associates of the targeted minorities. Previous studies have revealed that caregiver stigma were highly associated with depression. However, the moderating psychosocial mechanism remains unclear.

One hundred and twenty-four caregivers of children with development delay were recruited. The affiliate stigma (affiliate stigma scale), family support (APGAR Family Function Questionnaire), depression and other psychiatric diagnosis (Mini-International Neuropsychiatric Interview) were measured.

Majority of caregivers were women (85%). Mean score for affiliate stigma was 35.74 (min = 22, max = 68). The mean of APGAR score was 6.9. Sixteen caregivers ever experienced depression. Caregivers with depression had higher scores of affiliate stigma, and lower family support. There was marginal evidence of interaction between the family support and affiliate stigma. For those caregivers with better family support, the affiliate stigma had more impact to depression.

Although affiliate stigma experienced by caregivers is highly correlated with depression, the empirical evidence of present study may imply that the impact of affiliate stigma to depression was moderated by family support It would be important for clinician to assess and enhance the family support of caregivers with developmental delay children.

Rater Subjectivity in the Development of Imagination Test for University Student
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Chi-Chan Chen*, National Taichung University of Education, Taiwan
Cheng-Te Chen, National Tsing Hua University, Taiwan
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

This study develops a test of imagination for university student based on Torrance's (1966) and Vygotsky's (1978) theory, which Torrance (1966) developed the test of creative thinking (i.e. TTCT) based on the divergent thinking proposed by Guilford, and Vygotsky (1978) proposed that the imagination is the ability of linking to the fact instead of innovation. The measure for imagination used in this study is the "judgment of products", which has been adapted for a long time but also known for its serious drawback of subjectivity. In order to exclude the difference between rater's subjectivity from this measure and explore for possible interactions, item response theory (IRT) is introduced to analyze our data. Our preliminary result shows that difference between rater's subjectivity is non-ignorable, and raters tend to acquire their own criterion. We suggest that rater subjectivity should be treated with more attention in the development of imagination test.

Internet Addiction Disorder: Categories or Dimensions?
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Wenchao Ma*, Beijing Normal University, China
Yufang Bian, Beijing Normal University, China
Fang Luo, Beijing Normal University, China

Internet Addiction Disorder (IAD) is getting increasing concerns because it brings about many negative influences from both physical and mental aspects. However, an important but open question is whether the internal structure of IAD is dimensional or categorical. A false assumption of nature of latent variable is likely to cause biased results (Vermunt & Magidson, 2004).
This paper focuses on the latent structure of IAD—categories, dimension or combination. We analyzed 2511 Chinese middle school students' responses in Internet Addiction Test (Young, 1996) using the Rasch Model, Latent Class Model (LCM) and Mixed Rasch Model (MRM). To determine the appropriate number of latent classes, LCM and MRM with different numbers of classes were fitted to the data. The results show that MRM with two latent classes (MRM-2L) can fit data in terms of Q index (Rost & von Davier, 1994) and is the best-fitting model according to information criteria (BIC and CAIC). Thus, the data of IAD should be described by MRM-2L allowing for qualitative differences between two groups (difference in kind) as well as quantitative differences in each group (difference in

degree). Furthermore, the features of classification using MRM are discussed and comparisons are made with existing classification using cut-off raw scores. Finally, based on the new classification method, we provide some practical recommendations for assessment and treatment of IAD.

Dimensionality and item-wording effect of the Chinese Rosenberg Self-Esteem Scale
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Yi-Chang Cheng*,National Cheng Kung University, Taiwan
Wei-ming Luh, National Cheng Kung University, Taiwan

In this paper, we investigated the dimensionality and analyzed the wording effect of the Chinese version of Rosenberg's Self-Esteem scale (RSES-C). Although Rosenberg reported his scale is one-dimensional, some empirical evidences on factor analysis found that the global self-esteem might have two factors of positive and negative or self-competence and self-liking. Moreover, recent studies argued that the two dimensions merely resulted from the method effect. To further examine the mixed results and consider the appropriateness of the Chinese translation, we revised the RSES-C and administered the instrument to 692 junior high school students in Taiwan. One- and two-dimensional models were tested by confirmatory factor analysis. We also tested the model having relation between method effect associated with positively and negatively worded items. A series of confirmatory factor analysis including correlated trait-correlated uniqueness (CTCU) and correlated trait-correlated method (CTCM) were used and the results revealed that the inclusion of method effect was required to have the best fit among the competing models. Moreover, the two-dimensional model has better fit than the one-dimensional model. Finally, the item 8 has very low internal consistency because of the subjunctive statement, and the revision is needed in the future.

The Study of the New Immigrant Children's Academic Achievement, Learning Belief and Learning Interests in Taiwan
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Pei-Ching Chao*, National Chengchi University, Taiwan
Min-Ning Yu, National Chengchi University, Taiwan
Jia-Jia Syu, National Chengchi University, Taiwan
Po-Lin Chen, National Chengchi University, Taiwan
Pei-Chun Chung, National Chengchi University, Taiwan

Purpose: New immigrant children whose mothers come from abroad are rising and they are the large proportion of primary school students in Taiwan. This is an important and novel

topic of study, because their family structure and language development might affect their academic achievement, learning belief and learning interests.
Methods: This study uses the test equating to acquire ability scores with the BILOG-MG program. Taiwan Assessment of Student Achievement (TASA) database provided ten parallel test forms of multiple-choice items including anchor-items were administered to equivalent four-grade samples of about 8500 examinees drawn from the same population. Then the new immigrant children's ability scores, learning belief scores and learning interest scores from the TASA database were analyzed by t-test and latent-regression methods to compare with non-immigrant children.
Results: The results were as follows: (1) Non-immigrant children's achievement scores of Nature Science, Math, English, and Chinese were significantly higher than new immigrant children's. (2) Non-immigrant children's learning belief scores of Math and English were higher than new immigrant children's, except Nature Science and Chinese. (3) Non-immigrant children's learning interests scores of Nature Science, Math, English, and Chinese were not significantly higher than new immigrant children's.
Conclusions: Although new immigrant children's achievement scores were lower than non-immigrant children's, their learning interests were about the same as non-immigrant children's. School educators shouldn't give up giving assistance, especially for Math and English.

Analysis on Characteristics of Diagnostic Test for Depression in Koreans
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Seowoo Lee*, Pusan National University, South Korea
Daeyong Lee, Pusan National University, South Korea
Dahee Shim, Pusan National University, South Korea
Sukwoo Kim, Pusan National University, South Korea
Seock-Ho Kim, The University of Georgia, USA

The purpose of this study was to investigate the characteristics of diagnostic test for depression(DSM-IV) in Koreans. The subjects for this study were 1183 Korean patients who visited one of 18 nationwide depression clinical research centers from January 2006 to August 2008, diagnosed with MDD, Depression disorder NOS, or dysthymia. In this study, only the main depressive disorder diagnosis parts based on DSM-IV were extracted and analyzed from K-CIDI's entire data. The analysis of depression diagnosis categories are 1) depression mood, 2) loss of interest, 3) appetite change, 4) sleep disturbance, 5) psychomotor change, 6) fatigue, 7) guilty/worthlessness, 8) concentration difficulty, and 9) suicide. In order to identify the characteristics of depression of individual diagnostic category, the classical test theory and item response theory were used. It is more useful to

use IRT(item response theory) than the classical test theory or factor analysis which is used to evaluate the suitability of psychometric scaling with in most of the mental disorder assessment tools. For this purpose, we used SPSS 15.0 and BILOG-MG in this study. The results of this study found that there were no bias for diagnostic test for depression in Koreans, but the threshold of diagnostic level was high.

Study on the Immigrant Student Mathematics Achievement Impacted Factors: Taiwan's Grade 8 in TIMSS 2007

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Fang-chung Chang*, National Taipei University, Taiwan

Purpose: There have been some research works that identified the immigrant students' achievement in Taiwan. However, previous researchers merely collected data from local communities, and they did not use the database to analyze. The purposes of this study were to understand the current conditions of grade 8. We would understand the impacted factors on immigrant students.
Methods: Data from the Trend International Mathematics and Science Survey of 2007 (TIMSS 2007) were used to investigate variables that analyzed the impacted factors on mathematics achievement in grade 8 in Taiwan. There were 93 immigrant children in the study. It regarded the parents' education degree, the cultural capital, students' self-aspiration, interesting in mathematics as independent variables, and students' mathematics achievement as dependent variable. It used structural equation modeling (SEM) to test model by some SEM index, and found that the constructed model was fitted better.
Results: The meaning of model were as followings: the students' father education degree, computers and books in home(it meant they had more the cultural capital), self-aspiration, students' interesting and their perception of mathematics value were most significant positively factors, that is immigrant students had more self-aspiration and students' interesting, their mathematics achievement were higher.
Conclusions: Basing on the results, the study put forward suggestions for the educational guidance organizations, school teachers, parents and future studies.

Gender Differential Item Functioning Across Taiwan, Shanghai, Hong Kong & Macao for PISA 2009 Reading Assessment

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Song-Wei Ma*, National University of Tainan, Taiwan
Pei-Ming Chiang, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan

Differential gender performance in standardized assessment has long been a heated topic. The Programme for International Student Assessment (PISA) in 2009 focuses on reading. According to the PISA 2009 report, female students' performance is superior to male students' for about one academic year. It is noted that Taiwan, Shanghai, Hong Kong and Macao are administered in Chinese version in PISA 2009. This study uses PISA 2009 released data to investigate the gender DIF across Taiwan, Shanghai, Hong Kong and Macao for PISA 2009 reading assessment and its text formats and the three aspects (access & retrieve, integrate & interpret, reflect & evaluate) defined in the PISA 2009 framework. The Mantel-Haenszel method is employed to detect gender uniform DIF across the four countries/areas. Findings from this study are expected to provide useful information to the test development and potential users.

Asian Students' Achievement Motivation: Orientations and Characteristics
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Shanshan Zhang*, Ministry of Education of China, China
Hongyun Liu, Beijing Normal University, China
Kit-Tai Hau, The Chinese University of Hong Kong, Hong Kong

In a lot of cross-cultural academic achievement comparison studies, Chinese and other Asian students outperformed western counterparts and drew researchers' attention. Different academic motivation and related theories have been proposed to explain the outstanding performance. The present article compares and examines evidences for these theories and highlights recent viewpoints. Research show that Asian's families, irrespective of their economic and educational background, they try their best to support their children's education. Asian students, however, do not necessarily attribute more to effort and have higher interest in study than their Western counterparts. More recent studies emphasize cultural differences in the perception of different constructs (e.g., ability, effort). Western students feel proud of their success, and feel disappointed and lose their esteem when fail. In contrast, Chinese students see effort and study as virtue and social responsibility. When succeed, they still humbly look for perfection. When fail, they feel ashamed and guilty. Chinese may be collectivistic in human-relations and familial affairs, but Chinese students can be quite individualistic and emphasize personal success in academic achievement.

The rater effect and differential item functioning of cognitive tests in International Civic and Citizenship Education Study
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Chun-Hao Tao*, National Taiwan Normal University, Taiwan
Po-Hsi Chen, National Taiwan Normal University, Taiwan

Mei-Hui Liu, National Taiwan Normal University, Taiwan
Yao-Ting Sung, National Taiwan Normal University, Taiwan

This research aims to investigate the rater effect of the constructed response item of cognitive tests in International Civic and Citizenship Education Study（ICCS，2009）and whether constructed response have different item function influenced by the degree of urbanization of school or not. We use Multifaceted Model（Linacre,1989） to analyze the responses of 743 senior high school students which were scored by two different raters. The severity of the raters and the degree of urbanization of schools were included in the facet model in order to know their influences on the item parameter. Results indicated that: 1) the rater's effect were from -0.64 to +0.29 logit, 2) two items were more difficult to get high score, 3) the steps of an item were unreasonable shows there are problems in rating score or standard of rating, and 4) the items parameters were not influenced by the degree of urbanization of school. The suggestion of applying the multifaceted model on ICCS data analysis were discussed in this research.

Modification of the hierarchy consistency index
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Shuliang Ding*, Jiangxi Normal University, China
Mengmeng Mao, Jiangxi Normal University, China

Cui and Leighton (2009) proposed the hierarchy consistency index (HCI) to detect the fitness of an examinee's observed response pattern (ORP) to an expected response pattern (ERP) as a person fit index.
HCI is not defined well in the sense that when an examinee masters an attribute only and there is an item with the same attribute in the test, and the examinee responses correctly to the item only. The original HCI could not be computed because the number of comparisons being zero, which means the denominator being zero.
Unlike the person fit indices in the item response theory, HCI is not heavily dependent on the cognitive diagnostic model (CDM) provided that the CDM is the non-compensable, but the HCI is heavily dependent on the test specification, the Q matrix. In the paper there is an example (Sinharay and Almond, 2007) to demonstrate the conclusion. It is very important to detect whether a test specification coincides with the cognitive model before administering the test. An algorithm to judge matrix Qt being the sufficient and necessary is proposed in the paper. And an index named theoretic validity is proposed to describe how good the Qt matrix is.

Growth After Trauma: Validating Post Trauma Thriving Scale in the Philippines

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Imelu Mordeno*, Universidade de Sao Jose, Macau

Researches pertaining to growth after trauma have increased significantly. A complete understanding of a person with trauma requires clinical practitioners, counselors and other experts in the field to look not only on one's vulnerabilities or symptoms of traumatic distress but also of his or her capability to rise up and achieve psychological growth despite the emotional wounds suffered. This study then corresponds to an effort in assessing and quantifying thriving through looking at its factor structure and how it relates to other growth measures. Post Trauma Thriving Scale (PTTS) was developed purposively to measure Filipinos' growth dynamics after experiencing traumatic events. PTTS was translated into five Philippine dialects through a modified multiple forward-backward translation procedure. To account well the factor structure of the scale, Confirmatory Factor Analysis was done to determine if the previous model fits well with the present data. Subsequently, Exploratory Factor Analysis (EFA) was also performed for model comparison purposes. The results yielded similarities in both item and factor structures from the two factor analyses. Further, PTTS factors seem to indicate moderate relationships with other growth measures.

A study on the accuracy of score report in computerized adaptive testing
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Chiou-Yueh Shyu*, The National University of Tainan, Taiwan

Computerized adaptive testing (CAT) has become popular in recent years due to the modern computer technology. Like conventional paper and pencil (P&P) testing, the primary goal of computerized adaptive tests (CATs) is to make inferences about the proficiency of examinees that a test seeks to measure. In CAT, test items are adapted to the proficiency level of the individual examinees. One of the conditions in item selection is to choose items with the maximum test information function, that is, with the minimum standard error of measurement (SEM) or with the shortest confidence interval (CI) for proficiency. Thus, accurate SEMs and CIs for proficiency are required for obtaining an appropriate set of items and to report scores in CAT. In CAT research, many studies (e.g., Wang & Vispoel, 1998; Yi, Wang, & Ban, 1999) have examined the characteristics of different proficiency estimation methods. The research on procedures for constructing CIs is limited. Furthermore, no research on item selection based on the shortest CI has been found. Via simulation studies under unit-dimension and multi-dimension environments, the current study intended to investigate these procedures

under various CAT conditions. The proposed methods for constructing CIs for proficiency will be applied to the item selection procedure in a simulated CAT. This study intends to provide users with most accurate CIs for proficiency, thus items are appropriately selected and the accuracy of the score report in CATs is improved.

Development of Learning Motivation Test for Pupils based on the forms of self-report and semi-projective

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Guang Li*, Hunan Normal University, China
Lu Jiang, Hunan Normal University, China
Miewen Yan, Hunan Normal University, China
Yangming Zhou, Hunan Normal University, China
Xiang Li, Hunan Normal University, China

Objective: Adopting two forms of test, that is, the self-report type（SRT） and semi-projective type（SPT）, construct the Learning Motivation Test for Pupils based on the CTT. And compare their advantages in constructing test.
Method: Research participants consisted of 1132 second- to sixth-graders (611 boys, 521 girls). The framework and content of tests were established by drawing forefathers' researches, interviewing with the experts and surveying students with open-end questionnaires. SRT and SPT are compared in reliability and validity.
Result: The two tests consist of 25 items and two subtests, but in terms of items, they are not exactly the same. For the two tests, the correlations between items and subscales are within 0.52-0.73. Extreme group studies show that scores of each item in high-score group are significantly higher than those of low-score group. The two tests have no significantly difference in the results of item analyses, but SPT can improve the utilization of items. Cronbach' s coefficients of SRT and SPT are 0.71 and 0.62, respectively, but the measuring ranges of SPT are larger than that of SRT. According to the results of EFA, we know the values of the two tests' factor loadings range from 0.49~0.78.CFI and TLI of CFA are higher than 0.92, /df is lower than 1.34,and RMSEA is lower than 0.04; SPT is much better than SRT on the criterion-related validity.
Conclusion: The structures of the two tests are reasonable, reaching the psychometric standards. The validity of SPT and the reliability of SRT are good.

Development of Learning Preference Scale for Pupils Based on GGUM and CTT

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Yongbo Li*, Hunan Normal University, China
Danghui Shi, Hunan Normal University, China

Ying Long, Hunan Normal University, China
Dai Zheng, Hunan Normal University, China
Jiuyuan Tang, Hunan Normal University, China

Objective:We tried to develop the learning preference scale of student in primary school based on the traditional classical test theory and IRT. Discuss the theoretical construct of the learning preference scale, in order to deepen research on Theory of Learning Preference.
Method：According to the review of current literature and take account of existing studies and literature，the Learning Preference Scale for Pupils was constructed. In this paper, 1446 pupils completed the questionnaire and comprised the response rate as 92.81%.
Result: The learning preference scale of Pupils contract structure was accordant with four-dimension model, the Scale composed of 20 items, and each dimension includes 7,5,4 and 4 items.The scale and items are meeting the psychometrics which based on the GGUM （2004） ; the item locations θ are range from -3.26 to -1.65, item discrimination parameters are from 0.72 to 1.74, and better fitting prediction result with the scale construction which based on the CFA. The value of NFI、 GFI、AGFI、IFI、TLI and CFI in the CFA are all greater than 0.90， /df is 1.325, the RMSEA is lower than0.03 and the RMR is lower than 0.007.By using the scale can be assess the learning preference of Schoolchildren in effect, there are differences among school, grade and age for learning preference of pupils.
Conclusion: The results show that indexes reached requirement of the metrology, and the scale can well be used in the learning behavior and its related areas.

Development of Self-confidence Questionnaire for Pupils Based on CTT and IRT Unfolding Model

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Danghui Shi*, Hunan Normal University, China
Xingjie Qu, Hunan Normal University, China
Fusheng Xie, YueLu Teachers' College for Vocational Studies, Changsha, China
fanmei Zeng, Hunan Normal University, China
Zi Zhao, Hunan Normal University, China

Objective： Construct the self-confidence questionnaire(SCQ) for pupils with the generalized graded unfolding model (GGUM) of IRT. Analyze construction of the questionnaire and test the level of pupils' self-confidence.
Method: The questionnaire is proposed by studying the literature review. After then, do pre-test and re-write the item of the questionnaire. The samples are consisted of 1130 pupils

(573 boys, 557 girls) from grade 4 to grade 6. The structure of the questionnaire is confirmed. The construct validity and the criterion-related validity are tested.
Result：SCQ consists of 31 items and 8 factors. The item locations theta values range from -3.51 to -1.47, item discrimination parameters are from 0.57 to 1.85. Cronbach' coefficient is 0.86. GFI、AGFI、IFI、TLI and CFI of CFA are all greater than 0.9 and the criterion related validity is 0.62. In self-denial, moral self-confidence and appearance self-confidence schoolgirls have more score ,but in sport self-confidence schoolboys have more score（$p<0.01$）. City pupils have higher scores than country pupils in self-confidence （$p<0.01$).
Conclusion： It is feasible to develop the self-confidence questionnaire for pupils with GGUM. The structure of the test is reasonable.Some factors of the self-confidence questionnaire for pupils have significant differences in gender. There are significant differences between city pupils and country pupils in self-confidence.

Dynamic and comprehensive item selection strategies for computerized adaptive testing based on graded response model
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Fen Luo*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China
Xiaoqing Wang, Jiangxi Normal University, China

Item selection is a core component in Computerized Adaptive Testing (CAT). More information can be provided by polytomous items. Based on graded response model(GRM), a technique of the reduction dimensionality of difficulty(or step） parameters was employed to construct some item selection strategies (ISSs) proposed recently. And some corresponding modifications on each of the ISSs proposed recently are made. In order to improve maximum Fisher information criterion (MFI), two new types of ISSs are proposed based on GRM inspired by integration of interval estimation , dynamic a-Stratified and dynamic b-Stratified usually used when scoring 0-1. The results of Monte Carlo simulation study show that the new types of item selection method achieved a shorter test length and a lower average exposure rate than other methods involved in the paper, ensured accuracy of the original item selection methods. In more details, every new ISS applied the idea of the interval estimate was better than the correspondent ISS in the sense of obvious improvement of the Chi-square value. And the same effect appeared when comparing the dynamic a-Stratified ISS with MFI. This fact demonstrates that the new ISSs benefit improvement of the utility of the item pool .

Construction of Learning Attitude test for pupils Based on IRT Unfolding Model

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Xingjie Qu*, Hunan Normal University, China
Fusheng Xie, Yuelu Teachers' College for Vocational Studies , China
Wen Tan, Hunan Normal University, China
Yan Mao, Hunan Normal University, China
Xiyou Cheng, Hunan Normal University, China

Objective： Construct the self-confidence questionnaire(SCQ) for pupils with the generalized graded unfolding model (GGUM) of IRT. Analyze construction of the questionnaire and test the level of pupils' self-confidence.
Method: The questionnaire is proposed by studying the literature review. After then, do pre-test and re-write the item of the questionnaire. The samples are consisted of 1130 pupils (573 boys, 557 girls) from grade 4 to grade 6. The structure of the questionnaire is confirmed. The construct validity and the criterion-related validity are tested.
Result：SCQ consists of 31 items and 8 factors. The item locations theta values range from -3.51 to -1.47, item discrimination parameters are from 0.57 to 1.85. Cronbach'a coefficient is 0.86. GFI、AGFI、IFI、TLI and CFI of CFA are all greater than 0.9 and the criterion related validity is 0.62. In self-denial, moral self-confidence and appearance self-confidence schoolgirls have more score ,but in sport self-confidence schoolboys have more score（$p < 0.01$）. City pupils have higher scores than country pupils in self-confidence（$p < 0.01$).
Conclusion： It is feasible to develop the self-confidence questionnaire for pupils with GGUM. The structure of the test is reasonable.Some factors of the self-confidence questionnaire for pupils have significant differences in gender. There are significant differences between city pupils and country pupils in self-confidence.

The Effect of Student's Self-Confidence, Positve Affect and Teachers' Expectations On Science Achievement

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Fu-An Chi*, National Chung Hsing University, Taiwan
Jen Jang Sheu, National Chung Hsing University, Taiwan

This study explored the effects of students' positive affect toward science, students' self-confidence in learning science and science teachers' expectations on science achievement of 5041 fourth-grade students and 174 science teachers from 150 schools across Taiwan. A hierarchical linear modeling was used to analysis the data the Trends in International Mathematics and Science Study (TIMSS) 2007 fourth grade dataset; a significance level of 0.05 was used. There were significant differences between students' gender and SES on the achievements. While controlling for student-level demographic

characteristics, revealed the substantial predictive effects in level-1 predictors of students' positive affect toward science, students' self-confidence in learning science and also significant effect of science teachers' expectations ,the level 2 predictor, on science achievement on of fourth-grade students. About 10% of the variation in achievement was found among the Taiwanese schools. Cross-gender teacher expectations effects between students and teachers were also discussed. Some implications for researchers, policy-makers and school personnel are offered to improve science achievement in Taiwan.

Classification Consistency for Test Scores Composed of Testlets under IRT and non-IRT Approaches

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

So Yoon Park*, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

This article investigates how statistical procedures can be applied to estimate the classification consistency for test scores composed of testlets under IRT and non-IRT approaches.

The main purpose of this article is comparison of estimating classification consistency by two methods; item-based and testlet-score method. Another purpose is to investigate the classification consistency estimates according to IRT and non-IRT methods.

For the analysis two different IRT models are considered. Dichotomous model uses three-parameter model and polytomous model uses graded response model. In non-IRT models, Hanson and Brennan (1990) and compound multinomial (Lee et al., 2009) procedures are used.

All computations for the classification consistency in IRT models are carried out using the computer program IRT-CLASS (Lee & Kolen, 2008). Results for the Hanson and Brennan procedure are computed using BB-CLASS (Brennan, 2004) and results for the compound multinomial model are computed using MULT-CLASS(Lee, 2008). These all methods are applied to both real and simulated data.

The result of this study is that the testlet format has an impact on the estimating classification consistency. Item-based method is the highest estimate(κ) in both IRT and non-IRT method, and non-IRT method estimate(κ) is bigger than IRT method. Last, testlet-score method result under IRT approach is the smallest in all measurement methods. Table 1 displays the results of the real data.

Table 1

	Item-based Method			Testlet-score Method		
	P	κ	Pc	P	κ	Pc
non-IRT	0.97336	0.84123	0.83224	0.97524	0.83675	0.84834

IRT 0.97555 0.83781 0.84924 0.96990 0.83424 0.81841
To improve generalization, simulation study is in progress.

Teachers' expectations on students science achievements:evidence from TIMSS 2007
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Cindy Wu*, National Chung Hsing University, Taiwan
Jen Jang Sheu, National Chung Hsing University, Taiwan

This study examined the effects of students' positive affect toward science, students' valuing science, students' self-confidence in learning science and science teachers' expectations on science achievement of 3870 eighth-grade students and 150 science teachers from 150 schools across Taiwan. A hierarchical linear modeling was used to analysis the data from the Trends in International Mathematics and Science Study (TIMSS)2007 eighth grade dataset; a significance level of 0.05 was used. There were significant differences between students' gender on the achievements. While controlling for student-level demographic characteristics, revealed the substantial predictive effects in level-1 predictors of students' positive affect toward science, students' valuing science, students' self-confidence in learning science and also significant effect of science teachers' expectations ,the level 2 predictor, on science achievement on of eighth-grade students. About 36% of the variation in achievement was found among the Taiwanese schools. Cross-gender teacher expectations effects between students and teachers were also found.

The Development of Computerized Bodily-Kinesthetic Test
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Yung Chih Ou*,National Taiwan Normal University, Taiwan
Po-Hsi Chen, National Taiwan Normal University, Taiwan

The purpose of the study is to assess the bodily-kinesthetic intelligence of multiple intelligence theory (Gardner, 1983) efficiently and objectively. According to Gardner's definition, the bodily-kinesthetic intelligence includes two major components: Bodily-Dancer Abilities and Kinesthetic Athlete. The former is to control one's body, such as the way gymnasts control their bodies to perform perfectly; the latter is to handle objects skillfully, such as the ways in which tennis players interact with their partners or competitors. We used three indexes to assess: 1) balance refers to self-control ability, 2) reaction time refers to skillful interaction, and 3) hand-eye coordination refers to a combination of both. We developed a computerized test that contains subtests of the three indexes. Ninety undergraduate students were asked to perform in front of the screen, and then the webcam records examinees' performance and codes their responses. Partial credit

model (Masters, 1982) were used to analyze the data. The results reveal that most items were stable but tended to be easy. In addition, we used latent regression analysis to examine the gender differences. The results indicated that the female performed better than the male students. The items and samples of this computerized bodily-kinesthetic test will be increased in future research.

Sensation Seeking and Tobacco and Alcohol Use Among Adolescents: A Mediated Moderation Model

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Baojuan Ye*, South China Normal University, China
Dongping Li, South China Normal University, China
Qishan Chen, South China Normal University, China
Yanhui Wang , Jiaying University, China

Based on ecological systems theory and social learning theory, this study constructed a mediated moderation model in which stressful life events moderated the relationship between sensation seeking and tobacco and alcohol use, and this moderation effect was mediated by affiliation with deviant peers. Participants were 660 adolescents, and they completed the sensation seeking scale, stressful life events scale, affiliation with deviant peers questionnaire, and tobacco and alcohol use questionnaire. The results indicated that: (1) adolescents' sensation seeking was a risk factor of tobacco and alcohol use; (2) stressful life events moderated the effect of sensation seeking on tobacco and alcohol use; (3) affiliation with deviant peers mediated this effect.

Scoring Thresholds Setting for open-ended items on double-marking online system

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Lina Wang*, Beijing Normal University, China
Bo Wang, The Chinese University of Hong Kong , China
Hong-Sheng Che, Beijing Normal University, China
Meng Chen, Beijing Normal University, China
Ran Bian, Beijing Normal University, China

The paper aims to attract the researchers' interest in Scoring Thresholds Setting for open-ended items on double-marking online system. Now, open-ended items are being wildly used in various areas. The double-marking online system is used to improve the reliability of the rating. One examinee' response is distributed to two raters randomly, if the two raters score the same examinee' response within the scoring thresholds, the final score is the average of the two raters' scores; if not within it, the examinee' response will be sent

to the third rater. And if the third score of the examinee' response is within the scoring threshold with one of the two former scores, the final score is the average of the two scores within scoring threshold. If the third score is not within scoring threshold with either, the examinee' response will be sent to the fourth rater, who are often experts, to determine the final score.
How large should the scoring threshold be? The usual scoring threshold is 1/6 or 1/5 of the full score. In one large-scale examination, 245,890 attended it in 2009. The full score of the essay writing was 40. The scoring threshold was 8. When deleting the zero-score examinees, the average score of the item was 20.73, with standard deviation 3.72. The scoring threshold 8 is two times more than the standard deviation, which might be too large to control the rating quality. Therefore, how to set the scoring threshold dynamically should be researched by future research.

Measured Subgroup Mean Differences in Cognitive Ability Tests: Do Scoring Methods Matter?
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Li Tony*, Kenexa, UK;
Keeley Sean, Kenexa, UK

Cognitive ability tests are widely used in employment selection, education admission, and other high-stakes situations due to their proven validity in predicting performance. In assessing human talent, a dilemma is that these tests show substantial differences between ethnic groups. Using the test often leads to adverse impact by disproportionally selecting members from certain racial groups, resulting in social, legal, and scientific debates. Various strategies have been proposed to minimize adverse impact whilst maintaining the validity of selection tools.
The presentation aims to demonstrate the impact of scoring methods in passage-based cognitive tests on observed group mean score differences. Four scoring procedures are compared: (1) classical test theory scoring, (2) unidimensional IRT scoring, (3) polytomous IRT scoring, and (4) testlet IRT scoring. Significant mean score differences are evident in CTT and unidimensional IRT scoring methods. The group differences are found to be insignificant after applying polytomous IRT and particularly testlet IRT model. Practical implications will be discussed in the context of adverse impact. Further debate is called for to evaluate the magnitude of group mean score differences in cognitive ability tests.

Devising a moral judgment test for the measurement of care: A lost dimension from a psychometric perspective
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Huan-Wen Chen*,National University of Tainan, Taiwan

The purpose of this study is to develop a moral judgment test for the measurement of the 'care' dimension long neglected in the tradition of cognitive-developmental moral framework such as Piagetian or Kohlbergian ones. Literature review is widely researched from various fields to provide a rationale to construct such a test. The items in the test are real-context and daily-life based and cover a wide range of spheres. One of the focuses of this research is to apply psychometric models such as polytomous IRT models to the analysis of the response patterns obtained from the moral judgment test. With some of the basic assumptions of IRT models met, the advantages of the application of IRT models will facilitate the interpretation of the test results.

The effects of music learning in elementary school through the Dalcroze Eurhythmics
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Mei-lin Chen*, National Taiwan University of Art, Taiwan

In order to enhance the quality of education, the Ministry of Education has carried out lots of policies about art education since 1993. However, the research about "Arts and Humanities Domain" is still quite less. In addition, there are many discussions about teaching method of music education. The information talked about Dalcroze Eurhythmics, nevertheless, is so poor.The teaching method of Dalcroze Eurhythmics is the first revolutionary experiment about music. Dalcroze, what's more, affected deeply Orff and Kodaly. The purpose of this study is to understand how to use Dalcroze Eurhythmics in "Arts and Humanities Domain" and to explore the effects after lessons. The study adopts the design of instructional experiment. The subjects are two 3rd-grade classes from an elementary school in Taipei County. One class is experimental group and the other one is control group. The classes take 40 minutes per week for 10 weeks. Besides, the researcher makes a pre-test before class and a post test after whole lessons. The questionnaire is a support for study.
The research found expectedly it is possible to use Dalcroze Eurhythmics in "Arts and Humanities Domain". Furthermore, using method of Dalcroze Eurhythmics enhanced effects obviously in learning music. However, there's teaching limit. Especially, the main problem is lack of qualify to teach.

Solving complex optimization problems with many parameters by means of optimally designed block-relaxation algorithms
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Tom F. Wilderjans*,Katholieke Universiteit Leuven, Belgium

Iven Van Mechelen, Katholieke Universiteit Leuven, Belgium
Dirk Depril, Katholieke Universiteit Leuven, Belgium

Many data analysis problems involve the optimization of a criterion that is a function of many parameters, with these parameters being continuous, discrete, or a combination of both. To deal with such optimization problems, the class of block-relaxation algorithms (e.g., alternating least-squares algorithms) may be most useful. Characteristic of the algorithms that belong to this class is that the set of parameters is divided into a number of subsets, and that for each subset in turn the parameters that belong to it are updated until there is no further improvement in the loss function value. The parameter subsets are constructed in such a way that the optimal values for the parameters in each subset (conditional on the current estimates of the parameters in all other subsets) can be determined easily (e.g., in terms of closed-form expressions). When designing a block-relaxation algorithm, two choices need to be made, which may influence the performance of the algorithm: (1) the way in which the parameters are divided in subsets, and (2) the order in which the parameter subsets are updated.
In this presentation, based on theoretical and empirical arguments, guidelines for optimally designing block-relaxation algorithms will be derived. As an illustration, these guidelines will be applied to the estimation of the INDCLUS model (i.e., a mixed discrete-continuous optimization problem). Different alternating least-squares algorithms for fitting the INDCLUS model will be proposed and compared to each other in an extensive simulation study.

Using the Rasch Testlet Model to Detect Testlet DIF in Chinese Passage-based Reading Testing
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Congying Guo*, Beijing Normal University, China
Yufang Bian, Beijing Normal University, China

Detecting Differential Item Functioning is to ensure a fair test. With the development of test forms, testlet form test enjoys more and more popularity in Education and Psychological Testing. Passage-based form is a typical example of testlets, so the DIF procedures that are adopted must be able to handle the testlet effect properly. Current methods to deal with testlet effect fall into two categories: the alternative/indirect approach and the testlet model-based approach. The latter is more methodically sound, it provides the DIF effect of each item rather than the whole testlet.
This study pursues the second path and solve the testlet DIF issue in passage-based reading tests by using the Rasch Testlet Model, which is derived from the testlet model-based

approach. DIF is taken into account by adding DIF parameters into the Rasch testlet model. The first part employed the Rasch Testlet Model to detect DIF through a reading achievement test. The bootstrap method is conducted to approximate the standard errors of the estimators for the DIF parameters so that the Wald statistic can be computed to test the null hypothesis of no DIF.
The second part was a comparison study between the Rasch Testlet Model and traditional Rasch Model and the result displays the necessity and advantage of the testlet model-based approach.
The results indicated that the testlet model-based approach were more technically sound than the non-testlet DIF procedures for passage-based testing.

The Development of the Chinese Janusian Thinking Test for college Students
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Wei-Chun Li*, National Taitung University, Taiwan

The purpose of this research is to design a standardized Chinese janusian thinking test for college students to enrich the tool resource of research application. The related researches on "janusian thinking" were reviewed first, and then a scientific and systematic sample of janusian thinking was selected to construct the test. After the pilot-test, there were 20 items to be selected for the formal test which were categorized into two categories in each age group. There were eight to twelve items in each category. 304 college students were sampled as the norm. The Cronbach α coefficient was 0.836 to 0.882. The correlation coefficients between the two subtests were 0.871.
The performance of different background college students was also analyzed. The result showed that the better the college students' Chinese achievement was, the better their Chinese janusian thinking ability was. Besides that, the gender difference only found for the fourth graders was found for all age groups. Moreover, this study also investigated other factors about janusian thinking test, such as common item and the way item presented. The results suggested the higher graders performed better in common items. Overall, this test functions effectively for the preliminary screening purpose.

Fixed parameter calibration methods and its application to DIF analysis in online calibration designs
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Fabiola Gonzalez-Betanzos, Autonoma University of Madrid, Spain
Francisco J. Abad*, Autonoma University of Madrid, Spain
Juan Ramon Barrada, Autonomous University of Barcelona, Spain

In large-scale application of computerized adaptive testing programs it is common the periodic need to renew item bank. For this purpose, pretest items are presented in conjunction with operational items. Pretest items are calibrated with an IRT model and possible DIF is analyzed. In the present study we compare the free parameter calibration method with imputed responses with three fixed parameter calibration methods, which differ in the number of updates of the previous distribution and the number of EM cycles. The manipulated factors are: (a) test length; (b) kind of DIF; (c) DIF size; (d) difficulty and discrimination of the pretest item; (e) sample size; and (f) ability distribution of the focal group. Overall, no differences were found between methods with regard to Type I error and power in detecting DIF. The free parameter calibration method with imputation of missing responses underestimated the variance of the focal group, which leads to an overestimation of the size of DIF. The fixed parameter calibration method with multiple prior updates and multiple EM cycles was the most efficient in the recovery of the item parameters and the ability distribution of the groups.

Evaluating the Consistency of Verbal Reports and the Use of Cognitive Models in Educational Measurement

Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.

Xian Wang*, University of Alberta, Canada .
Jacqueline P. Leighton, University of Alberta, Canada

In the field of psychology, verbal reports are commonly used as a data source to explain human information processing. To date, few studies have investigated the accuracy of verbal reports for providing information on students'cognitive models during problem solving on educational tasks. The purpose of this study is to evaluate the consistency of concurrent and retrospective verbal reports, as well as the effects of student achievement, interviewer knowledge level, and item difficulty on the consistency of verbal reports. There were seventy-one Grade 12 students from two high schools involved in the study, which included 39 girls and 32 boys enrolled in Grade 12 university-tracked pure mathematics course. All students participated in a think-aloud interview and provided verbal responses to 15 multiple choice test items from the Alberta Pure Mathematics Diploma Examination. Interviewer knowledge level was manipulated as between-subject variable and item difficulty was manipulated as within-subject variable. The descriptive analyses indicated that students were generally consistent in using the same cognitive models during problem-solving. Independent t-tests showed significant effect of student achievement on the consistency, namely, higher-achieving students demonstrate greater consistencies in verbal reports than moderate achieving students. The one-way ANOVAs indicated that there is no significant effect of interviewer knowledge level and item difficulty on the

consistency of verbal reports. Overall, the study indicated that eliciting verbal reports from both concurrent and retrospective generally leads to consistent information about students'cognitive models in the domain of educational measurement.

Assessing fit of the DINA models
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Jung Yeon Park*, Columbia University, USA

Cognitive diagnosis model is an advanced psychometric model that evaluates student strengths and weakness for problem solving in which specific skills are required in that this model classifies examinees into latent classes determined by vectors of binary skill indicators, and in the language of more general latent class modeling, models for doing this are called multiple classification latent class models (Maris,1999). DINA(The deterministic inputs, noisy "and" gate) model is one of the most well-known CDM because it is tractable and easily interpretable.However one of the weaknesses noted by previous researches is its expensiveness in terms of parameter estimation in saturated model assumption of skill vectors.
For a decade there have been active researches for DINA model fit within fully Bayesian framework with MCMC algorithms. Based on Junker and Sijstma(2001). The higher-order DINA(HO-DINA) suggested De la Torre and Douglas(2004) significantly reduced the computational complexity from the saturated model. Also Henson et al (2009) applied log-linear cognitive diagnosis model to DINA model. Recently G-DINA model has been introduced with more relaxed model assumption(de la Torre,2011).
Thus purpose of this study is to review and estimate all those models and examine which model is better fit. The data analysis with Tasuoka(1990) and simulation studies will be done with MCMC implementation. As a model selection criteria, the Bayes factor of Carlin-Chib (Carlin & Chib, 1995) which fine-tune pseudopriors that works well with the posterior distribution, Posterior predictive model checking (PPMC), DIC,AIC, and BIC will be used to examine performance of each criteria.

Teacher's beliefs, attitudes, and professional development: A cross-country analysis using multilevel modeling
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Chi Chang*, Michigan State University, USA

The purpose of this study is based on two questions: whether there are significant differences among countries with regard to teacher's professional development willingness, and how teacher's background, their teaching beliefs, and attitude explain it. 46,061

teachers in 14 countries in Organizational for Economic, Cooperation and Development (OECD) 2008 Teaching and Learning International Survey dataset (TALIS) were investigated. In the meantime, national-level specific variables of these countries from OECD database were linked with TALIS for examining whether education investments of countries make teacher's perception of professional development different. The blockwise multilevel logistic regression were performed using HLM software. The findings reveal significant cross-country differences in teacher's professional development willingness. They are not only driven by teaching constructivism beliefs, but also significantly influenced by nation-specific characteristic. In addition, the finding also brings out the importance of latent class analysis in the application of multilevel modeling for future analyses.

A new cognitive diagnosis model for analyzing multiple-choice options
Poster Session : Tuesday, 19 July, 6:00 p.m. -- 7:30 p.m.
Koken Ozaki*, The Institute of Statistical Mathematics, Japan

A new cognitive diagnosis model (based on DINA model) for analyzing multiple-choice options is developed. The method has the same purpose as de la Torre (2009). The difference is that the deloped method has the much smaller number of parameters than his method but can elaborately expresses response behaviors of examinees. The results of a simulation study will be shown.

Wednesday, 20 July, 2011

Cognitive Diagnosis Modes, Item Response Theory, Mixture IRT, Latent Transitions Models, The Many Faces of Latent Class Analysis
Invited Symposium : Wednesday, 20 July, 11:10 a.m. – 12:30 a.m., D1-LP-03

Extended LogLinear Rasch Models
Henk Kelderman*, VU University Amsterdam, The Netherlands

Rasch models are equivalent to loglinear models with latent class variables. Within the larger framework of loglinear models, various extensions of the Rasch model can be formulated. We discuss log-linear Rasch models for polytomous items, log-linear multidimensional Rasch models, Rasch models violating measurement invariance, mixture distribution Rasch models, mixture measurement Rasch models, Rasch models where item responses are conditionally dependent, and Rasch models with latent responses. We also give some software scripts.

A Variational Approximation Estimation Method for the Item Response Theory Model with Random Item Effects across Groups
Frank Rijmen*, Educational Testing Service, USA

Item response theory is the dominant approach to analyze the data stemming from international educational assessments conducted in many countries. The assumption that all items behave the same in all countries is often not tenable. The variability of item parameters across populations can be taken into account by assuming that the item parameters are random effects with a distribution that is defined over populations. However, the complex latent structure of such a model, with latent variables both at the item and the person level, renders maximum likelihood estimation computationally challenging. This inherent complexity of the model can be easily shown when adopting a graphical model framework. There is a need for the development of estimation methods that offer good approximations to maximum likelihood estimation but are computationally feasible. A variational estimation technique is presented that consists of approximating the likelihood function by a computationally tractable lower bound. An advantage of the variational method is that it can be used regardless of the distributional assumptions of the random effects. The method is evaluated in a simulation study and applied to the Progress in International Reading Study of 2006. The results of the simulation study indicate that all model parameters are recovered well. In the application, a high positive relation was found between the magnitudes of the model-based variances of the item parameters and the sizes

of the likelihood ratio statistics testing for differential item functioning under a logistic regression approach.

Why latent class models are cognitive diagnosis models – or the other way around…

Matthias von Davier*, Educational Testing Service, USA
Xueli Xu, Educational Testing Service, USA
Kentaro Yamamoto, Educational Testing Service, USA

The equivalency of certain types of ordered latent class models and the Rasch model is a well established fact (DeLeeuw & Verhelst; 1986; Formann, 1985; Lindsay, Clogg & Grego, 1991; Heinen, 1991). Kelderman (1984) showed that Rasch models are equivalent to log-linear models with latent class variables. Many free and commercially available software programs for item response theory (IRT) analyses utilize the EM algorithm and estimate the latent ability distribution as a unidimensional array of ordered latent classes. Together with constraints on class specific response probabilities, latent class analysis (LCA) can be used to 'emulate' a large variety of models, including IRT, multidimensional IRT models, and diagnostic models. For example: Haberman, von Davier & Lee (2008) have shown that a surprisingly small number of ordered levels per dimension can be used in a latent class model that is essentially indistinguishable from a multidimensional IRT model with normally distributed latent variables. In a recent commentary on a survey of diagnostic models, von Davier (2008) has argued that diagnostic classification models can be re-cast as latent class models. To be sure, even when recasting a diagnostic model in terms of a constrained LCA, there is still the threat of multiple, equivalent representations (Maris & Bechger, 2008).
The presentation delivers some new results on this equivalency of well-known psychometric models and constrained latent class models and discusses implications for model selection.

New Directions with Intensive Longitudinal Data
Invited Symposium : ***Wednesday, 20 July, 11:10 a.m. – 12:30 a.m., D1-LP-04***

Accommodating Nonergodicity Across Individual Processes Using an Alternative to Granger Causality

Kathleen M. Gates*, The Pennsylvania State University, USA
Peter C. M. Molenaar, The Pennsylvania State University, USA
Michael J. Rovine, The Pennsylvania State University, USA
Nilam Ram, The Pennsylvania State University, USA

Process-oriented researchers often wish to identify the lead-lag relationships among variables and the influence of specific events on those relationships. Unfortunately, the current standards in the social sciences for arriving at group inferences from time series data sometimes produce results which fail to describe the individuals comprising the group. This greatly diminishes the utility of the findings. Such results occur because the processes are nonergodic across individuals. In this paper we offer a practical solution that provides unbiased group-level estimates while acknowledging individual-level nuances in relations among variables across time. To demonstrate the problem and solution, we utilize a state-space modeling approach recently introduced to the neuroscience community, the extended unified SEM (euSEM). The euSEM estimates the direct and bilinear influence of external events in addition to lagged and contemporaneous relations among variables. First, using Monte Carlo simulations we demonstrate the biases that may result when using standard methods of analysis on time series data. Second, we present a technique which utilizes an entirely automatic search procedure, implemented via an in-house Matlab program that utilizes Lisrel, which makes use of selection criteria akin to Granger causality for arriving at a group model which accounts for individual differences and yields valid group inferences. Third, we demonstrate the utility of the alternative approaches using empirical data from daily diary and functional MRI studies. The generalizability of our free program for identifying optimal group-level models offers the potential for improving the practical utility of group inference across multiple domains in the social sciences.

Modeling the Dynamics in Physiological Arousal between Children with Sensory Processing Disorder and Therapists during Psychotherapy

Siwei Liu*, The Pennsylvania State University, USA
Peter C. M. Molenaar, The Pennsylvania State University, USA
Michael J. Rovine, The Pennsylvania State University, USA
Matthew Goodwin, The Pennsylvania State University, USA

Physiological arousal is an important aspect in psychotherapy for children with Sensory Processing Disorder (SPD). Synchrony in physiological arousal between children and therapists reflects the social-emotional process during psychotherapy and is likely to affect therapy outcomes. We obtained multivariate time series of electrodermal activity (EDA) from 22 pairs of children with SPD and their therapists. EDA was measured by two wireless sensors worn on the right and left ankles of both the child and the therapist during individual therapy sessions that last approximately 1 hour. Values were recorded from the sensors every 500 milliseconds. We applied time-frequency analysis to each therapy session. Specifically, a moving-window vector autoregressive model is fitted to obtain the power spectrum, coherency, and partial-directed coherence (PDC) estimates for the

multivariate time series. The PDC estimates allow for Granger causality testing in the frequency domain. Our preliminary analysis of one therapy session indicates that low frequency components explain most of the variation in EDA for both the child and the therapist. The synchrony in EDA is high at the beginning of the therapy session, low at the middle of the session, and increases slightly towards the end. More importantly, a unidirectional influence was found from the therapist to the child, but not from the child to the therapist. These results provide insight to child-therapist interaction during therapy and can be used to identify activities or strategies that are most influential to the child. The method developed can be used to study interpersonal physiological dynamics in other settings.

Time-Varying Effect Model of Intensive Longitudinal Data: An Application to Smoking Cessation Behavior

Mariya Shiyko*, The Pennsylvania State University, USA
Xianming Tan, The Pennsylvania State University, USA
Runze Li, The Pennsylvania State University, USA
Saul Shiffman, The University of Pittsburgh, USA

Study designs that employ ecological momentary, ambulatory, or other types of intensive-longitudinal-data (ILD) assessments are frequently interested in the relationship between covariates (time-varying or time-invariant) and intensively-sampled processes (e.g. smoking urges, pain intensity). Current models for analyzing these data (e.g. mixed-effects models) make an assumption of the constant effect of a covariate on an outcome. In this study, we build on richness of analytical approaches for functional data and present a time-varying effects model (TVEM). TVEM is a non-parametric approach to estimating functional forms of model parameters. Incorporating the P-spline approach, added to PROC MIXED, we are able to extend the mixed-effects model such that intercept and slope parameters are represented by functions varying with time. In our empirical example, we examine ecological momentary assessment data from a smoking-cessation study of 304 participants. The model is applied to explore the dynamic association between self-efficacy (confidence) for quitting and intensity of smoking urges after the quit attempt. We demonstrate how the magnitude of the relationship changes as a function of days post-quit. Implications of the model are discussed.

Parallelism, Ergodicity, and Psychological Explanations

Keith A. Markus*, The City University of New York, USA

Discussions of the impact of non-ergodicity on inferences from psychological data often frame the issue in terms of a binary contrast between variation between people and variation within people (Molenaar, 2004; 2007). The Principle of Parallelism suggests that one can frame these issues in terms of a broader range of research design features (Reichardt, 2006). Rubin's Causal Model (Rubin, 1974; Holland, 1986) provides an approach to analyzing inferences from comparative data to causal effects. The effect of circling verbs on reading comprehension provides a concrete example for exploring the conceptual relationships between these three ideas. One characterization of these relationships focuses on a common causal effect and attributes differences in observed effects to various biases. This approach fails to capture the value of explanations in terms of stable noncausal patterns. An alternative characterization embraces back-tracking counterfactuals (Lewis, 1986) as a useful tool in psychological explanation. Such counterfactuals link two effects of the same cause. This characterization offers a more constructive understanding of various practices of psychological explanation. This characterization suggests parallel strengths and weaknesses in studying various types of variation. It also suggests that such explanations rely on the idea of conditional non-governing psychological laws (Beebee, 2000). Non-governing laws have greater counter-factual fragility than governing laws and thus support a narrower range of inferences. Explanations based on such laws generalize less than purely causal explanations. The analysis of non-ergodicity across a range of design elements using Rubin's Causal Model helps illustrate the value and limitations of this type of explanation.

Comparison of Small-Sample Equating Methods for Mixed-Format Tests in a NEAT Design

Parallel Session: Equating and Linking; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Euijin Lim*, Yonsei University, South Korea
Hwangkyu Lim, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

Traditionally, it was generally agreed that identity equating is better than any other equating method when sample sizes per test form are under 100 (Hanson, Zeng, & Colton, 1994; Kolen & Brennan, 2004). However, recently published studies proposed that applying circle-arc equating method leads to more accurate equating results than does identity equating even when sample sizes are very small (Kim & Livingston, 2010; Livingston & Kim, 2008, 2009, 2010). The purpose of this study was to compare the accuracy of small-sample equating methods for mixed-format tests in a NEAT design. Several simulation studies were conducted to examine which method would be preferable under certain conditions including sample size, composition of anchor items, and test difficulty.

Levine mean, Levine linear, Levine simplified circle-arc equating methods and Identity equating were implemented for simulated data.
It was found that RMSD sharply increased when sample size was reduced from 25 to 10 for a new form and 75 to 30 for an old form, respectively. When sample size was extremely small in case of 10 for a new form and 30 for an old form, an anchor test composed of constructed response items leaded to smaller RMSD than did anchor tests containing multiple-choice items. Also, when the test difficulties between old and new forms were similar, identity equating appeared a better way to decrease RMSD. On the other hand, when the test difficulties were different, equating methods such as Levine mean and circle-arc equating methods reduced RMSD than did identity equating.

Considerations to Evaluate Equating Results Based on IRT Calibration and Equating
Parallel Session: Equating and Linking; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Yue Zhao*, The Hong Kong Institute of Education, Hong Kong

Item Response Theory (IRT) is commonly used to calibrate and equate the state assessment test programs. Equating is one of the crucial steps to generate score conversion table which is used for producing scale score and proficiency level for each individual student. Whether or not the equating is conducted properly considering its practical consequences? Whether or not the anchor set is appropriately applied for the use of equating? Are there any outlier anchor items to be removed from the anchor set? This presentation highlights some considerations to evaluate equating results, including IRT model fit, Test Characteristic Curves (TCCs), score distributions, the score and proficiency profile from the reference year, and property of the anchor set. Also, the consideration and alternative to remove outlier anchor items is discussed. Examples are illustrated as well to address the practical consequences of equating.

The Comparison of IRT Equating Methods and Link Plans in Large Scale Assessment
Parallel Session: Equating and Linking; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Yan Gao*,Beijing Normal Univeersity, China
Tingting Yang, Beijing Normal Univeersity, China
Tao Yang, Beijing Normal Univeersity, China
Mengjie He, Beijing Normal Univeersity, China

Equating is an important step in the process of developing a test. Through various researches have been done on different equating methods, it is rare to see studies on the

effect of various equating plans, especially on the precision of different equating methods in the context of various equating plans. This paper focuses on comparing the accuracy of different equating methods and equating plans in the common-item nonequivalent groups design study. Three equating methods were compared: Stocking & Lord approach, mean-mean approach, and concurrent calibration method. And two linking plans were studied: the focus equating plan and the chain equating plan. The research used the real test data with large sample criteria as equating criteria and RMSE as precision indicator.
The results showed that the precision of Stocking & Lord approach, mean-mean approach was better than that of concurrent calibration. Generally speaking, mean-mean approach resulted in a smaller RMSE than that of Stocking & Lord approach in the process of estimating slope parameters, and Stocking & Lord approach resulted in a smaller RMSE than that of mean-mean approach in the process of estimating threshold parameters.

Comparison of Multiple-Group and Single-Group Calibration Methods for Linking
Parallel Session: Equating and Linking; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Won-Chan Lee*, University of Iowa, USA
Ja Young Kim, University of Iowa, USA

In a common-item nonequivalent group equating design, two forms of a test (new and old forms) have a set of items in common, and two groups from different populations are administered the two forms. IRT parameter estimates for the two test forms, if calibrated separately, will not be on the same ability scale because the two groups are from different populations. The goal of IRT linking is to place the two sets of parameter estimates from the two different groups on the common scale through the common items. This study compares two linking methods, the multiple-group calibration (MGC) and single-group calibration (SGC) methods. The MGC calibrates the data from both forms together and one of the groups is specified as a reference group so that the resultant parameter estimates for the other group will be on the scale of the reference group. By contrast, the SGC uses the same combined data as for the MGC, but it treats the data as if they are from the same single population. Consequently, the parameter estimates for the two forms will be on the scale that can be referred to as a combined population. The primary purpose of this study is to evaluate and compare the performance of the two linking methods using a simulation study.

Performance Evaluation of Plausible Value Method in the Equated Tests
Parallel Session: Equating and Linking; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06
Shiau-Chian Tseng*, National Taichung University, Taiwan

Huey-Min Wu, National Academy for Educational Research, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Kai-Chih Pai, National Taichung University, Taiwan

For large-scale assessments, the spectrum of subject matter is usually wide and the simultaneous sampling of items and students is a practical way to obtain representative indications of students' performance. Balanced incomplete block design (BIB) and non-equivalent groups with anchor test design (NEAT) are two popular test equating methods for this condition. In addition, the purpose of the large-scale assessment is to monitor population progress, such as NAEP, TIMSS and PISA and the plausible value method is usually used to estimate the population characteristics.
The goal of this study is to explore the performance of plausible values method under BIB, NEAT and complete designs for horizontal equating based on simulated and real data. Unlike BIB or NEAT designs with missing data, the complete design means that all items are administrated to the same examinees. The data from Taiwan Assessment of Student Achievement (TASA) is applied in the real data experiment. The experimental results show that two linking designs (BIB and NEAT) can lead to more precision estimates by using plausible value method. Adding background variables can make two linking designs have better performance and close to complete designs.

Estimation of Classification Accuracy and Consistency under Item Response Theory Models
Parallel Session: Item Response Theory – Applications; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Ying Cheng*, University of Notre Dame, USA
Cheng Liu, University of Notre Dame, USA

Educational and psychological testing is often used to make classification decisions. For example, the test scores maybe used to categorize examinees into passing or failure groups, or different proficiency groups such as high, medium and low. One central issue is how accurately and consistently these classification decisions are made. Researchers have developed many methods to estimate classification accuracy and consistency rates based on one single test administration (e.g. Huynh, 1976a, 1976b; Lee, Hanson & Brennan, 2002; Livingston & Lewis, 1995; Subkoviak, 1976). These papers mainly focus on the case where the classifications are made based on number-correct score. It is a well-known fact that the number-correct score is not a sufficient statistic for the underlying latent trait θ when 2PL or 3PL models are used. Many testing programs, in fact, report scores on the basis of these two IRT models, and it is therefore interesting and necessary to define and explore classification

accuracy and consistency under the IRT framework based directly on θ estimates. This paper discusses exactly the procedure to do that, and how the procedure can be used with tests with dichotomous or polytomous items, and how the procedure can be easily extended to more complex decision rules.

Development and Validation of Learning Progression for the Oxidation-Reduction: A Rasch Measurement Approach
Parallel Session: Item Response Theory – Applications; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Kun-Shia Liu*, National Sun Yat-sen University, Taiwan
Ying-Yao Cheng, National Sun Yat-sen University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

The oxidation-reduction (redox) plays a crucial role in knowledge revolution of chemistry. However, little research focused on the development of a learning progression for this concept. This study aims to develop learning progressions and assessment for grades 7-9 students in acquiring the concept of redox. Six experts and three high school chemistry teachers were recruited into the research team. Through 15 panel discussions, five big ideas of redox including combustion, oxidation, reduction, oxidation reactivity, and oxidation-reduction were selected to form the concept map, propositional statements, and ordered multiple-choice items. Two samples of Taiwanese middle-school students participated in the test development: one for item revision and the other for validation. Sample 1 and 2 consisted of 626 and 903 students, respectively. Rasch partial credit model was applied to assess model-data fit, to examine the differential item functioning between genders, and to validate student progressions for learning redox reaction. In addition, this study presented abundant feedback information for learning diagnosis and provided a mechanism for aligning instruction and assessment.

A Rasch Approach to Measure Undergraduates' Key Competence
Parallel Session: Item Response Theory – Applications; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Li-Ming Chen*, National Sun Yat-sen University, Taiwan
Ching-Lin Shih, National Sun Yat-sen University, Taiwan
Paichi Pat Shein, National Sun Yat-sen University, Taiwan
Kun-Shia Liu, National Sun Yat-sen University, Taiwan
Ying-Yao Cheng, National Sun Yat-sen University, Taiwan

This study aims to develop a self-reported instrument to measure undergraduates' sense of competence around nine dimensions: lifelong learning, social responsibility, critical thinking, creativity, communication, leadership, aesthetic understanding, appreciation for nature, and global perspective. The definitions and test items of these nine subscales were constructed based on literature review and consultation with international experts. Two samples of Taiwanese undergraduates participated in the study, one for a pilot test of the instrument (n=1110) and the other for validation (n=1343). Multidimensional Partial Credit Model was applied to analyze the data and assess the model–data fit of the instrument. The results showed that the data fit the MPCM model well and no differential item functioning (DIF) was found between genders. The person separation reliabilities of the measures from nine subscales ranged from .88 to .96. The correlations between nine subscales ranged from .59 to .93. The orderings of item difficulties of the nine subscales were also validated across the two samples. This study provided evidence to support validity arguments during the instrument development process. Future research and the application of this scale in higher education were also discussed.

Item Response Theory Analyses of Adult Self-Ratings of the ADHD Symptoms in the Current Symptoms Scale
Parallel Session: Item Response Theory – Applications; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Rapson Gomez*, University of Tasmania, Australia

The graded response model (GRM), which is based on item response theory (IRT), was used to evaluate the psychometric properties of adult self-ratings (N = 852) of the ADHD inattention, hyperactivity, and impulsivity symptoms presented in the Current Symptoms Scale (CSS; Barkley & Murphy, 1998). This scale has four ordered response categories. The results for the discrimination parameters showed that all symptoms were generally good for discriminating their respective latent traits. For virtually all symptoms, their threshold values showed that they were especially good at representing the appropriate traits from around the mean trait level onwards. The item information function values for most symptoms indicated reasonable reliability from approximately the mean trait level onwards. All these findings are new, and extend existing psychometric information for adult self-ratings of the ADHD symptoms in the CSS.

Explanatory Person-Fit Analysis in Clinical Practice
Parallel Session: Item Response Theory – Applications; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Judith Conijn*, Tilburg University, Netherlands

Wilco Emons, Tilburg University, Netherlands
Marcel van Assen, Tilburg University, Netherlands
Klaas Sijtsma, Tilburg University, Netherlands

Clinicians increasingly use self-report measures in their practice and one of the primary reasons for doing so is to make important treatment decisions for individual patients. However, concentration and motivation problems may result in responses that are inconsistent with the respondent's latent trait value and impair the validity of these individual self-reports. Person-fit methods are tools to detect inconsistent response patterns and they may warn clinicians that prudence is called for when interpreting the individual's test score. Existing person-fit methods, however, have limited utility in the clinical practice. Main disadvantages of existing person-fit methods include the absence of information to diagnose possible causes underlying the inconsistency and limited power. In the present study, we propose new explanatory person-fit methods to detect and diagnose response inconsistency. Using simulated data and empirical data on anxiety measurements in a clinical population, we demonstrate how these methods can be used to explain variation in response consistency by mood state, personality, diagnosis, and demographic variables.

Comparing Imputaion Using Differnt Partitions of Data for Latent Class Models
Parallel Session: Missing Data; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.;
D1-LP-08

Ting Hsiang Lin*, National Taipei University, Taiwan
Cheng Ken Wu, , Taiwan

Survey is a popular research tool, but often causes missing values for some reasons. When the proportion of the missing value is high, it can seriously affect the conclusion. Imputation is an alternative is to handle missing data. For categorical missing data, both model-based and non- model based imputation methods have been proposed, for example, hot deck imputation and log-linear models. However, there are still some problems for these methods.
Latent class analysis (LCA) is a popularly used method for categorical variable. LCA identifies the optimal number of latent classes based on observed variables, and estimate class membership probability and conditional probabilities within each class.
Many studies have already used LCA for missing data imputation. We can partition the missing data as "vertical information", "horizontal information, and "overlapping information". Conventional approach to impute LCA is to use vertical information. We proposed some algorithms for imputation based on different partitions of the data, i.e., "vertical information", "horizontal information, or "overlapping information". We are

particularly interested in studying if there exists difference when using different partition of the data for imputation.
The imputation methods were evaluated in terms of accuracy rates. The result shows the significant factors are conditional probability, latent class proportions, number of manifest variables, imputation method, sample size, missing data mechanism.

Differential Item Functioning (DIF) Analysis under Missing-Data Imputation Framework (MI-DIF)
Parallel Session: Missing Data; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Gee Hune Kim*, Columbia University, USA

DIF is defined as differential group performance on test items, conditional on the latent examinees' ability variables (Angoff, 1993). Despite its well-established statistical properties and robust performance, the popular Mantel-Haenszel (MH) test has the issue of sparse-data asymptotics and decreased power for extreme difficulty items (Sinharay & Dorans, 2010). In addition, MH-test does not theoretically address non-uniform DIF, and the issue of possible non-ignorable missing data, e.g., missing data in speeded-test environment. Another approach, IRT model-based methods, can deal with both uniform and non-uniform DIF, by considering all item parameters simultaneously, albeit much greater computational demand to estimate additional item parameters and potential group ability difference.
Combining both approaches, this study proposes to incorporate missing-data imputation method for multi-step DIF detection method, MI-DIF. Assuming responses to potential DIF item(s) in focal group as missing, MI-DIF imputes the missing values utilizing all the other items in the test. Then, 2x4 contingency table is constructed by comparing the actual and imputed item responses: 2 groups being focal and reference group, and 4 categories being hit (both actual and imputed as correct), correct-rejection (both as incorrect), false-alarm (only imputed as correct), and miss (only imputed as incorrect). Finally, the null independence hypothesis of this 2x4 contingency table (i.e., non-DIF) is tested under multinomial distribution assumption. Simulation outcomes for type I error rate and power for MI-DIF will be presented, and practical implications for available software and actual testing data will be discussed.

Treatment of Missing Data in the Test Adopting both Basal and Ceiling Rules
Parallel Session: Missing Data; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Wei He*, Northwest Evaluation Association (NWEA), USA

In many cognitive or achievement assessments, items are commonly presented in a sequence of increasing difficulty. To avoid examinee frustration and minimize the cost and time of testing, not only a basal but also a ceiling rule is adopted, meaning that examinees may start the test at different items based on their ages, grades, or estimated level of developmental functioning and end the test at different items as well based on the termination rule. This practice produces stochastically censored data, a form of nonignorable missing data; and these missing responses tend to occur at both lower and higher ends of the test. The purpose of this study is to investigate how accurately examinees' abilities are recovered in a test adopting both basal and ceiling rules under the framework of Item Response Theory (IRT). Using simulation approach, this study will explore the effects of five factors that may potentially affect ability recovery accuracy: 1) treatment of missing responses caused by both basal and ceiling rules; 2) item densities, i.e., the average distances between difficulties of consecutive items across the scale; 3) basal rule, i.e., starting rule; 4) ceiling rule, i.e., termination rule; and 5) ability estimation method. Both descriptive and inferential statistical analysis will be used to address research questions.

An Estimation Method for Parameters of Two Multinomial Populations under the Stochastic Ordering with Sparse or Missing Data
Parallel Session: Computational Methods; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08
Lixin Meng*,Northeast Normal University, China
Jian Tao, Northeast Normal University, China
Xiang Bin Meng, Northeast Normal University, China

Categorical questionnaire data are often collected from sociological surveys and psychological tests. Multi-way contingency tables are very useful as a general tool for summarizing such data. In this paper, when some cells in a multi-way contingency table are sparse or missing, a parameter estimation method under stochastic ordering is proposed by amalgamating the sparse or missing cells with their neighboring cells. Compared with traditional EM algorithm, the new estimation method doesn’t depend on the choice of initial values of parameters and can guarantee the uniqueness of the maximum of likelihood function. In addition, a simulation study is conducted to show the performance of the new method, and an empirical example is used to illustrate its feasibility and applicability.

Social Network Models for Educational Interventions
Parallel Session: Multivariate Data Analysis IV; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08

Brian Junker*, Carnegie Mellon University, USA
Tracy Sweet, Carnegie Mellon University, USA

Intervention studies in school systems are sometimes aimed not at changing curriculum or classroom technique, but rather at changing the way that teachers, teaching coaches and administrators in schools work with one another--in short, changing the professional social networks of educators. In one such ongoing study, 80 schools in an urban school district are being randomized into treatment and comparison groups. While longitudinal versions (e.g. Hanneke, Fu & Xing, 2010; Snijders, Steglich & Schweinberger, 2005) of descriptive and generative models for a single social network (principally exponential random graph models, latent space models, and mixed membership block models; e.g. Goldenberg, Zheng, Fienberg & Airoldi, 2009) have been developed, current approaches are ill-suited to modeling multiple replications of a social network, or defining or detecting the effect of an intervention on the social network itself. In this talk I will outline an approach (Sweet, 2011) that accommodates both multiple social networks as well as intervention effects on social networks. This approach will be illustrated with real and simulated data.

Regularized K-means Clustering with Variable Weighting
Parallel Session: Multivariate Data Analysis IV; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Yutaka Nishida*, Osaka University, Japan

In this study, a new method of k-means clustering is proposed to calculate the weight for variables. The k-means algorithm is a one of the most popular clustering method, but there are some problems.
One of them is about variable weighting. Though the k-means algorithm equally treats all variables when the distance between cluster centers and data points is calculated, there is a case that a certain variable might be more important than other variables.
The proposed method achieves the purpose of calculating variable weights using an entropy regularization method (Miyamoto, Ichihashi & Honda, 2008) which is developed to obtain fuzzy memberships in fuzzy clustering. The proposed method allows us to identify the important variable for clustering. The usefulness of the proposed method is demonstrated with synthetic and real data.
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The Different Choice of Basis Functions in Functional Data Conversion
Parallel Session: Multivariate Data Analysis IV; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Minping Xiong*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

In psychological study, psychologists and behavioral scientists are increasingly collecting data that are drawn from continuous underlying processes, such as longitudinal data from ERP、fMRI and developmental psychology experiments, these studies produce millions of data points every few seconds, and the points are correlated both in space and in time. However, conventional statistical approaches cannot take advantage of the additional information implied by the smoothness of the underlying functions. The functional data analysis methods that we describe here can often extract additional information contained in the functions and their derivatives, not normally available through traditional methods. The first step of functional data analysis is to convert the raw data into functional objects. A common procedure representing discrete data as a smooth function is the use of a basis expansion. There are many different types of basis function systems, such as powers of t or monomials, Fourier series, B-spline functions, Bernstein functions and so on. The present study summarized the different basis functions and suggested that researchers should choose different basis functions on the basis of their research aims or data that they wanted to analyze.

Functional Analysis of Variance for Data from ERPs
Parallel Session: Multivariate Data Analysis IV; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Shuyi Liang*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Minping Xiong, South China Normal University, China

In many psychological researches, it's usually necessary to test whether there is any statistically significant difference between experiment and control groups to demonstrate the effect of the independent variables. ANOVA is one of the most common techniques. With the rapid development of psychology in China, psychologists and behavioral scientists are increasingly collecting data that are drawn from continuous underlying processes. Although these data are in the form of discrete points, they reflect continuous and underlying variability of the processes. Consequently, traditional ANOVA, which could only be used for discrete observations, isn't the best way to analyze such type of data, because it ignores their entirety and continuity. As a result, a new technique, functional analysis of variance, can be used to extend the capabilities of classical ANOVA. Functional analysis of variance is under the frame of functional data analysis, so its first step is to convert the raw data into continuous ones, such as in the form of curves or images. Then the estimated curves, instead of the original data, are used for the rest of the analysis. Evoked Response Potentials (ERPs) are collected by placing electrodes on the surface of the scalp and electrical activity is measured in response to various stimuli or tasks. The process generating the ERPs is continuous. Obviously, much more information can be got if we analyze them with functional analysis of variance. The aim of this article is to show how we handle ERPs data with functional analysis of variance appropriately.

Evaluating Order Constrained Hypotheses for Circular Data using Permutation Tests
Parallel Session: Multivariate Data Analysis IV; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08

Irene Klugkist*, Utrecht University, Netherlands
Jessie Bullens, Utrecht University, Netherlands
Albert Postma, Utrecht University, Netherlands

Psychological researchers in different fields sometimes encounter circular or directional data. Circular data are data measured in the form of angles or two-dimensional orientations. As an example, an experiment investigating the development of spatial memory and an experiment investigating the influence of visual experience on haptic orientation perception are presented. Three permutation tests are proposed for the evaluation of ordered hypotheses. The quality of the permutation tests is investigated by means of several simulation studies. The results of these studies show the expected increase in power when the permutation tests for ordered hypotheses are compared to a common non-directional test for circular data. The differences in power between the three tests for ordered alternatives are small.

The Development of Concerto : An Open Source Online Adaptive Testing Platform

Parallel Session: E-testing; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Michal S. Kosinski*, University of Cambridge, UK
John N. Rust, University of Cambridge, UK

Online and computer adaptive testing systems have long been the jewels in the crown among the IT resources of the large test publishers who compete with each other to acquire the necessary knowhow and staff. At the same time there has been a dearth of practical experience in this field among the academic community, which has seriously handicapped the development of new skills outside the big company firewalls. At the University of Cambridge Psychometric Centre we are developing Concerto, an open source adaptive IRT platform that utilises our combined experience in adaptive algorithms in R, and also in web-based and social network programming in PHP and HTML. We will present some results from the trialling of this system on our huge (>6,000,000 users) database of personality and IQ test data from the Facebook applications myPersonality and myIQ.

The Development of Computer-based Case Simulations for Psychological Counseling
Parallel Session: E-testing; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Peng Wang*,Jiangxi Normal University & Shandong Normal University, China
Haiqi Dai, Jiangxi Normal University, China

Computer-based Case Simulations (CCS) is the world-class medical clinical simulation system. Computer-based Case Simulations for Psychological Counseling (CCSPC) is developed in this study in order to measure the subjects' practical skills and decision-making styles during the psychological counseling progress, as well as the related knowledge of concepts, principles and methods, to get a whole assessment of the subjects' counseling skills.
A case with compulsive neurosis is chosen as the script for computer program. CCSPC is also developed on the basis of psychological counselors' competency model. The subjects interact with the case through four modules, i.e. the beginning of counseling, psychological testing, diagnoses and differential diagnoses, counseling plan and practice. Large size sample check proves the stability, security and accessibility of CCSPC. The percent of stability is 97.34%.
978 subjects take part in the exam of CCSPC. The data is analyzed by the methods of both Classical Test Theory (CTT) and Item Response Theory (IRT). The analyses by CTT show the distribution of difficulty is acceptable. The test information of CCSPC is considerably high. The results from CTT and Bifactor show that the structure of CCSPC data can prove the competency model to some extent. The two scoring methods (CTT & MIRT) both get

good evidence of predictive validity. Based on the results of this study and the past studies, IRT is more suitable for the data analysis of CCSPC.

Building Affordable CD-CAT Systems for Schools To Address Today's Challenges In Assessment

Parallel Session: E-testing; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10

Hua-Hua Chang*, University of Illinois at Urbana-Champaign, USA

Most current Computerized Adaptive Testing (CAT) systems are proprietary and can be operated and managed only by testing companies or commercial testing sites. Schools usually have no access to resources and activities such as system management and item bank maintenance. The rapid developments of hardware and network technology have made CAT applications really affordable to schools. In the presentation a CAT design based on the cutting-edge Browser/Server Architecture will be introduced. A new, feasible in-school CAT system should have a turnkey server application that can be installed easily on an existing laptop or desktop machine, and should provide test administration through a common, web-based, Internet browser application. The B/S architecture uses commonly available web-browsing software on the client side and a simple server that can be fitted onto a regular PC or laptop connected to the school's existing network of PCs and Macs. In the presentation we will show that CAT can be used effectively not only to estimate an examinee's latent trait, but also to classify the examinee's mastery levels of the skills the test is designed to measure. CAT is revolutionarily changing the way we address challenges in assessment and learning. CAT research has created many exciting transformative perspectives. For example, the CAT technology originally developed in education is being used innovatively in health-related quality-of-life (HQOL) measures. Finally, various issues in current CAT research will be addressed.

Developing an e-Assessment System for English and Putonghua Learning

Parallel Session: E-testing; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10

Kenneth Wong*, Caritas Institute of Higher Education, Hong Kong
Reggie Kwan, Caritas Institute of Higher Education, Hong Kong
Kat Leung, Caritas Institute of Higher Education, Hong Kong
Philip Tsang, Caritas Institute of Higher Education, Hong Kong

Language learning is always challenging for all students. This paper presents the design of a self-regulating and diagnostic online learning system in the areas of English and Putonghua focusing on the concept of "Assessment for Learning". The e-Assessment system aims to diversify students' learning experience and customize the approaches to learn languages

through self-directed, self-controlled, and to some extent, individually packaged "assessment" opportunities. The test theory behind the system is based on "Computerized Adaptive Testing" and "Item Response Theory" implying that the test items will be tailor-made for students. Students will receive questions in accordance with their ability levels in English and Putonghua. The item to be selected next fully depends on the student's performance on the previous question. If a student gets a correct answer to a given item, the next question generated will be slightly more difficult and/or subtly different from the current one. If the answer is wrong, a slightly easier item in terms of linguistic and conceptual structure will be selected next. By using the e-Assessment system, students can follow their own pace in learning English and Putonghua in a challenging and unique way. With the new online assessment system, it is hoped that undergraduate and sub-degree students' self-directed learning abilities and motivation in language acquisition will be significantly improved. This paper delineates the details of developing the prototype of such an e-Assessment system while a pilot study will be conducted to establish the validity and reliability of the system in the coming academic year.

Developing a Computerized Performance Assessment Tool for Sensory Integration
Parallel Session: E-testing; Wednesday, 20 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Chin-Kai Lin*, National Taichung University of Education, Taiwan
Huey-Min Wu, National Academy for Educational Research, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan

The purpose of this study is to develop a computerized performance assessment tool for bilateral integration and motor sequencing. The bilateral integration and motor sequencing (BIS), a motor skill, is one of important indicators of diagnosing the dysfunction of sensory integration in children. Based on the view of performance assessments, the pattern recognition is combined with the visual surveillance procedures to analyze the bilateral integration and motor sequencing (the coordination of two hands) and to diagnose the BIS dysfunction of subjects with a mean age of 5 years 2 months. The participants are selected from kindergartens in Taiwan, comprising 132 boys and 107 girls. The accuracy of the computerized performance assessment tool is evaluated by comparison with the judgments of an expert, an occupational therapist with more than 20 years of pediatric experience, as the criterion standard. The computerized performance assessment tool for bilateral integration and motor sequencing assesses children with poor outcomes with an accuracy of 0.85. The computerized performance assessment tool for bilateral integration and motor sequencing has potential for use in clinical settings to screen children with poor sensory integration.

Thursday, 21 July, 2011

Categorical Marginal Models
Invited Symposium : Thursday, 21 July, 11:10 a.m. – 12:30 a.m., D1-LP-03

Marginal Models for Dependent, Clustered, and Longitudinal Categorical Data.
Wicher P. Bergsma*, London School of Economics, UK
Marcel A. Croon, Tilburg University, The Netherlands
Jacques A. Hagenaars, Tilburg University, The Netherlands

In the social, behavioural, educational, economic, and biomedical sciences, data are often collected in ways that introduce dependencies in the observations to be compared. For example, the same respondents are interviewed at several occasions, several members of networks or groups are interviewed within the same survey, or, within families, both children and parents are investigated. Statistical methods that take the dependencies in the data into account must then be used, e.g., when observations at time one and time two are compared in longitudinal studies. At present, researchers almost automatically turn to multi-level models or to GEE estimation to deal with these dependencies. Despite the enormous potential and applicability of these recent developments, they require restrictive assumptions on the nature of the dependencies in the data. The marginal models of this talk provide another way of dealing with these dependencies, without the need for such assumptions, and can be used to answer research questions directly at the intended marginal level. The maximum likelihood method, with its attractive statistical properties, is used for fitting the models. This talk is based on a recent book by the authors in the Springer series Statistics for the Social Sciences, see www.cmm.st.

Estimating Categorical Marginal Models for Large Sparse Contingency Tables
L. Andries van der Ark*, Tilburg University, The Netherlands
Wicher P. Bergsma, London School of Economics, UK
Marcel A. Croon, Tilburg University, The Netherlands

Categorical marginal models (CMMs) are flexible tools to model location, spread, and association in categorical data that have some dependence structure. The categorical data are collected in a contingency table; location, spread, or association is modeled by restricting certain marginals of the contingency table. If contingency tables are large, maximum likelihood estimation of the CMMs is no longer feasible due to computer memory problems. We propose maximum empirical likelihood estimation (MEL) procedure for estimating CMMs for large contingency tables, and discuss three related problems: The

problem of finding the correct design matrices and the so-called empty set problem can be solved satisfactorily; the problem of obtaining good starting values remains unsolved. A simulation study shows that for small data contingency tables ML and MEL yield comparable estimates. For large tables, when ML does not work, MEL has a good sensitivity and specificity if good starting values are available.

Testing Cronbach's Alpha Using Feldt's Approach and a New Marginal Modeling Approach

Renske E. Kuijpers*, Tilburg University, The Netherlands
L. Andries van der Ark , Tilburg University, The Netherlands
Marcel A. Croon, Tilburg University, The Netherlands

Feldt developed an approach for testing three relevant hypotheses involving Cronbach's alpha: (1) Alpha equals a particular criterion; (2) two alpha coefficients computed on two independent samples are equal; and (3) two alpha coefficients computed on the same sample are equal. The assumptions of Feldt's approach are unrealistic for many test and questionnaire data, and little is known about the robustness of the approach against violations of the assumptions. We propose a new approach to testing the three hypotheses. The new approach uses marginal modeling and is based on weaker assumptions. The Type I error rate and the power of both approaches were compared in a simulation study using realistic conditions. In general, the two approaches showed similar results showing that Feldt's approach is robust against violations of the assumptions. In some cases, however, the marginal modeling approach was more accurate: For computing Type I error rates for very high values of alpha, for computing Type I error rates for hypothesis (3), and for computing the power of hypothesis (3) using a small sample size.

Marginal Models for Longitudinal Categorical Data from a Complex Rotating Design

Marcel A. Croon*, Tilburg University, The Netherlands
Wicher P. Bergsma, London School of Economics, UK
Jacques A. Hagenaars, Tilburg University, The Netherlands
Francesca Bassi, University of Padova, Italy

In their book Marginal *Models for Dependent, Clustered, and Longitudinal Categorical Data* (2009), Bergsma, Croon & Hagenaars discuss several applications of marginal models for categorical data observed in longitudinal studies. They distinguish between the analysis of trend data, when different random samples from the same population are drawn at different time points, and panel data, when the same random sample from a population is

observed at different time points. For both types of data, they discuss how various hypotheses about gross and net changes over time can be tested by marginal modeling. These methods can be extended to the case the data are collected in a more complex way, for instance, by means of a rotating design in which different random cross-sectional samples are followed over time at different measurement occasions. The data which will be analyzed come from the Italian Continuous Quarterly Labour Force Survey, which is cross-sectional with a 2-2-2 rotating design. The questionnaire yields multiple indicators of labour force participation for each quarter: (i) each respondent is classified as employed, unemployed or out of the labour market according to the definition of the International Labour Office on the bases of answers given to a group of questions (ii) each respondent is asked to classify himself as employed, unemployed or out of the labour market, the so-called self-perceived condition; and (iii) a retrospective question asks about condition in the labour market one year before the interview.
In the analysis of the data from this survey, the emphasis is on the study how changes in labour status are reflected by each of the three indicators, and how differences and similarities among them change over time.

Cognitive Diagnostic Computerized Adaptive Testing: Key Issues on Item Selection Algorithm
Symposium : Thursday, 21 July, 11:10 a.m. -- 12:30 a.m., D1-LP-04

A Comparative Study of Item Exposure Control Methods in Cognitive Diagnostic Computerized Adaptive Testing
Ping Chen*, Beijing Normal University, China
Tao Xin, Beijing Normal University

Like regular Computerized Adaptive Testing (CAT), the questions of item overexposure, item underexposure and unevenness of item exposure in high-stakes Cognitive Diagnostic CAT (CD-CAT) not only will affect the test security, but also will lead to a waste of costs used in item maintenance and development. And discussions of item exposure control in CD-CAT have been largely absent from the current literature. In addition, according to a preliminary study which compared different CD-CAT item selection strategies, the Shannon Entropy (SHE) method always produced the highest pattern classification correct rate and was inclined to select the items which have small sum values of the guessing and slipping parameters. Thus, this study proposed three item exposure control schemes and incorporate them into the SHE method under the DINA model: (1) stratify the item bank according to the sum value of the guessing and slipping parameters in descending order (denoted as SHE(Stra)) as the a-stratified method of Chang and Ying (1999); (2) modified Maximum

Priority Index (Cheng, 2008) method (denoted as SHE(MMPI)) and (3) the method combined SHE(Stra) with SHE(MMPI) (denoted as SHE(Stra_MMPI)). Simulation results showed that the three exposure control methods were able to improve the uniformity of item pool usage and decrease the test overlap rate. Specially, the SHE(MMPI) and SHE(Stra_MMPI) methods could largely reduce the maximum item exposure rate and increase the minimum item exposure rate. However, all these methods improved the quality of item bank usage at the expense of slightly decreasing the estimation accuracy of the knowledge states.

Generalized Monte Carlo Approach in Cognitive Diagnostic Computerized Adaptive Testing with Content Constraints

Xiuzhen Mao*, Beijing Normal University, China
Tao Xin, Beijing Normal University

Cognitive diagnostic computerized adaptive testing (CD-CAT) which combines the advantages of both cognitive diagnosis and adaptive testing can provides detailed information about the advantages and disadvantages of the examinees' knowledge states just through testing a few items.Test validity is an essential consideration in CD-CAT, because it is one of the most important factors which affect measurement accuracy. Unlike traditional paper and pencil test, items for CD-CAT are not assigned before the test starts. Therefore, it is worthwhile to probe the item selection method for CD-CAT with content constraints in order to improve the test validity.
With content constraints, the Monte Carlo approach in traditional computerized adaptive testing (CAT) is generalized to the cognitive diagnostic CAT. When the number of items measuring each attribute is the only content constraints, this study compares the generalized Monte Carlo (GMC) method with the modified maximum global discrimination index (MMGDI) method. Results of the simulation experiments show that: (a) the GMC method can not only fulfill the requirements of test content, but also produces satisfying results of measurement accuracy and item exposure; (b) the GMC method outperforms the MMGDI method when the former one uses posterior-weighted Kullback-Leibler algorithm or hybrid Kullback-Leibler information as item selection index. In other words, the recovery rates of knowledge state, the distribution of item exposure and utilization rates of the item bank all get much better.

Research on item-selection strategy of computerized adaptive cognitive diagnostic testing

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Shuliang Ding, Jiangxi Normal University, China

Gan Dengwen, Jiangxi Normal University, China

How to choose items to be administered is an important component in computerized adaptive testing with cognitive diagnosis (CD-CAT).Meanwhile, a cognitive diagnostic test blueprint will not bring mismatch of examinees' knowledge states when the reachability matrix (RM) is included in a blueprint in the case of expected response patterns being considered. On the basis of Shannon's Entropy item-selection strategy, in this paper four different test blueprints are adopted to examine effect on diagnostic accuracy in the process of applying RM. The results of Monte Carlo simulation show that choosing all the corresponding items of RM plays an important role to improve the diagnostic accuracy in CD-CAT, and it is also important reference to formulate item-selection strategy in CD-CAT. In the process of CD-CAT choosing more corresponding items of RM can obviously increase the pattern match rate (PMR), items quality has little effect on the results, and when item pool does not contain or have less items of RM, item quality has great influence on PMR. Using RM is benefit to construct test and item-selection strategy for cognitive diagnosis purpose.

The improved Maximum Priority Index method and its application in Cognitive Diagnostic Computerized Adaptive Testing

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Shuliang Ding, Jiangxi Normal University, China

Maximum Priority Index method，advanced by Cheng Ying , sometimes violates constraints and tends to choose those items with less constraints because the index of the gap from attaining the lower (upper) bound is not great than one. To overcome the above disadvantages, the improved Maximum Priority Index method (improved MPI) is proposed in this study. Considering of combining balancing attribute coverage with the similarity of any two attribute patterns, the improved MPI turns to another item selection method, namely, MGCDI, for cognitive diagnostic computerized adaptive testing (CD-CAT). MGCDI benefits an item in two aspects: the recovering of attributes and well performance in similar attribute patterns. Results of Monte Carlo simulation indicate that the improved MPI not only controls constraints successfully but also makes estimates of examinees' abilities more precise. Compared with MMGDI and CDI, MGCDI performs as well as MMGDI in balancing attribute coverage and CDI in discriminating similar attribute patterns, furthermore, MGCDI is of higher pattern match ratio and marginal match rate.

The Review of Two Methods of Questionnaire and Dimension——Traditional Methods and Facet Theory

Parallel Session: Measurement Issues; Thursday , 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Li Zhang*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

Compared to the traditional method of questionnaire, mapping sentence can provide a holistic framework for questionnaire. At the same time, it can promote exchange and communication between researchers, and is beneficial for the comparison between researches. It also provides the basis for the division of the dimension, which can unify the questionnaire and dimension. We can see that smallest space analysis is more stable and reliable in small sample size by simulation. Compared with factor analysis, smallest space analysis owns other advantages, for example, less requirements of data, no require of a linear assumption, easy understood results etc.

Does Increasing Number of Points in Likert Scale Better Approaches Normality?
Parallel Session: Measurement Issues; Thursday , 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Huiping Wu*, Central China Normal University, China
Shing On Leung, University of Macau, Macau

Likert Scale is widely used in many psychological and educational studies. It is commonly constructed with 4 to 7 points though the uses of 11 points provide a natural scale ranged from 0 to 10. We simulate data from standard normal distribution, and cut the distribution into 4 to 11 categories, corresponding to number of points in Likert Scale. For each simulated distribution, three scoring systems are used: (a) the Raw scores x which are neutral numbers starting 1, 2, … etc; (b) the Categorical score which is defined as the mid-point of the categories from the underlying distribution; and (c) the Snell scores which use the Snell transformation trying to approximate a normal distribution as much as possible. Tests of normality are conducted via SW test statistics, skewness and kurtosis. The whole process is repeated with skewed Gamma distribution replacing symmetric normal. Results show that as number of point increases, scales better approach to normal. When the underlying is normal, all three scores are linearly correlated so that it is indifferent in using any of them in scaling. However, when the underlying is skewed Gamma, the Raw and Snell scores correlate linearly with each other but neither of them is linearly correlated with the Categorical scores. Results may imply that ordinal scale data can be approximated by interval scale data only if the underlying distribution is normal.

Exploring Added Value Subscores with Item Topic Modeling

Parallel Session: Measurement Issues; Thursday , 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Makoto Sano*, Prometric Japan Co., Ltd., Japan

There is an increasing interest in reporting subscores. Sinharay (2010) provided a collection of results regarding when subscores had added value over total scores for several educational testing data sets with applying PRMSE (Haberman, 2008). If initial subscores of a particular exam do not have added value and suggested new subscores have, it might be worth revising groups of items and reporting the new subscores. Applying MIRT to exploring possible item groups and evaluate new subscores with PRMSE is one of the possible paradigms as Sinharay (2010) suggested. But Sano (2009) illustrated a limitation just using item response data for quantifying item content similarity. Also some previous studies detecting item cluster (possible subscore groups) with item response data and/or item similarity deterministic rating data (e.g. Sireci and Geisinger, 1992) have limitations especially for non-cognitively-based licensing/certification exams in terms of cost-effective rating data aggregation. This study introduces an R add-in package called "RMeCab" (Ishida, 2008) with Japanese morphological analyzer (tokenizer) of "MeCab" (Kudo, 2005) for quantifying item content similarity from item text data. And a topic modeling technique with Latent Dirichlet Allocation (Blei et al., 2003) on the items * tokens matrix are applied to explore possible item groups expected to have added value subscores. The real data study shows a possible topic modeling application to explore added value subscores.

A Random Sampling Inspection Model for Performance Measurement: An Alternative to IRT

Parallel Session: Measurement Issues; Thursday , 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-06

Zhong'en Xi*, Chongqing University of Post and Telecommunications, China

As a derivative of the two laws of measurement, item hardness is redefined as the inverse of the average degree of correctness of response to the item in question by all the members of the standard test-taker group. This hardness is measured in the unit of the average performance of the standard test-taker group. On the basis of this, definitions of item performance are given for both the group and the individual. Equating the group average performance as a random-chosen individual's performance, I have proved that the model thus designed met the criteria of specific objectivity, namely, performance independent of the hardness of items, and item hardness independent of the test-taker population. The associated model for the evaluation of the uncertainty of performance is also given. Besides, one set of real test data is used to illustrate the measurement model; another set is used to

illustrate the uncertainty model. It is suggested that this model can replace IRT models for computerized adaptive performance testing.

Traps of the Bootstrap
Parallel Session: Rasch Models – Methodology; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Rainer Alexandrowicz*, Alps-Adria-University Klagenfurt, Austria
Clemens Draxler, Ludwig-Maximilians-University Munich, Germany

The Andersen (1973) Likelihood Ratio Test (LRT) allows for the assessment of the equal item discrimination assumption or Differential Item Functioning in the Rasch Model (RM). However, if samples are small or items are few, the approximation to the theoretical chi-square distribution is questionable. The present contribution presents a clear guideline when the theoretic approximation can be considered sufficient. In cases, in which this requirement is not fulfilled, the bootstrap may be applied instead. Three pertinent methods of generating the bootstrap samples are analyzed with respect to their aptness of providing the adequate distribution of the test statistic. We show that there are severe pitfalls when it is applied in the LRT/RM-context, causing highly misleading or even artificial results. Only a sequential probability sampling scheme allows for correct results under both the null and a fixed alternative hypothesis.

Reducing Item Difficulty Estimation Bias in the Rasch Model Caused by Guessing: A Weighted Conditional Likelihood Approach
Parallel Session: Rasch Models – Methodology; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Christof Schuster*, Univeristy of Giessen, Germany
Ke-Hai Yuan, University of Notre Dame, USA

According to the random sampling interpretation of the item characteristic curve in item response theory, the Rasch model's item characteristic curve gives the proportion of individuals knowing the correct answer to an item as a function of ability. According to the model, this proportion tends to zero as ability decreases. If individuals can answer items correctly by random guessing, the model's item characteristic curve will miss-specify the proportion of low-ability individuals solving the items correctly. As a consequence, item difficulty parameter estimates will be biased. A weighted likelihood approach is developed in which the responses of individuals whose person-fit statistics indicate low fit will be down-weighted, thereby reducing the influence of these individuals on the item difficulty estimation. Because person-fit statistics based on a miss-specified model are expected to be

biased also, the procedure iterates between weighted likelihood estimation of the item difficulties and the estimation of person-fit until convergence. Simulation studies show that this approach leads to reduced bias and mean squared error of the item difficulty estimates.

Applying the Rasch Sampler to Identify Aberrant Responding by Person Fit Statistics under Fixed α-level
Parallel Session: Rasch Models – Methodology; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Christian Spoden*, University of Duisburg-Essen, Germany
Jens Fleischer, University of Duisburg-Essen, Germany
Detlev Leutner, University of Duisburg-Essen, Germany

Normalization formulas often fail to approximate the distribution of person fit statistics in item response theory correctly when estimated instead of true parameters are used (Emons, Meijer & Sijtsma, 2002; Nering, 1995; van Krimpen-Stoop & Meijer, 1999). As a consequence, the variance of the statistic is inaccurately estimated and type I error rates for these statistics are either in- or deflated. Parametric monte carlo simulations of the statistics' distribution sample the latent ability from a normal distribution and are only appropriate when the item sample is sufficiently large (Rizopoulos, 2010). For the dichotomous Rasch model, the Rasch Sampler (Verhelst, 2008) generates new data matrices with the same marginals as the original data and thereby offers another opportunity to simulate the distribution of person fit statistics for any response vector in the original data matrix. Two simulation studies are conducted to evaluate type I error and power of prominent person fit statistics; P-values are obtained by the simulation of equally likely data matrices in the Rasch Sampler for small item samples (10, 20 and 30 items). These rates are compared to traditional approximations of the p-values by normalization formulas and a conventional parametric monte carlo procedure. First results indicate that the empirical type I error rates match the expected error rates adequately with the new approach while noticeable differences were found for the normalization formulas and the conventional monte carlo approach. Detection rates for the new approach are about as high as for the normalization formulas.

Optimizing distribution of Rating Scale Category in Rasch Model
Parallel Session: Rasch Models – Methodology; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Han-Dau Yau*, National Taiwan Sport University, Taiwan
Wei-Che Yao, National Taiwan Sport University, Taiwan

In tradition, testing of sports skills used to set categories by subjective method. Yau (2010) developed a new objective method of category setting, but did not point out what kind of distribution theory was used accurately. The purpose of the study was to optimize distribution of rating scale category in Rasch model. The studied objects are normal distribution, logistic distribution, binomial distribution, and uniform distribution. The method was to use SAS and Minitab to produce random data, and then use Winsteps to estimate data categories. Experiment design was two-way design(sample size × test length),and we simulated them five times for each cell. The results were: 1. Normal distribution was the ideal distribution when sample size was over 3000 in response data. 2. Logistic distribution was the better distribution when sample size was less than 1500 in response data. The conclusion of the study was that optimizing distribution of rating scale category in Rasch model was related to sample size.

Monitoring Compromised Items on Live Exams
Parallel Session: Rasch Models – Methodology; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-07
Shu-Chuan Kao*, Pearson, USA
John Stahl, Pearson, USA

The purpose of this study is to propose criteria for applying item drift indices to detect compromised items in live pools on computer adaptive tests (CATs). By assessing the violation of parameter invariance, a better way to monitor the quality of live CAT pools is possible.
A simulation study is proposed to evaluate the statistical power of parameter drift indices on identifying live items that become significantly easier than their pretest calibrations and to suggest the cut-off points for flagging compromised, live items. Item parameters are selected to mirror current CAT pools using the Rasch model. The results in which 0% of examinees having preknowledge of items will serve as the baseline for comparison. The research design varies sample size, item difficulty, percentage of examinees having preknowledge of exam items, and the pattern of compromised items (linear vs. non-linear). Along with examining the effect of research factors, residual analysis will be conducted to provide supplemental information. Decision accuracy for different levels of cut-off points of the parameter drift indices will also be provided.
If compromised items can be identified and suspended in time, test security can be better guarded and test validity better assured. The results of the proposed study can be used to evaluate the statistical sensitivity of the parameter drift indices under different testing scenarios to help determine the minimum sample size required for reliable results and to recommend general criteria for flagging compromised items.

Dynamic Generalized Structured Component Analysis: A Structural Equation Model for Analyzing Effective Connectivity in Functional Neuroimaging
Parallel Session: Structural Equation Modeling - Methodology I; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Kwanghee Jung*, McGill University, Canada
Yoshio Takane, McGill University, Canada
Heungsun Hwang, McGill University, Canada

Modeling effective connectivity in functional neuroimaging refers to an approach whereby a number of specific neural regions are selected for analysis, based on a hypothesis about their importance in certain cognitive tasks. This method allows stronger inferences related to questions about causal connectivity (e.g., region A exerts influence on region B). Structural equation modeling (SEM) for analyzing effective connectivity in functional neuroimaging focuses on the representations of intra-individual dynamics of state space (e.g., ROIs or regions of interest). The current SEMs (e.g., the extended unified SEM of Gates et al in press) for multivariate time series data, due perhaps to computational difficulties, amount to path analytic models without measurement models. In this paper, we propose a component-based SEM, named Dynamic GSCA (Generalized Structured Component Analysis) that overcomes this limitation in analyzing effective connectivity. To illustrate the use of the proposed method, results of empirical studies based on simulated and real data are reported.

A Copula Approach to Dyadic Data: Negative Affect in Couples
Parallel Session: Structural Equation Modeling - Methodology I; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Johan Braeken*, Tilburg University, Netherlands
Emilio Ferrer, University of California Davis, USA

A dyad is an observational unit consisting of two interacting entities; A typical example given is a male-female couple. Conventional statistical methods consider the observational unit to be a single entity and for statistical inference they rely on the assumption of independent observations.
The latter assumption clearly does not hold for dyadic data, as members within a dyad structurally depend on eachother. The main challenge in statistical models is then to properly account for this dyadic dependence.

We will incorporate copula functions into traditional structural equation models (SEM) with exactly this purpose. The approach has the advantage of broadening the model specification on two levels:
1. A larger range of parametric models can be used for the sub model of each dyad member;
2. A larger range of parametric dependence structures can be used (e.g., lower-tail dependence instead of mere linear gaussian dependence).
This should benefit the formulation of more realistic dyadic equation models and improve model fit. Furthermore, it allows the statistical testing of the default multivariate normal setup in SEM for dyadic data:
1. Simulations for statistical sensitivity studies on model specification can be set up;
2. The empirical robustness of conclusions in substantive research studies can be assessed.
The proposed copula approach will be illustrated with an application towards characterizing the interplay of negative affect within couples.

Replacing Moderated Multiple Regression with Multiple-Group Path Analysis under Invariance Constraints in Predictive Studies
Parallel Session: Structural Equation Modeling - Methodology I; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Roger Millsap*, Arizona State University, USA
Margarita Olivares-Aguilar, Arizona State University, USA

In multiple-group studies of predictive invariance for a test in the prediction of some criterion measure, a common method of analysis is moderated multiple regression (MMR). An assumption in such analyses is that the residual variance in the regression is homogeneous across groups. Violations of that assumption can adversely affect the outcome of tests of significance in the MMR. An alternative method of analysis in such data is multiple-group path analysis, with tests of invariance constraints being used to evaluate the relevant hypotheses. In such tests, there has traditionally been no assumption of homogeneity of residual variance. Is such an assumption necessary in the path analytic approach? We conducted simulations to examine the Type I error rates under both MMR and the path analytic approach when homogeneity of residual variance was violated. Overall, the path analytic approach has better Type I error performance when sample sizes are unequal, and comparable performance under the equal sample size case.

SEM and Regression Estimation in the Absolute Simplex (Bentler-Guttman Scale)
Parallel Session: Structural Equation Modeling - Methodology I; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Peter Bentler*, University of California at Los Angeles, USA

This paper summarizes some technical details for an absolute simplex theory (AST) that has been 40 years in the making. An absolute simplex is a parameterized Guttman scale in which an N p data matrix can be generated completely from p item parameters. Bentler (1971) introduced AST, developed a parameterization related to coefficients of variation, developed pre-SEM estimators, showed how to extend the model with additional parameters to handle model violations, and provided person parameters that permit distribution-free determination of the associated cumulative distribution function. Bentler (2009, SMEP) showed how the model and its extensions can be tested with modern structural equation modeling (SEM) methods and proposed a methodology for recovering an associated interval scale when this is justified. He also provided a new mean and moment matrix based parameterization for AST and showed how the parameters could be estimated and the model tested with SEM. Bentler (2011, WPA) developed a new item-weighting parameterization, showed that a weighted linear combination of item responses characterize the person distribution function, and showed how SEM and regression can be used to estimate the parameters, recover an interval scale, provide meaningful indices of model adequacy, and select items.

Functional Extended Redundancy Analysis
Parallel Session: Structural Equation Modeling - Methodology I; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D1-LP-08
Heungsun Hwang*, McGill University, Canada
Hye Won Suk, McGill University, Canada
Jang-Han Lee, Chung-Ang University, South Korea
Debbie S. Moskowitz, McGill University, Canada

We propose a functional version of extended redundancy analysis that examines directional relationships among several sets of multivariate variables. As in extended redundancy analysis, the proposed method posits that a weighed composite of each set of exogenous variables influences a set of endogenous variables. It further considers endogenous and/or exogenous variables functional, varying over time, space, or other continua. This method accommodates three different models, accounting for which set of variables is functional. Computationally, the method reduces to solving a penalized least squares problem through the adoption of a basis expansion approach to approximating functions. We illustrate the empirical usefulness of the proposed method by fitting the proposed models to real data.

On the Likelihood Ratio Test for Bivariate ACE Models

Parallel Session: Generalized Linear and Nonlinear Mixed Effects Models; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08

Hao Wu*, Virginia Commonwealth University, USA
Michael, C. Neale, Virginia Commonwealth University, USA

The ACE and ADE models are variance component models heavily exploited in twin studies. However, the validity of the likelihood ratio test (LRT) of the existence of a variance component, a key step in the use of such models, has been doubted because the true value of the parameters lie on the boundary of the parameter space of the alternative model for such tests, violating a regularity condition required for a LRT. Our current work as
presented in this paper resolves the issue of LRTs in bivariate ACDE models by exploiting the theoretical frameworks of inequality constrained LRTs based on conic approximations. Our derivation shows that the asymptotic sampling distribution of the test statistic for testing a single component in the ACE or ADE model is a mixture of chi square distributions of degrees of freedom (dfs) ranging from 0 to 3, and that for testing both the A and C (or D) components is one of dfs ranging from 0 to 6. These correct distributions are stochastically smaller than the chi square distributions in traditional LRTs and therefore LRTs based on these distributions are more powerful than those used naively. Methods for calculating the weights are proposed and the derived sampling distribution is confirmed by simulation studies. These results can be easily generalized to testing bivariate variance components in general random coefficient models as well as other testing problems with similar boundary constraints.

Measuring Implicit Learning with Random Effects: An Application of The Linear Ballistic Accumulator Model

Parallel Session: Generalized Linear and Nonlinear Mixed Effects Models; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08

Ingmar Visser*, University of Amsterdam, Netherlands
Thomas Marshall, University of Amsterdam, Netherlands

Implicit learning is a basic learning process underlying many forms of skilled behavior such as causal inference and learning language. Typical measures of implicit learning are response time difference scores, which are notoriously unreliable. In the current research we propose to use a particular diffusion model, the linear ballistic accumulator (LBA; Brown & Heathcote, 2008). The goal is to characterize implicit learning and at the same time characterize individual differences and relate them to other person characteristics. The LBA can be viewed as a random effects model with random effects at the trial levels, which can

be further related to person and item characteristics. The LBA very well captures implicit learning data.

On the Statistical Meaning of the Identified Parameters in a Semiparametric Rasch Model
Parallel Session: Generalized Linear and Nonlinear Mixed Effects Models; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Ernesto San Martin*, Pontificia Universidad Catolica de Chile, Chile

Recently, San Martin, Jara, Rolin & Mouchart (2011) have shown that, in a Rasch model, the distribution generating the individual abilities, G, is not identified by the observations, although a functional of those distribution as well as the item parameters are identified. How can these identified parameters be statistically interpreted? In this talk, we show an explicit interpretation of them. It is thus shown that the item parameters does not correspond to the odd ratios of an item with respect to a standard item. Regarding the identified functionals of G, it is shown that they correspond to ratios of marginal probabilities of specific pattern responses. By so doing, it is not only possible to propose simple estimators of those parameters, but also to understand why a semi-parametric version of the Rasch model is unfeasible.

Combining Generalizability Theory and Item Response Theory using the GLLAMM Framework
Parallel Session: Generalized Linear and Nonlinear Mixed Effects Models; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Jinnie Choi*, University of California at Berkeley, USA
Mark Wilson, University of California at Berkeley, USA
Sophia Rabe-Hesketh, University of California at Berkeley, USA

Briggs & Wilson (2007) combined generalizability theory (GT) and item response theory (IRT) for dichotomous responses with a simple pxi design using the Markov chain Monte Carlo (MCMC, Karim and Zeger, 1992) method with the Gibbs sampler. The procedure involved construction of an expected item response matrix requiring multiple sets of assumptions for the true parameters. A multidimensional extension (Choi et al., 2009) to a between-item multidimensional model with a multivariate $p^{\bullet}xi^{\circ}$ design produced a downward bias in the estimated variance components for item side and residual error. This study applies a generalized linear latent and mixed model (GLLAMM; Skrondal & Rabe-Hesketh, 2004) approach in which flexible one-stage modeling for a combination of crossed random-effects IRT models and GT variance components models is

straight-forward to formulate and easily expandable to more complex measurement situations. The model specifies a latent threshold parameter as a function of cross-classified person and item random-effects and the variance components for each facet. The random person and item parameters are estimated using Laplace approximation implemented in the xtmelogit command in Stata and the lmer function in R. The method is applied to classroom assessment data from the 2008-2009 Carbon Cycle project which includes 1,958 students' responses to 19 items, and to a large-scale educational assessment data, the PISA 2009 Science dataset, which includes 3,617 students from the United States who responded to 53 science it

The Multilevel Generalized Graded Unfolding Model
Parallel Session: Generalized Linear and Nonlinear Mixed Effects Models; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-08
Chen-Wei Liu*, The Hong Kong Institute of Education, Hong Kong
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

The generalized graded unfolding model (GGUM; Roberts, Donoghue, & Laughlin, 2000) has been applied to attitude data to unfold persons' and items' locations. It assumes that all persons are sampled randomly from the same distribution (i.e., simple random sampling). In practice, sampled data may have a multilevel structure, for example, repeated measures nested within a person, persons nested within a family, or students nested within a school. It is likely that data sampled from the same cluster (e.g., students from the same school) are more homogenous than data sampled from different clusters (e.g., students from different schools). To account for such a multilevel structure, we developed the multilevel generalized graded unfolding model (MGGUM). We proposed to use Markov chain Monte Carlo Bayesian methods that were implemented in WinBUGS (Lunn, 2000) for parameter estimation of the MGGUM. A series of simulations were conducted. The results showed that the parameters can be recovered fairly well; and statistics of model comparison could correctly select the MGGUM over the GGUM. An empirical example of political attitude was given.

Never Say "Not:" Impact of Negative Wording in Probability Phrases on Imprecise Probability Judgments
Parallel Session: Test Development and Validation; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09
Michael Smithson*, The Australian National University, Australia
David Budescu, Fordham University, USA
Stephen Broomell, Pennsylvania State University, USA

Han-Hui Por, Fordham University, USA

A reanalysis of Budescu et al.'s (2009) data on numerical interpretations of the Intergovernmental Panel on Climate Change (IPCC 2007) fourth report's verbal probability expressions (PE's) revealed that negative wording has deleterious effects on lay judgments. Budescu et al. asked participants to interpret PE's in IPCC report sentences, by asking them to provide lower, "best" and upper estimates of the probabilities that they thought the authors intended. There were four experimental conditions, determining whether participants were given any numerical guidelines for translating the PE's into numbers. The first analysis presented here focuses on six sentences in Budescu et al. that used the PE "very likely" or "very unlikely". A mixed beta regression (Verkuilen & Smithson, in press) modeling the three numerical estimates simultaneously revealed a less regressive mean and less dispersion for positive than for negative wording in all three estimates. Negative wording therefore resulted in more regressive estimates and less consensus regardless of experimental condition. The second analysis focuses on two statements that were positive-negative duals. Appropriate pairs of responses were assessed for conjugacy and additivity. A mixed beta regression model of these three variables revealed that the lower P(A) and upper P(Ac) pairs adhered most closely to conjugacy. Also, the greatest dispersion occurred for lower P(A) + upper P(Ac), followed by upper P(A) + lower P(Ac). These results were driven by the dispersion in the estimates for the negatively-worded statement. This paper also describes the effects of the experimental conditions on conjugacy and dispersion.

Is Test Taker Perception Of Assessment Related to Construct Validity?
Parallel Session: Test Development and Validation; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09

Qin Xie*, The Hong Kong Institute of Education, Hong Kong

This study examined test takers' perception of assessment demand and its impact on the measurement of intended constructs. Over 800 test takers took a pre- and a post-test of College English Test Band 4 and filled in a perception questionnaire to report the skills they perceive as necessary for answering the test. The study found test takers perceived language skills and test-taking skills as equally necessary. Perception of reading skills negatively affected performance on the reading test, while perceptions of test-taking skills positively affected performance on the reading test. Test takers' perception of assessment seemed to affect the measurement of the intended construct, though the effects are small and limited. The study also found instrumentally oriented test takers and test takers with higher starting

English ability perceived the test as more demanding, such perception, in turn, contributed to better test performance.

The Effects of Individual Characteristics, Family Backgrounds, and School Region Factors on Students' Bullying: A Multilevel Analysis of Public Middle Schools in China

Parallel Session: Test Development and Validation; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09

Li-Jun Wang*, Zhejiang Normal University, China
Hai-Gen Gu, Shanghai Normal University, China
Xian-Liang Zheng, Gannan Normal University, China
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

This study investigated the effects of individual characteristics (gender, performance, critical thinking and rates of absenteeism), communicating effectively, solving the conflict, school experiences (positive and frustrating), and school region factors (rural, county, city and province-wide information) on adolescents' verbal, physical, psychological bullying behaviors and bullying behaviors through Internet. A random sample of 7194 7th–12th grade students from 36 public middle schools in Shanghai, Zhejiang and Jiangxi Province, China was selected for this study. A self-report questionnaire survey was administered. The results showed that during the previous semester, 8.3% of the students had ever bullied other students physically while 17% had verbally bullied others, 10.5% of the students had ever bullied other students psychological while 11.4% had bullying behaviors through Internet, 10.6% of the students had ever been bullied by other students physically while 31.4% had verbally been bullied, 22.8% of the students had ever been bullied by other students psychological while 12.8% had been bullied through Internet. Hierarchical linear modeling was employed to conduct a two-level analysis. Individual characteristics including Grade level, gender, rates of absenteeism, peer conflict resolution, positive school experiences were found to significantly contribute to bullying. Family background characteristics, including father's educational level and child rearing patterns, were also associated with bullying. School region, different provinces, different regions of China significantly were found to significantly contribute to bullying behaviors. Weak economies in the region were positively associated with bullying. Implications were discussed.

Factor Structure and Psychometric Properties of Two Shortened Scales for Measuring Competency for Universities Students in the 21st Century

Parallel Session: Test Development and Validation; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09

Nicole Ruihui Xu*, University of Macau, Macau
Shing On Leung, University of Macau, Macau
Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

A scale was established to measure competency for universities students in the 21st Century. It has 6 domains (Basic, creativity, communication, moral & civic, international perspective and self directed learning), 40 items with each having 3 aspects (importance, self-rated and universities provision). Factor structure for each domain clearly identifies 3 aspects; and for each aspect clearly identifies 6 domains. Each scale is shortened by factor analysis where items are chosen according to absolute magnitude of factor loadings; and also by using the BI-method (Bhargava and Ishizuka 1981). The first four moments (mean, SD, skewness and kurtosis), reliabilities, factor structures and other basic psychometric properties are compared among two shortened scales and the original. Correlations among two shortened scales and the original are also compared. Implications of these findings are discussed. Technically, there are 120 items (40 items for 6 domains x 3 aspects). Factor analysis of all of them is messy and hence prohibits shortening the overall scale, but the BI-method does not have this limitation.

The Psychometric Properties of Survey of Attitudes Toward Statistics (SATs)
Parallel Session: Test Development and Validation; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-09

Ratna Jatnika*, University of Padjadjaran, Indonesia
Fitri Ariyanti, University of Padjadjaran, Indonesia

Many of us who teach statistics work hard to improve our instruction, especially in social science faculty. Part of that effort needs to be directed toward developing and using good assessments. Theory, research, and the experiences of both teachers and students of statistics indicate that attitudes toward statistics are important in the teaching-learning process. The Survey of Attitudes Toward Statistics (SATS) is developed by Schau (2003) help us to understand these attitudes and how they impact in teaching and learning. SATS consists of six aspects: affect (student's feeling concerning statistics), cognitive competence (student's attitudes about their intellectual knowledge and skill when applied statistics), value (student's attitudes about their usefulness, relevance, and worth of statistics in personal and professional life), difficulty (student's attitudes about the difficulty of statistics as a subject), interest (student's level of individual interest in statistics) and effort (amount of work the student expends to learn statistics). The aim of this research is to know the

psychometric properties of SATS, the reliability and validity of SATS. The data is collected from 81 undergraduate students in Psychology Faculty in University of Padjadjaran. The result shows that SATS is reliable (cronbach alpha = 0.907). Using confirmatory factor analysis, SATS can be measured using six manifest variables (affect, cognitive competence, value, difficulty, interest and effort). Confirmatory factor analysis shows Goodness of Fit Index = 0.89. This result after that is compared to psychometric properties of SATS developed by Schau (2003) and Carnell (2008).

Detection of Differential Item Functioning in Multiple Groups Using Item Response Theory Methods
Parallel Session: Differential Item Functioning & Local Independence; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Seock-Ho Kim*, The University of Georgia, USA
Allan S. Cohen, The University of Georgia, USA
Youn-Jeng Choi, The University of Georgia, USA
Sun-Joo Cho, Vanderbilt University, USA
Sukwoo Kim, Pusan National University, South Korea

Analysis of differential item functioning (DIF) is often done by comparing two groups of examinees, and item response theory (IRT) DIF detection methods are often used. It is sometimes important, however, to determine whether DIF is present in three or more groups. This paper presents a review of IRT methods for detection of DIF in multiple groups. The methods include the likelihood ratio test using MULTILOG (e.g., Thissen, Steinberg, & Wainer, 1988), the standardized DIF method using BILOG-MG (e.g., Muraki, 1999), the use of the quadratic term based on the parameter estimates and the estimated variance and covariance matrices (Kim, Cohen, & Park, 1995), and the MANOVA method (Kim & Cohen, 2007). Relationships among the methods and other existing methods for two groups are discussed. Illustrations with real data are provided.

Incorporating Differential Item Function into Longitudinal Item Response Models
Parallel Session: Differential Item Functioning & Local Independence; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Leah McGuire*, University of Minnesota, USA

It is a commonly held belief that curriculum affects learning, however the mechanisms behind the differences in learning due to curriculum are not widely understood (Schmidt et al., 2001). In order to begin to understand these mechanisms, it is important to study how learning and curriculum interact. One way to examine how achievement and curriculum

interact is to examine interactions between curriculum group membership and item difficulty by adding curriculum differential item function (DIF) terms to the item response model. The DIF term would illustrate whether items were more or less difficult for students who took a certain course, when controlling for ability. This study demonstrates how DIF can be added to a longitudinal item response model to explore how learning and curriculum interact using longitudinal data. Longitudinal curriculum DIF models were estimated using data from the Longitudinal Study of American Youth (Miller et. al., 1992). Items with significant DIF were found for students who took certain mathematics and science courses, even when controlling for ability. These DIF terms showed how mathematics and science curriculum can interact with ability and learning.

Detection of Differential Item Functioning in MULTILOG and IRTLRDIF
Parallel Session: Differential Item Functioning & Local Independence; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Youn-Jeng Choi*, University of Georgia, USA
Allan S. Cohen, University of Georgia, USA
Seock-Ho Kim, University of Georgia, USA

Thissen, Steinberg, and Gerrard (1986) and Thissen, Steinberg, and Wainer (1988, 1993) described the likelihood ratio test for differential item functioning (DIF), which compares two different models; a compact model in which no DIF is assumed and an augmented model in which DIF is assumed to be possible in the studied item. To analyze likelihood ratio test, MULTILOG and IRTLRDIF computer program will be used in this study. IRTLRDIF manual (Thissen, 2001) reports that the results of IRTLRDIF are similar, but not identical to MULTILOG with different conditions (e.g., starting values for the item parameters, convergence criteria, default for the location and scale of ability, and quadrature for the numerical integrations and so on). However, IRTLRDIF tended to detect more DIF items than MULTILOG using empirical data (Choi, Cohen, & Kim, 2011). Relationships among the two methods are discussed. Illustrations with real and simulated data are provided.

A New Procedure for Detecting Departures from Local Independence in Item Response Models
Parallel Session: Differential Item Functioning & Local Independence; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Michael Edwards*, The Ohio State University, USA
Carrie Houts, The Ohio State University, USA
Li Cai*, University of California at Los Angeles, USA

Item response models are widely used psychometric models which gain their strength (in part) through a series of assumptions. The focus of this talk is on one of the most common assumptions of item response models, local independence. We will briefly explore the different kinds of local independence (strong vs. weak) before reviewing the potential impact of violating this assumption in practice. A new method, called the Jackknife Slope Index (JSI), will be proposed to detect departures from local independence. The method works by serially removing each item in a set of items and observing the impact on the remaining items' slopes. We demonstrate via simulations that the method has promise for detecting underlying and surface local dependence (Chen & Thissen, 1997) and show an empirical example to illustrate the flexibility of the JSI.

Identifying Local Dependence with a Score Test Statistic Based on the Bifactor 2-Parameter Logistic Model
Parallel Session: Differential Item Functioning & Local Independence; Thursday, 21 July, 11:10 a.m. -- 12:30 p.m.; D2-LP-10
Yang Liu*, The University of North Carolina, USA
David Thissen, The University of North Carolina, USA

Local dependence (LD) refers to the violation of the local independence assumption of most item response models. Statistics that indicate LD between a pair of items on a test or questionnaire that is being fitted with an item response model can play a useful diagnostic role in applications of item response theory. In this presentation a new score test statistic, S_b, for underlying LD (ULD) is proposed based on the bifactor 2-parameter logistic model. To compare the performance of S_b with the score test statistic (S_t) based on a threshold shift model for surface LD (SLD) (Glas & Suarez Falcon, 2003), and the LD X^2 statistic (Chen & Thissen, 1997), we simulated data under null, ULD, and SLD conditions, and evaluated the null distribution and power of each of these test statistics. The results summarize the null distributions of all three diagnostic statistics, and their power for approximately matched degrees of ULD and SLD. Future research directions are discussed, including the straightforward generalization of S_b for polytomous item response models, and the challenges involved in the corresponding generalizations of S_t and the LD X^2 statistic.

Some aspects of design and analysis in longitudinal studies
Invited Symposium : Thursday, 21 July, 1:30 p.m. – 2:50 p.m., D1-LP-03

Maximin marginal designs for longitudinal studies

Frans E.S. Tan*, Maastricht University, The Netherlands

In general optimal design problems lead to local optimal designs that depend on the choice of the model as well as on the unknown value of the model parameters. This is in particular unattractive because the choice of a design should be made before data collection. Additional problems come into the picture if covariates (*prior-uncontrolled* variables) are involved for which the design cannot be (easily) determined before data collection. For example, in a cluster randomized intervention study where pupils of different schools were measured repeatedly, a comparison between treated and untreated schools might be of interest for different socio-economic classes (SEC) or for different other level-one covariates. The distribution of the baseline measurements and the variable SEC are usually determined after data collection. In order to determine the optimal (marginal) design of a subset of the *prior-controlled* variables, one needs to have additional information about the values of the regression parameters and the distribution of the *prior-uncontrolled* variables. The maximin procedure is an approach that can be used to overcome the dependency of an optimal design on unknown parameter values and distribution. The distribution of the maximin designs, however, is often not uniformly distributed, which is very unattractive for practical purposes. Moreover, in most cases the optimal distribution can only be determined numerically. In this presentation, the conditions will be discussed under which the maximin design for GLMM models is uniformly distributed. Robustness when some of the conditions are not met will also be considered.

Modeling HIV Viral Rebound using Differential Equations

Jan Serroyen*, Maastricht University, The Netherlands
Geert Molenberghs, Hasselt University and K.U. Leuven, Belgium

Viral dynamics is a relatively new field of study that relies on mathematical models to describe the temporal evolution of virus levels in the blood plasma, the so-called viral load. Our scientific aim is to find a flexible, yet parsimonious mechanistic model based on ordinary differential equations (ODE) for the so-called rebounders, a special subgroup of patients who, after an initial decrease in viral load levels, show a sudden rise in viral load levels during treatment. This rebound is generally caused by the emergence of a drug-resistant virus strain. The data of rebounders analyzed come from pooling three clinical trials on Prezista, a new protease inhibitor. In conclusion, the issue of parameter identifiability is briefly discussed and practical recommendations are formulated for researchers designing studies in the field of HIV dynamics.

Model Based Estimates of Long-Term Persistence of Induced HPV Antibodies: Hierarchical Bayesian Approach

Ziv Shkedy*, Hasselt University and K.U. Leuven, Belgium
Mehreteab Fantahun, Hasselt University and K.U. Leuven, Belgium
Geert Molenberghs, Hasselt University and K.U. Leuven, Belgium

Prediction of long-term persistence of vaccine-induced antibody is of primary interest in vaccination clinical trials. In this study hierarchical Bayesian models are used in order to predict the long-term persistence of vaccine-induced antibody of HPV-16/18 and to obtain the estimated time points where the individual titers are below the threshold value for protection. Linear and non linear subject-specific hierarchical models are used in order to model the change anti-HPV-16/18 levels and to estimate the rate of the change. Using the posterior predictive distribution we can obtained a subject-specific model based estimates for long-term persistence. Moreover, we can derive, for each subject in the study the posterior probability to be protected, i.e. the probability that the subject titers are above the threshold value for protection. In addition, linear mixed models are used to model both the population and the subject-specific evolution of the antibody over time. Empirical based estimates for the subject-specific random effects are used to in order predict the antibody level for each subject and to evaluate the proportion individuals remain protected over time. The two modeling approached are implemented and compared using longitudinal data from vaccination trails of HPV 16/18.

Modelling the Impact of Hypertensive Treatments on Longitudinal Blood Pressure Measurements and Cardiovascular Events

M Carr*, University of Manchester, UK
R McNamee, University of Manchester, UK
J Pan, University of Manchester, UK
K Cruickshank, University of Manchester, UK
G Dunn, University of Manchester, UK

Modelling the impact of longitudinal blood pressure measurements on cardiovascular event risk is problematic. This is particularly true in a trial context where hypertensive treatment options are designed to reduce event rates via the reduction and control of blood pressure itself. Blood pressure measures are only available at discrete observation points and the measurement process is notoriously error-prone. The resulting measurement error, combined with natural biological fluctuations, can induce regression attenuation if readings are used directly as covariate information in survival models. One means of addressing the problem is a two-stage approach where estimates of 'error-free' blood pressure obtained

from a random effects model act with other covariates in a second stage survival model. However, blood pressure is a time-dependent covariate and standard survival models for risk assessment require time-dependent covariates to be external to the event process. Blood pressure is the output of an internal process and is directly related to the cardiovascular event mechanism. The solution is joint optimisation of the two processes. We are principally concerned with the nature of the relationship between blood pressure and the event process and whether treatment options have an additional 'direct' effect on risk that is not manifested through blood pressure reduction. Further concerns include the potential for confounding by additional variables including seasonality and blood pressure variability and we also entertain the possibility that, in the presence of treatment changes, blood pressure itself may function as a time-dependent confounder for the treatment-event relationship.

Measuring a Learning Progression for Data Modeling: Alternative Psychometric Modeling Approaches
Symposium : Thursday, 21 July, 1:30 p.m. -- 2:50 p.m., D1-LP-04

Developing Assessments of Data Modeling and Mapping a Learning Progression
Mark Wilson*, University of California, Berkeley, USA
Elizabeth Ayers, University of California, Berkeley, USA
Rich Lehrer, University of California, Berkeley, USA

The Assessing Data Modeling and Statistical Reasoning (ADMSR) project is a collaborative effort between measurement and learning specialists to develop a curricular and embedded assessment system in the domain of statistical reasoning and data modeling (Lehrer et al., 2007). The ADMSR project has developed seven related but distinct constructs pertaining to statistical reasoning and data modeling. For each construct, curriculum and supporting teacher materials have been developed. In addition, items have been designed to measure student ability and understanding on each construct. This symposium presents several different measurement modeling approaches that we see as being relevant for this learning progression. In this paper, we introduce the project and describe the learning progression. We begin by discussing our theoretical connections between the constructs. We believe that, with appropriate instruction, students will move to higher levels along a single construct, but also in a coordinated way across several constructs (i.e. a student operating at a given level in one of the constructs will likely be operating at a specific level on one or more of the other constructs in the learning progression). We then summarize results from a pre-post analysis from a school in Wisconsin that indicate gains are statistically significant, as well as educationally significant.

Mapping a Learning Progression Using Unidimensional and Multidimensional Item Response Models

Robert Schwartz*, University of California, Berkeley, USA
Elizabeth Ayers, University of California, Berkeley, USA
Mark Wilson, University of California, Berkeley, USA

We begin by individually analyzing the seven constructs using Masters' Partial Credit Model (Masters, 1982). These unidimensional results were examined to aid in item and construct development. As a result, refinements were made to the constructs, scoring guides, and items. In addition, new items were developed to elicit responses at construct levels on which we had insufficient data. Our theory behind the ADMSR learning progression, however, does not assume that the constructs are completely independent of one another. Thus, the seven constructs were then analyzed together using the Multidimensional Random Coefficients Multinomial Logit (MRCML) Model (Adams, Wilson & Wang, 1997). This allowed examination into the correlations and covariances between the constructs. The multidimensional results were estimated using the Delta Dimensional Adjustment method, a procedure which adjusts the metrics of the dimensions so that comparisons of student proficiencies and item difficulties can be interpreted across dimensions. These analyses have been carried out using ConQuest (Wu et al, 1998). Results show (as expected) the reliability of the estimated student proficiencies increase in the multidimensional analysis. When looking at empirical support for the theoretical connections, some are supported while others are not. For the unsupported connections, we hesitate to dismiss them after the results of only one sample. It might be the case that while no support for the connections between construct levels was present here, there could be evidence of the existence of the connection when we analyze additional samples. These analyses have been completed, and we are currently finishing the write-up.

Modeling Links Between Dimensions of a Learning Progression Using SEM

Elizabeth Ayers*, University of California, Berkeley, USA
David Torres Irribarra, University of California, Berkeley, USA
Mark Wilson, University of California, Berkeley, USA

The previous paper modeled the learning progression as a profile of progress along multiple dimensions. However, the data modeling perspective suggests that learning involves links among these dimensions of knowledge and skill. The research literature and early data analyses led us to hypothesize the links among the seven constructs, as described in the first paper. In this paper, we will model these links using Structural Equation Modeling (SEM;

Bollen, 1989). We will report on the empirical evidence for this structure provided by these analyses, including comparison to simpler and more complex structures within SEM. An obvious simpler model would be one with no links (such as the standard multidimensional analysis in the previous paper), and the most complex model would be the one with all the hypothesized links. We have the data ready for these analyses, and plan to complete them in the next month or so using M-Plus (Muthén & Muthén, 1998-2007).

Developing Assessments of Data Modeling and Mapping a Learning Progression using a Structured Constructs Model

Ronli Diakow*, University of California, Berkeley, USA
David Torres Irribarra, University of California, Berkeley, USA

One of the benefits of developing a detailed learning progression for a given domain is the ability to generate hypotheses about the relations among the constructs that constitute the learning progression. However, if such hypotheses are generated, we need to be able to validate them empirically. Structured construct models (SCMs; Wilson, 2009) are proposed in this paper for that purpose. The SCMs described in this paper represent each construct as a set of ordered latent classes (Croon, 1990) and model links among the constructs as restrictions on the joint probabilities of class membership. Using these models, different hypothesized links can be tested by comparing models with different probability constraints. However, the validity of SCM relies heavily on statistical and conceptual assumptions, requiring confirmation that the latent class model is correctly specified and that the 'meaning' of the classes is consistent with the levels of proficiency described in the theory. In this presentation, we will address these issues and discuss the analysis that is needed to justify statistical and substantive interpretation of the SCMs. We will then illustrate how the models can be implemented to test and explore the conceptual pathways that students would follow as a result of instruction among two constructs of the ADMSR project. We will discuss how the results of the models can be reported and interpreted. Our current analysis was conducted using Latent GOLD (Vermunt & Magidson, 2005) and the graphical summaries of the results were made using R (R Development Core Team, 2010).

Assessing Eye Movement Transitions using Multilevel Markov Models
Parallel Session: Latent Class Analysis; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Samantha Bouwmeester*, Erasmus University Rotterdam, Netherlands
Lisa VandeBerg, Erasmus University Rotterdam, Netherlands
Rolf A. Zwaan, Erasmus University Rotterdam, Netherlands

Many eye tracking studies are designed to reveal cognitive processes that occur within individuals. However, traditional analyses mostly reflect the viewing tendency of a group of people over trials, rather than a realistic fixation pattern that occurs within individuals and trials. We argue that assessing shifts in attention between regions of interest (i.e., eye fixation transitions to relevant referents) by means of multilevel markov modeling can provide vital information about viewing patterns within trials. We will demonstrate how the multilevel markov modeling technique can be used on eye tracking data based on a relevant example (assessing lexical co-activation in a visual world paradigm), and discuss the practical applications and theoretical implications when applying transition analyses to any type of eye tracking data.

Dynamic Bayesian Inference Network for Modeling Learning Progressions over Multiple Time Points
Parallel Session: Latent Class Analysis; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Younyoung Choi*, University of Maryland, USA
Robert Mislevy, Univsersity of Maryland, USA

Dynamic Bayesian Inference Network (Murphy, 2002) is a probability-based framework in which specific models can be constructed using elements from Bayesian Inference Networks in accordance with substantive theory. Recently, Learning Progressions have captured attention in mathematics and science education (National Research Council, 2007; Shin, Stevens, Short & Krajcik, 2009; Learning Progressions in Science Conference, 2009). Substantive, psychological, instructional, and task development aspects of Learning Progressions have received much attention, but less research has addressed the assessment design framework and psychometric models for longitudinal designs. The work is based on used the Evidence Centered Design framework (Mislevy, et al, 2003) to link the theory embodied in a Learning Progression, task design to provide evidence about students' levels, and psychometric models. The focus here is on the psychometric model. DBINs are introduced to characterize the relationship between student performances and levels on Learning Progressions in a longitudinal design. The fundamental concepts of graph theory and probability theory for constructing a DBIN are presented. The approach is shown to be equivalent to a Hidden Markov model. Two simulation studies are conducted for evaluating the performances of estimation for the DBINs. The studied conditions are different numbers of tasks, sample sizes, types of transition probability matrices, types of conditional probabilities of observables given levels on learning progressions, and distributions of students on learning progressions. The studies consider a simple DBIN model and an extended DBIN model with a covariate.

Hierarchical Bayes Granger Causality Analysis for Understanding Purchase Behaviors of Multiple Product Categories
Parallel Session: Latent Class Analysis; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Kei Miyazaki*, Nagoya University, Japan
Takahiro Hoshino, Nagoya University, Japan

This study proposes a model that can explore time series variation of purchase quantities of multiple product categories or brands for each consumer segment. In economic time series analysis, Granger causality analysis is used frequently for understanding the interrelated influences among several times series. In this study, by introducing latent classes I developed the model that could search the interaction of time series variations of several products' purchase quantities. The proposed model makes it possible to infer appropriate promotional activities for each segment that differs in consumer demographics and to understand latent switching of purchase behavior or loyalty in case that any promotional activities are not conducted. In parameter estimation, I used a Bayesian estimation method using Markov Chain Monte Carlo algorithm. I applied the proposed method to scanner panel data and meaningful results were obtained.

Multilevel Latent Class Model Used in Group-level Classification: Appropriate Application of Model Criteria
Parallel Session: Latent Class Analysis; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Jie-Ting Zhang*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Can Jiao, Shenzhen University, China

Multilevel latent class model is good at estimating group level effect on test and helping to realize local independence in traditional latent class model, which makes the sample classification more accurate and reasonable. Moreover, it is appropriate to cross-regional and cross-culture researches, according to which measure could be taken specific to different kinds of group. Apparently, it is of great significance to Chinese Mainland with great demographic diversity.
However, all these advantages are based on the accuracy of models, which is determined by the model criterion we choose. The problem will be even more complex in multilevel model, because more factors should be considered about. Certain researchers have discovered that

criteria such as BIC, AIC have different advantages in different contexts of sample size in both individual and group level.
The present simulation study, on basis of some conclusions made in the previous ones, is to investigate how sample size in both levels influence the accuracy of model selection using criteria AIC, AIC3, BIC and adjusted BIC, when latent class number in group level is comparatively high. The result is compared with those in the previous studies. Then a conclusion is made about how to properly apply the criteria for multilevel model under different kinds of condition.
Finally, multilevel latent class analysis is conducted on an empirical dataset, in order to verify the simulation result and illustrate the application of the method.

Work-Family Conflict : A Latent Prolife Analysis
Parallel Session: Latent Class Analysis; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Yanhong Gao*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

The present study introduced some methods on the basis of latent class model to analyze a binominal test. Index indicates whether the item can reflect the examinee's ability definitely; index and the difference of conditional probability among various latent classes shows how well the item discriminates a certain class from others; while the test-specific index assesses the discrimination of a certain response vector among various classes. Comparison between the traditional analysis methods and the new ones is conducted according to an empirical research, which demonstrates that methods base on latent class model precedes the traditional index such as reliability coefficient. The new methods evaluate the test quality specific to various ability level of examinees, which is more sensible to the actual sample distribution with multi-modal rather than unimodal. Additionally, item-specific index offer more objective foundations in cutting or modifying items.

Validation of Hortwitz's (1987) Beliefs about Language Learning Inventory with Chinese Mainland Sample – Traditional Factor Analysis Versus Rasch Modeling
Parallel Session: Rasch Models - Theory and Practice; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Lijuan Li*, The Hong Kong Institute of Education, China

This study aimed at establishing, within the classical test theory and Rasch framework, respectively, construct validity of the translated version of Horwitz's (1987) beliefs about

language learning inventory to be used with Chinese mainland college ESL students. Based on a convenience sample of 362 tertiary-level college students, from the original 34-item conceptually-composed 5-factor inventory the exploratory and subsequent confirmatory factor analyses generated a 15-item four-factor solution. Of the four factors, only two demonstrated marginally acceptable internal consistency. Alternatively the Rasch scaling method was utilized in a parallel manner. Psychometric properties, e.g., the item and model fit, category functioning of the items, and dimensionality of the inventory, were empirically put under close scrutiny. After the removal of 10 items with poor item fit or persistently disordered categories, it ended up with a refined inventory, of which no absolute evidence of unidimensionality had been captured. The purification exercise continued with identification of items that displayed differential item functioning (DIF) values till the remaining 21 items, as evidenced, measured a single underlying construct. Consequently deprived from the Rasch measurement model was a short version of the inventory with clinically appropriate length and proved construct validity, though the present study did not attempt to tell which approach was superior to the other. It's hoped that the robust validation techniques would optimize the final factor solution, thereby ensuring the legitimacy of the inventory to be used for the investigation on the patterns of Chinese Mainland college students' beliefs about learning English as a second language.

Assessing Dimensionality Using Rasch Rating Scale Model
Parallel Session: Rasch Models - Theory and Practice; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Kun Jacob Xu*, The Hong Kong Institute of Education, Hong Kong
Magdalena Mo Ching Mok, The Hong Kong Institute of Education, Hong Kong

In practice, many educational and psychological tests are multidimensional. Ackerman (2003) highlighted Multidimensional Item Response Theory (MIRT) models for polytomous data and higher dimensional space as one of the key directions for future research. Many methods have been proposed for assessing dimensionality in IRT models, including the use of Principal Components Analysis on standardized residuals and others (see e.g., Hattie, 1985; Karabatsos, 2000; Linacre, 1998; Smith, 2002). Nevertheless, the literature is still equivocal regarding such issues as cut-point of the first eigenvalue used in PCA of standardized residuals, and its relation to sample size, test length, the number of dimensions, and the degree of dimensionality (Chou & Wang, 2010). This study aims to verify methods of assessing dimensionality using a series of Monte Carlo simulation with data generated in the context of Rating Scale Rasch model under systematic combination of conditions of test length (5 or 10 items), difference in test length between dimensions (nil, small, large), sample size (500 or 1000 students), strength of correlation (0.0, 0.3, 0.7, 0.9),

number of dimensions (2 or 3 dimensions), and status of dimensionality (between or within items). Combinations of these conditions were manipulated in this study in order to find out their impacts on rate of Type I error and Power of multidimensional detection.

Sample Size Determination for Rasch Model Tests
Parallel Session: Rasch Models - Theory and Practice; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Clemens Draxler*, Ludwig-Maximilians-Universität München, Germany

This paper is concerned with supplementing statistical tests for the Rasch model so that additionally to the probability of the error of the first kind (Type I probability) the probability of the error of the second kind (Type II probability) can be controlled at predetermined level by basing the test on the appropriate number of observations. An approach to determining practically meaningful model deviations is proposed and the approximate distributions of the Score (or Lagrange multiplier), Wald and likelihood ratio test are derived under the extent of model deviation of interest. Numerical examples show the optimal sample sizes for the 3 tests needed for various extents of model deviation and different scenarios regarding error probabilities.

Modeling of Students' Satisfaction of an Online Database: An Empirical Study
Parallel Session: Rasch Models - Theory and Practice; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Atiquil Islam A.Y.M. *, International Islamic University Malaysia, Malaysia

In its effort to foster a stimulating research environment, the IIUM has provided an online database facility. The database comprises volumes of research articles published in journals and conference proceedings. However, despite a decade of existence, the database was discovered to be underutilized, especially by students. Determinants such as perceived ease of use, perceived benefits, computer self-efficacy, and end-user satisfaction were postulated to be major barriers. To assess the influence of these determinants on postgraduate students' satisfaction of the online database, an adoption questionnaire based on an extended Technology Acceptance Model (TAM) was administered to 180 postgraduate students from four faculties (Education, Economics, Engineering and Human sciences). The questionnaires' reliability and validity were performed through a RASCH analysis; the data were analysed using the Structural Equation Modeling. The results demonstrated significant influences of perceived ease of use, perceived usefulness and computer self-efficacy on postgraduate students' satisfaction in using the online database. In addition, the results also revealed significant positive interrelationships among the three exogenous constructs of an

extended TAM. The findings contributed to a better understanding of the two intrinsic motivation components, namely computer self-efficacy and satisfaction, were incorporated in the original framework of the TAM and technology satisfaction among postgraduate students.

Analyzing Two-Tier Items with the Steps Model
Parallel Session: Rasch Models - Theory and Practice; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Hak Ping Tam*, National Taiwan Normal University, Taiwan
Margaret Wu, University of Melbourne, Australia

The two-tier item is a relatively new item format that is quite popular among a circle of researchers in science education. Typically, a phenomenon related to science was given about which the respondents have to answer a factual item followed by an item that solicited the reason behind their answer to the first item. Unfortunately, the methodology regarding how this type of items can be analyzed is quite rudimentary and is typically handled by means of comparison of percentages. Recently, there have been attempts to use Rasch type modeling approach together with user-defined fit statistics to analyze this kind of data. This study suggests that a better idea of the relationship between responses to the factual item and the reason item can be attained if one could regard a two-tiered item as a 2-part process. First, a student is presented with a factual item. Once he/she provides a correct or incorrect response, the student is then presented with the reason item to support his/her response to the factual item. If we hypothesize that students who provide a correct response to the factual item may answer the reason item in a different way from those who provide an incorrect response to the factual item, then we may consider splitting the reason item into two items: one for students who provide the correct answer to the factual item, and one for those who provide an incorrect answer. Interpretation from this approach will be illustrated with an example followed by discussion.

Measurement Invariance of Survey Data: A Cross-Cultural Analysis
Parallel Session: Structural Equation Modeling - Applications I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Timothy Teo*, Nanyang Technological University, Singapore

Cross-cultural surveys are important in enhancing the validity of an instrument, among other things. However, when respondents react to an instrument, they bring many characteristics along with them. Of these, culture is one of many subtle traits that impact on the survey data. This is especially so when an instrument is translated into different

languages for a survey. This aim of this study is to examine the impact cultural differences among the responses of participants from different countries. The instrument in question comprised items designed to measure users' acceptance of technology. Data collected from Singapore and Turkey will be compared for configural, metric and scalar invariance. Finally, issues relating to cross-cultural survey will be discussed.

Investigating Factorial Invariance of Teacher Assessment Literacy Inventory between Primary and Secondary School Teachers
Parallel Session: Structural Equation Modeling - Applications I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
See Ling Suah*, Universiti Sains Malaysia, Malaysia
Saw Lan Ong, Universiti Sains Malaysia, Malaysia

The main objectives of this study were to confirm the factorial structure of the Teacher Assessment Literacy Inventory (TALI) and examine the invariance of the factorial structure of TALI between primary and secondary school teachers. TALI is an instrument developed to determine the level of assessment literacy of school teachers in northern Malaysia. The inventory consists of 41 items with high overall internal consistency using Cronbach's Alpha coefficient. The same is true for the five subscales of Methods of Assessments, Developing Tests, Test Usage, Scoring & Grading and Providing Feedbacks. A confirmatory factor analysis using structural equation modeling (SEM) was conducted to examine the factorial structure and the invariance of the factorial structure between primary and secondary school teachers. A five-factor model was postulated and tested. Modifications of the initial hypothesized five-factor structure were necessary to adequately fit the data. The results pointed out several aberrant items that were specific to a particular group. The inventory appeared to be factorially invariant for primary and secondary school teachers.

Confirmatory Factor Models for Representing Processing Strategies Associated with a Cognitive Measure
Parallel Session: Structural Equation Modeling - Applications I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Karl Schweizer*, Goethe University Frankfurt, Germany

Confirmatory models with fixed factor loadings enable the identification and investigation of processing strategies that may be selected by participants in completing the items of a cognitive measure. In such models sets of factor loadings represent processing strategies as loading vectors. Since the model of the covariance matrix (Jöreskog, 1970) provides the

framework for such representations, the focus is on the account of variance by processing strategies. It is demonstrated that three types of representation are possible: (1) the first type concentrates on sources of individual differences since such sources generate true variance. The second type is characterized by the consideration of the probabilities of outcomes since probabilities of outcomes can be transformed into variances. Finally, there is the possibility of considering discrepancies between expectations.
In the application to a measure of working memory capacity three processing strategies are considered: compliance strategy, non-compliance strategy and probability-based strategy. Using the data of 345 individuals it was investigated whether these processing strategies contributes to a good model fit. Furthermore, combinations of strategies were considered since the various members of the sample could be expected to prefer different strategies or to change from one strategy to another strategy. It turned out that in lab data the combination of compliance and probability-based strategies did best whereas in internet data the best model fit was observed for the combination of compliance and non-compliance strategies. As could be expected for a measure of working memory, only the processing strategy associated with instruction led to a considerable correlation with fluid intelligence.

The Development of Leisure Satisfaction Scale for Gifted Students
Parallel Session: Structural Equation Modeling - Applications I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Wei-Ching Lee*, Taipei Municipal University of Education, Taiwan
Chin-Fei Cheng, Taipei Municipal University of Education, Taiwan

The purposes of this study were to construct a reliable and valid leisure satisfaction scale for gifted students and to compare whether there were groups invariance for the different background gifted students in this scale.
Based on theories, a self-designed scale for gifted students was used to survey gifted students of the junior high and elementary schools. 1,059 valid samples were collected by the stratified random sampling and cluster sampling. The samples were divided into three sets by a random procedure. First, the first sample set was analyzed by item analysis and exploratory factor analysis. Moreover, the second sample set was analyzed by confirmatory factor analysis of structure equation modeling and the cross-validation was tested by the third sample set. Finally, the different levels of strictness multi-groups analysis were proceeded.
The results showed that the factors had great structures and there were construction validities in this scale. The reliabilities of the data were satisfactory, too. The collected data fitted to the theoretical model and this stability of model passed the statistical tests from

loose to tight replication strategies. In this study, measurement invariance was confirmed for gifted students with different background, too.

Exploring the Validity of Learning-Related Boredom Scale in Canada and China
Parallel Session: Structural Equation Modeling - Applications I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Virginia Man Chung Tze*, University of Alberta, Canada
Robert Klassen, University of Alberta, Canada
Lia Daniels, University of Alberta, Canada
Johnson Ching Hong Li, University of Alberta, Canada

Recent research has shown that boredom has an adverse impact on students' achievement (Mann & Robinson, 2009). In particular, Pekrun, Goetz, Daniels, Stupnisky, and Perry (2010) found that boredom in learning negatively predicted students' academic achievement even after controlling for their prior achievement. Given the importance of boredom in student learning, a scale that measures learning-related boredom—if proven to be valid and reliable—could be a useful tool to assess and evaluate student's boredom levels in academic learning. The goal of this study, therefore, was to examine the validity of the Learning-Related Boredom Scale (LRBS; Pekrun, Goetz, & Perry, 2005), in two culturally different settings – Canada and China.
Samples were comprised of university students from Canada (n = 151) and China (n = 254). Multi-group confirmatory factor analysis was used to test the factor structure and measurement invariance across settings, after which we examined the relationships between the LRBS, frequency of reported boredom in class, self-efficacy for self-regulated learning (SESRL), and intrinsic motivation. The LRBS showed convincing evidence of reliability and measurement invariance across the two countries, and the relationships between the boredom scale, SESRL, and intrinsic motivation were similar across settings.

The study provides general evidence that learning-related boredom is a valid construct across culturally diverse settings and specific evidence that boredom in learning showed a similar relationship with both SESRL and intrinsic motivation in two settings. Results from the study provide evidence about the usefulness of the measure in its current form for use in cross-national studies.

Factor Analyzing Regression Slopes in Multilevel Model
Parallel Session: Hierarchical & Multilevel Models; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Yasuo Miyazaki*, Virgnia Tech, USA

A model that factor analyzes regression slopes at level 1 in two level hierarchical linear models is presented. Multilevel factor analysis developed by Longford and Muthén (1992) factor analyzes the group means, i.e., random intercepts, to extract the factors operating at the macro level, but the proposed model, works on the random slopes. It is often the case that the focuses of researchers of substantive interests in behavioral and social sciences lie at regression slopes that indicate the impact of the independent variables on the dependent variable or the strength of association between those, instead of only means. When we have multiple independent variables at level 1, these sets of regression slopes as well as the intercepts, which possibly vary from group to group (level 2), can be regarded as indexes that characterize the unique nature of each group. When these level-1 regression coefficients randomly vary, there are many cases that these regression coefficients covary each other with substantial correlations. In such cases, it is possible to consider factors operating at the macro level that generated the correlations. The factorization of regression coefficients would facilitate a better interpretation of the results by reducing the number of parameters in the model. The worked-out examples from education are presented to illustrate the techniques and possible interpretations of the results.

Avoiding Boundary Estimates in Hierarchical Linear Models Through Weakly Informative Priors
Parallel Session: Hierarchical & Multilevel Models; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Yeojin Chung*, University of California, Berkeley, USA
Sophia Rabe-Hesketh, University of California, Berkeley, USA
Andrew Gelman, Columbia University, USA
Jingchen Liu, Columbia University, USA
Vincent Dorie, Columbia University, USA

When fitting a hierarchical linear model by (restricted) maximum likelihood, a problem frequently encountered is that the estimates of the variance-covariance matrix of the random effects are on the boundary of parameter space, or that convergence fails. To avoid this problem, we propose specifying appropriate Bayesian prior distributions for variance (and covariance) parameters, and maximizing the marginal posterior distribution, integrated over the random effects. For random-intercept models, we suggest a prior distribution that prevents boundary estimates but increases the variance estimate by only about one standard error, and hence has little influence when the data are informative about the variance. We compared our Bayes modal estimation approach with maximum likelihood and restricted maximum likelihood estimation in simulations across a wide range of conditions. Bayes

modal estimation performed well, not only in terms of parameter recovery but also by providing better estimates of standard errors of regression coefficients in many situations. Our approach has been implemented in gllamm and lmer, running in Stata and R, respectively.

Comparison of Aggregated Scores Adjusted and Non-Adjusted for Nested Effects in Nested/Hierarchical Measures
Parallel Session: Hierarchical & Multilevel Models; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Ralph Carlson*, The University of Texas Pan American, USA
Hilda Medrano, The University of Texas Pan American, USA
Carlo Flores, McAllen Independent School District, USA

Psychological and educational measures are often organized by subtests, scales, or factors into nested/hierarchical structures. Measures are nested within a hierarchical structure if each level of one measure is within one and only one level of another measure. For example, within the Wechsler Scales a significant discrepancy among subtests, first level of hierarchy, within Verbal Type or Performance Type Scales would yield an aggregated Verbal Scale score or Performance Scale score, second level of hierarchy, that are not interpretable due to a lack of "cohesion." When there are significant discrepanies/differences within a lower level of a nested hierarchical measure, all successive levels are not interpretable due to a lack of "cohesion'; therefore, there is a problem with loss of information. Nested variance is transitive and flows from bottom of a nested/hierarchical structure to the apex; therefore, adjustment and interpretation of nested effects must be from bottom-up. The study presents a model that adjusts for nested effects in nested/hierarchical measures and thus provides a solution by alleviating the loss of information due to a lack of "cohesion" across successive levels of a nested/hierarchical measure. The current study presents an example that compares aggregated scores in a hierarchy that are adjusted and non-adjusted for nested effects in a nested/hierarchical measure. These data were obtained on the Wechsler Intelligince Scale for Children from random a sample of 6 year old bilingual Hispanic children. This study presents a refinement in thinking, analysis, and interpretation of nested/hierarchical measures.

A Hierarchical Testlet Response Theory Model
Parallel Session: Hierarchical & Multilevel Models; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Chia-Hua Lin*, National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan

Tien-Yu Hsieh, National Taichung University of Education, Taiwan
Yan-Ru Wu, National Taichung University of Education, Taiwan

Testlet items are widely used in large-scale standardized tests to evaluate the learning achievements of the students. The assessment framework of the many large-scale standardized tests is the hierarchical assessment framework. Many studies showed that hierarchical item response theory (HIRT) model is a better way to model data when the assessment framework is hierarchical.
In this study, a hierarchical testlet response theory (HTRT) model is proposed to model the testlet items with a hierarchical assessment structure. The performances of the original testlet response theory (TRT) model and the proposed HTRT model are evaluated in a simulation study. The results show that the performance (root mean square errors, RMSEs) of HTRT is better than that of TRT.

Multilevel Item Response Models for Hierarchal Latent Traits
Parallel Session: Hierarchical & Multilevel Models; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Wen Chung Wang*,The Hong Kong Institute of Education, Hong Kong
Kuan-Yu Jin, The Hong Kong Institute of Education, Hong Kong
Joseph Kui-Foon Chow, The Hong Kong Institute of Education, Hong Kong

In the human sciences, sampled data may have a multilevel structure. For example, repeated measures are nested within persons; and students are nested within schools. In addition to a multilevel structure in sampled data, the latent traits of interest may have a hierarchal structure. For instance, a language proficiency test may measure four kinds of proficiency: listing, speaking, reading and writing. Not only the "overall" language proficiency but also the four "domain" proficiencies are of great interest and should be reported. Likewise, a test of quality of life may contain multiple domains, such as physical, mental, social, and environmental, so that not only the overall quality of life measure but also the four domain quality of life measures are of interest. It is likely that not only sampled data have a multilevel structure but also latent traits have a hierarchical structure. Existing IRT models can accommodate either multilevel structure in sampled data or hierarchical structure in latent traits. In this study, we developed a series of item response models that can accommodate both multilevel structure and hierarchical structure simultaneously, and conducted a series of simulations to evaluate parameter recovery. It was found that the parameters of the new models can be recovered very well by using WinBUGS. Two empirical examples of the Civic Education Study were analyzed for demonstration of the new model.

A Two-Tier Testing and Bayesian Network Based Adaptive Remedial Instruction System in Dilation of a Graph

Parallel Session: Test Development and Validation - Ability Measures I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Shu-Chuan Shih*,National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan
Chih-Wei Yang, National Taichung University of Education, Taiwan

The main purposes of this study are to construct an adaptive remedial instruction system in the "dilation of a graph" unit and explore its effect in practical instruction. The system proposed in this study including the two-tier diagnostic tests based on Bayesian networks, and remedial instruction media designed according to the diagnostic results. Five steps are involved in this study: developing the cognitive diagnostic model based on Bayesian network that can describe the relations between two-tier items and bugs; constructing two-tier items that students can be provided an opportunity to reveal their bugs in dilation of a graph; using cognitive conflict strategy to design remedial instruction media for each bug in the cognitive diagnostic model; integrating the two-tier diagnostic tests and online remedial instruction to complete the adaptive remedial instruction system; and assessing the effectiveness of the system by experimental teaching.
The research takes a quasi-experimental approach using pretest-posttest, nonequivalent group design. The subjects are 154 sixth grade students from an elementary school in Taichung (64 students in the experimental group and 90 students in the control group). The experimental group is diagnosed and taught using "the adaptive remedial instruction system", while the control group learned using "the traditional remedial instruction activity" The pretest and posttest using the system are conducted on two groups to understand the effects of the system. Experimental results indicated that the proposed system can provide individual bug diagnosis immediately and enhance the effect of remedial instruction ($F=4.993$ and $p=.027<.05$).

Neural Cognitive Assessments in Recognizing Pictographic and Phonemic Abilities

Parallel Session: Test Development and Validation - Ability Measures I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Pei-Tzu Huang*,National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

The study proposes novel neural cognitive assessments for evaluating pictographic and phonemic abilities that are critical factors in predicting word recognition developments. The

proposed neural cognitive assessments include a series of pictographic Chinese characters, modern Chinese characters, mandarin phonetic symbols and pictures of real objects. The series represents varied degrees of pictographic and phonemic stimuli that require participants to use corresponding levels of neurocognitive abilities to answer the questions timely and properly. The participants were recruited based on two levels of word recognition skills, the mastered- and learner-levels. Various ages, cognitive levels, and both genders are included in the study. All the participants were evaluated by behavioral and neurocognitive assessments with their performance in event related potentials (ERP) records. The study also provides a novel quantitative model in analyzing the datasets. In addition, neurocognitive variations can be found among different levels of literates. Participants were shown having gender effects in ERP recordings when they answered the questions of modern Chinese characters. Interestingly, male learners show considerable activations in the auditory area of cortical regions when mandarin phonetic symbols were presented. In conclusions, the study shows the quantitative validities of the novel neurocognitive assessments and it also address the empirical values of the quantitative models.

Kittagali Scale – a Scale to Measure Productivity under the Influence of Music, Motor and Logical Analogy
Parallel Session: Test Development and Validation - Ability Measures I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Anilkumar Kittagali*, Acharya's Bangalore B-School, India

The Scale can be used to measure the performance of person on the influence of logical, kinesthetic and musical intelligence by using Kittagali Scale, a self developed scale.
The test involved in analyzing the psycho-motor ability of a person influenced with musical intelligence and mathematical or logical reasoning. The test involves the use of treadmill attached with monitor display to choose the questions of choice run under the select musical choice on select choice of treadmill speed.
The scale should read the best cognitive ability to answer under the influence of music and psycho-motor agility. The test is conducted on 200 persons measured on same and different levels of intelligences. The output of measurement is proportional to the productivity of the person on the performance index according the “Kittagali Scale”.

Cognitive Diagnosis Research Based on RSM for Chinese Children’ Rapid Naming and Working Memory Defects
Parallel Session: Test Development and Validation - Ability Measures I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Xiaoling Fan*, Hunan Normal University, China
Fang Liu, Hunan Normal University, China
Jun Wang, Hunan Normal University, China

Objective: Through cognitive diagnostic test of the children in Rapid Naming and Working Memory , discuss the attribute-master model, to provide theoretical and practical basis for its diagnostic.
Methods: The framework and projects were established by drawing forefathers' researchs and interviewing with experts. Three times forecast analyses, formed two parallel formal tests, which contained 2 subtests and 7 items. Using individual testing, 314 subjects were adopted, including 35 RD subuects in test A and 44 in test B.
Results: The CFA showed that the attributes hierarchy model of the tests were reasonable. The difficulty parameters of test A and B were 0.96-2.83 and 0.80-2.74. The discrimination parameters were-2.53~-0.22 and -3.13~0.03. The result based RSM showed that the ability parameters of were -2.40~-0.04 和-3.11~0.98. The classified rate of the 79 pupils with RD was 95%. .The result showed that more than 83% pupils with RD were classified to typical attribute-mastery patterns 1, 4, 5, and 7. For four basic attributes, respectively the mastery rates was 37.14%-94.28% and 3.36%-97.72%, in which Rapid Naming was the highest, the Sentence Comprehension was the lowest. Subjects existing defects in Naming Rapid with RD were 23.4%, Working Memory were 64.4%, and two defects was 4%. The parallel reliability was 0.85. The retest reliability were 0.97 and 0.96. Hit rates were 87% and 93%.
Conclusion: CDT psychometric were fine, which could provide information to identify the children with RD in Rapid Naming and Working Memory defects.

The Case Study of University Teacher' Course- Arrangement in Learning Calculus
Parallel Session: Test Development and Validation - Ability Measures I; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Bor-Chen Kuo, National Taichung University , Taiwan
Mu-Yu Ting*, National Formosa University, Taiwan

Course arrangement is not easy to carry on. Teachers have no efficient time to edit or produce related teaching resources. Teacher' course- arrangement influences the achievement of students learning Calculus. We want to improve the success rates in several of our calculus courses. Details of the process to our calculus courses are described in the following. Some University' freshmen, when matriculation before the mathematics, had not the significant difference in the Calculus pretest. On the first semester, one class has continuously 2 day - 3 hour Calculus curriculums each week, but curriculum arrangements of another class are more reasonable, 1day- 2 hour curriculums, to the 4th day have 1 hour

curriculum again, let the students have the sufficient time to review the new curriculum. However, while we had a positive anecdotal response, there was no study conducted on the effectiveness of the four-day versus the two-day schedule, and some still felt that more needed to be done to improve students' success rates. There were 103 first grade students of some University, including 99 boys and 4 girls, who participated in this study. The author started teaching Calculus under the new schedule. Next semester the curriculum schedules of two classes exchange. Regular examination results were used to evaluate and dissect the effects of this method. The experiment lasted 27 weeks, during which six assessments, two midterms and a final exam were given. After each examination, the course instructor attempts to assess the results.

An Application of Many-Facet Rasch Measurement in the Yes/No Angoff Standard Setting Procedure

Parallel Session: Standard Setting and Score Use; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. ; D2-LP-10

Mingchuan Hsieh*, National Academy for Educational Research, Taiwan

Most standard setting procedures commonly utilize scatter plots or descriptive information such as means and standard deviations as feedback for panelists so they can understand how far their decisions deviate from others. Such descriptive feedback is certainly useful; however, when there are many items to be reviewed in a short timeframe, this information may not be efficient enough for the panelists to quickly identify the most problematic items which should be reviewed first.

When implementing the Yes/no Angoff method, each panelist must determine whether the minimally competent examinees can answer the items correctly based on performance level descriptions. After receiving the feedback, it is difficult for the panelists to review each item again given the limited amount of time. Panelists might want to know which item judgments seem to be aberrant from their other item judgments, and make appropriate corrections. In addition, the standard setting coordinator may desire to know which panelist's judgment seems to be away from other judges and whose judgments seem to have many internal conflicts in order to ascertain which judges require re-training or removal. The purpose of this article is to use Multifaceted Rasch model to quantify the uncertainties of the judges in a criterion references test that is designed as an English assessment test for elementary students. This study also shows how to use the information from Multi-facet Rasch model as feedback for panelists. The Yes/No Angoff procedure was implemented to facilitate the illustration.

Item-Centered Procedures for Standard Setting in the Rasch Poisson Counts Model

Parallel Session: Standard Setting and Score Use; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. ; D2-LP-10

Jorge González, Pontificia Universidad Católica de Chile, Chile
Rianne Janssen*, Katholieke Universiteit Leuven, Belgium
Ernesto San Martin, Pontificia Universidad Católica de Chile, Chile

In some cases of licensure or certification, a standard may be needed for counts data. The present paper proposes two new item-centered procedures for setting a cutoff. Both procedures are based on the Rasch Poisson Counts model (RPCM) developed by Rasch (1980; see also Jansen, 1986, 1995; Jansen & van Duijn, 1992; van Duijn & Jansen, 1995). Judges are asked to give the number of errors that are still admissible for the minimally competent student to make either on each subtest, or on the domain in general. The last judgment is processed by a hierarchical extension of the RPCM on the item side. Both procedures are illustrated with a standard-setting study on spelling.

Setting Cutscores with the Bookmark Method: Internal and External Validation
Parallel Session: Standard Setting and Score Use; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. ; D2-LP-10

Zamri khairani Ahmad*, Universiti sains malaysia, Malaysia
Nordin Abd. Razak, Universiti sains malaysia, Malaysia

The purpose of this study is to establish empirical evidence on both internal and external validity evidence for Basic, Proficient, and Advanced cutscores established from the Bookmark standard setting procedure. The criteria for internal evidence of validity includes consistency within method as well as intra-judge and inter-judge consistency Consistency within method is examined through calculation of the standard error of the cutsores (SEcut) based on cluster sample. Intra-judge consistency was examined through calculation of reliability coefficients for cutscores across rounds. Inter-judge consistency, meanwhile, was examined through investigation of standard deviation of judges?cutscores. This study examined external validity in terms of whether the cutscores were clearly and meaningfully differentiated. The external validity is also examines with regards to the appropriateness of the classification by comparing the mean ability estimates of students in each performance level. Even though the present study provided strong evidence of external validity, mixed results with regards to internal validity especially the lack of agreement among them about the recommended cutscores provided evidence of credibility to the standard setting session, since it may indicate a desired diversity of views provided by the judges. Lesson learned from the study as well as implication from future research will also be discussed.

Communicating Test Scores to Teachers: Moving from Statistics to Use
Parallel Session: Standard Setting and Score Use; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. ; D2-LP-10
Gavin T L Brown*, The Hong Kong Institute of Education, Hong Kong
John Hattie, The University of Melbourne, Australia

Psychometric research focuses on the development of statistically robust scores that accurately reflect an object of interest (e.g., performance, ability, knowledge, or attitude) and the various sources of variance affecting the accuracy of the scores. In contrast, education professionals need to be concerned with the inferences and actions that arise once a statistically-derived score is found. Consequently, just as there is a disjuncture between Psychometrika and Clinicia (Cronbach, 1954), there is a similar disjuncture between Psychometrika and Educa (the world of educational practice). While much is made in the professional Standards for Educational and Psychological Testing (AERA, APA, & NCME, 1999) concerning the dependability of scores, little is said about the nature of reporting scores to educational users (e.g., teachers, administrators, students, or parents). The ultimate validity of a psychometrically-derived score is that the reader of the report makes the correct and appropriate inference and takes appropriate actions based on the assessed scores. Hence, if tests are to contribute to improved education, test developers need to know they have successfully communicated test scores to users.
This paper will report a series of studies conducted in New Zealand with school users of standardised test reports. We will illustrate the importance of communicating, not so much the right score, as the scores in the right way for teaching professionals. This ability depends on understanding the informational needs and professional goals of teachers, the prior knowledge of such test users, and principles of effective communication as touchstones in developing appropriate reports.

Statistical Quality Control Tools and Models in Monitoring Test Scores
Parallel Session: Standard Setting and Score Use; Thursday, 21 July, 1:30 p.m. -- 2:50 p.m. ; D2-LP-10
Alina A. von Davier*, Educational Testing Service, USA

For testing programs that provide a large number of administrations each year, the challenge of maintaining comparability of test scores is influenced by the potential rapid accumulation of errors and by the lack of time between administrations to apply the usual techniques for detecting and addressing scale drift. The traditional quality control techniques have been developed for tests with only a small number of administrations per year, and therefore, while very valuable and necessary, they are not sufficient for catching changes in a complex

and rapid flow of scores. Model-based techniques that can be updated at each administration could be used to flag any unusual pattern. The basis for the paper is recent research conducted at Educational Testing Service. I will provide an application of traditional quality control charts, such as Shewhart and CUSUM charts on testing data, time series models, change point models, and hidden Markov models to the means of scale scores to detect abrupt changes. Some preliminary data mining approaches and results also will be discussed. This type of data analysis of scale scores is relatively new and any application of the aforementioned tools is subject to the typical pitfalls: Are the appropriate variables included? Are the identified patterns meaningful? Are time series models or hidden Markov models suitable for only a particular set of data used in the study or can they be generalized to data from other tests?

Aspects of structural equation modeling
Invited Symposium : Thursday, 21 July, 4:00 p.m. -- 5:20 p.m., D1-LP-03

A Measure of Skewness of Testing for Normality
Shigekazu Nakagawa*, Kurashiki University of Science and the Arts, Japan
Hiroki Hashiguchi, Saitama University, Japan
Naoto Niki, Tokyo University, Japan

The focus of this paper is related to the problem of testing whether an underlying population is normally distributed. As a test statistic under the null hypothesis of normality, we propose a new test statistic based on the Pearson measure of skewness. Pearson measure of skewness is initiated by Karl Pearson and is one of measure of skewness defined by a standardized difference between population mean and mode. Considering Pearson system which includes normal distributions, Pearson measure of skewness becomes a rational function of population skewness and kurtosis. Our proposal statistic is an estimator of this function and is called sample Pearson measure of skewness. We give the asymptotic first four moments of the null distribution for sample Pearson measure of skewness by using a computer algebra system and give its normalizing transformation based on a Johnson system. Power comparisons against some asymmetric alternative distributions are also illustrated.

Applications of asymptotic expansion in structural equation modeling
Haruhiko Ogasawara*, Otaru University of Commerce, Japan

As applications of asymptotic expansion in structural equation modeling, the distributions of parameter estimators in mean and covariance structures are dealt with. The parameters

may be common to or specific in means and covariances of observable variables. The means are possibly structured by the common/specific parameters. First, the distributions of the parameter estimators standardized by the population asymptotic standard errors are expanded using the single- and the two-term Edgeworth expansions. In practice, the pivotal statistic or the Studentized estimator with the asymptotically distribution-free standard error is of interest. An asymptotic distribution of the pivotal statistic is also derived by the Cornish-Fisher expansion. Simulations are performed for a factor analysis model with nonzero factor means to see the accuracy of the asymptotic expansions in finite samples.

Interaction between strategies and invariance/noninvariance conditions in testing for partial invariance in structural equation modeling

Soonmook Lee*, Sungkyunkwan University, Korea
Hanjoe Kim, Tennessee State University, USA

In testing for partial invariance in multi-group analysis of structural equation modeling, there are two contrasting strategies. Once a baseline model (e.g., configural invariance) is established, one may test more restricted models by adopting two alternatives. Strategy 1 is constraining all parameters to be equal across groups and freeing the flagged parameters, one at a time. Strategy 2 is forming models by constraining only one parameter at a time, in addition to the referent parameter, and comparing with the baseline model. In a context of detecting metric noninvariance Strategy 1 worked well when invariance held across groups in majority and worked poorly when noninvariance was in majority (Yoon & Millsap, 2007). In a context of detecting differential functioning items, Strategy 2 was more effective than Strategy 1 (Stark, Chernyshenko, & Drasgow, 2006). Strategies 1 and 2 may interact with invariance/noninvariance observed in majority. A Monte Carlo study was conducted to examine the interaction and to provide practical suggestions for a choice of proper strategy.

Joint Bayesian model selection and parameter estimation for latent growth curve mixture model

Satoshi Usami*, University of Tokyo, Japan

Latent variable models using categorical latent variables can be used to estimate unobserved components (or populations) stratification and clustering. Especially, latent growth curve mixture modeling (LGCMM) enables us to assess the different mean growth trajectories among components, and it has attracted increasing interest in behavioral and psychological science. In the present research, we discuss the issues of joint Bayesian model selection and parameter estimation for LGCMM. As for some of LGCMM that include a proportional parameter and/or a cross-lag parameter (e.g., dynamic latent change score models), not only

estimating the number of unknown components but evaluating equivalence of these parameters among components and/or variables are sometimes a major aim of research, since model misspecification may lead incorrect interpretation for dynamic changes and causal relation among variables. In the simulation study, we compare the accuracy of model selection (i.e., the number of unknown components and the equivalence of proportional and cross-lag parameters) for latent change score models based on various indices and estimation methods such as Bayesian Information Criterion (BIC), Deviance Information Criterion (DIC), posterior predictive P-value and Reversible Jump Markov Chain Monte Carlo (RJMCMC) algorithm. Additionally, the issue of needed sample size to obtain the "meaningful components" (in the sense that researchers are free from obtaining some nonsense artifacts through LGCMM) and real data examples of LGCMM are also addressed in the presentation.

Process models for behavioral dynamics
Symposium : Thursday, 21 July, 4:00 p.m. -- 5:20 p.m., D1-LP-04

Models of dyadic dependence for event sampling data.
Peter F. Halpin*, University of Amsterdam, The Netherlands
Raoul P. P. P. Grasman, University of Amsterdam, The Netherlands
Paul De Boeck, University of Amsterdam & K.U.Leuven, The Netherlands/ Belgium

This paper concerns event sampling data collected on dyads. The events of interest are defined in terms of the individual members of the dyad, for example an observed behaviour or self-reported experience. For each individual and each event of interest, the times at which the event occurs are recorded. These data are represented as chains of time-shifted unit impulses and we refer to each such chain as a temporal pattern. We consider non-stationary point process models in which the probabilities of a target temporal pattern are predicted by specific sub-sequences of other temporal patterns. These sub-sequences are referred to as either self-stimulus sequences or other-stimulus sequences, depending on which member of the dyad they are drawn from. We focus on the identification of other-stimulus sequences that regularly precede or co-occur with the events in a target temporal pattern. The absence of such sequences would indicate independence between members of a dyad, for the events of interest. Both symmetrical and asymmetrical relations are possible and can be useful in describing and summarising interpersonal dynamics. Estimation and assessment of model fit are detailed for the case where a single dyad is observed. Extensions are suggested.

Structural relations underlying multivariate event sequences

Raoul P. P. P. Grasman*, University of Amsterdam, The Netherlands
Peter F. Halpin, University of Amsterdam, Netherlands

Research on dynamics in psychological processes is gaining more and more attention in psychology. Most time series models in use fall in the category of auto-regression and/or moving average models (formulated as such or in the state-space framework), and come with or without nonlinear components (e.g., by introducing thresholds or switching between multiple states). Some sequences however, consist of measurement of times (response times, event scoring, etc.) instead of measures that vary orthogonally to the time axis. While not always recognized (e.g., in analyzing oscillatory components in response time sequences), the most natural class of stochastic models for these series are point processes. We will consider linear structural relations between point processes for analyzing multivariate event data and the advantages and disadvantages of time- and frequency domain approaches.

Hierarchical diffusion models for intensive longitudinal data analysis

Francis Tuerlinckx*, K.U. Leuven, Belgium
Zita Oravecz, K. U. Leuven, Belgium
Joachim Vandekerckhove, K. U. Leuven, Belgium

Multivariate intensive longitudinal panel data often arise in psychology through experience sampling studies in which subjects are measured in their daily life. Or more technically, a sample of subjects is examined on several variables at a relatively large number of unequally spaced time points. In this talk we discuss hierarchical diffusion models that can be used to analyze such data (see Oravecz, et al., 2011). The basic aspects of the model will be explained (interpretation, the inclusion of time-invariant and time-varying covariates). In addition, we will discuss further aspects such as a new variance decomposition identity based on this model, possible problems with random effects extensions and the relation to existing models. Finally, a newly developed software tool is introduced.

Sequential order based GLMMs for random person and item effects

Paul De Boeck*, University of Amsterdam & K.U.Leuven, The Netherlands/ Belgium

The multiple item response profile (MIRP) model is a model with two or more random person variables and two or more random item variables. When applied to item response data from time 1 to time T, T random person variables and also T random item variables can be defined, so that two covariance structures result, one for the persons and one for the items. A multivariate normal distribution is assumed for both. Based on Generalized Linear Mixed Model (GLMM) versions of the MIRP model, various constraints stemming from the

sequential order can be imposed on the model. The approach will be applied to a short time series of data from the Outcome Questionnaire (OQ, Lambert et al., 2003) with 45 items presented in a psychotherapy context to assess improvements in mental health. It will be explained how the model can be estimated with the lmer function of the lme4 package in R. Extensions to a multidimensional model for panel data will be considered.

A Joint Model for Item Response and Response Times Based on the Relationship Between Accuracy and Speed of Test Takers
Parallel Session: Response Time and Equating; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Xiang Bin Meng*, Northeast Normal University, China
Jian Tao, Northeast Normal University, China
Ning-Zhong Shi, Northeast Normal University, China

With the introduction of computerized test, the record of response times has become quite common. In order to model the relationship between speed and accuracy appropriately, the concepts of speed and relative speed were defined explicitly in this article. Then, we proposed a model framework for responses and response times on test items which incorporates a covariance structure to explain the dependency between speed and accuracy within items. It is shown how all parameters in this model can be estimated by a Markov chain Monte Carlo (MCMC) method. The Congdon's version of AIC and BIC and deviance information criterion (DIC) were developed for comparing model fit among models with different covariance parameters, which are easily calculated as byproducts of the MCMC computation. The posterior predictive model checking (PPMC) methods were used to evaluate the fit of the model. Finally, the performance of our approach is illustrated by means of a simulation study and an empirical example.

Modeling Response Time in Computerized Testing Using Semi-parametric Linear Transformation Model
Parallel Session: Response Time and Equating; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Chun Wang*, University of Illinois at Urbana-Champaign, USA
Hua-Hua Chang, University of Illinois at Urbana-Champaign, USA
Jeffrey Douglas, University of Illinois at Urbana-Champaign, USA

The item response times (RTs) collected from computerized testing represent an underutilized type of information about items and examinees. In addition to knowing the examinees' responses to each item, we can investigate the amount of time examinees spend

on each item. Current models for response times are focused on parametric models, which have the advantage of conciseness, but may suffer from a reduced flexibility to fit real data. We propose a semi-parametric approach, i.e., the linear transformation model with a latent speed covariate, which combines the flexibility of nonparametric modeling and the brevity as well as interpretability of the parametric modeling. In this new modeling approach, the RTs, after some non-parametric monotone increasing transformation, become a linear model with latent speed as covariate plus an error term. The distribution of the error term implicitly defines the relationship between the RT and examinees' latent speeds; whereas the non-parametric transformation is able to describe various shapes of RT distributions. In fact, the linear transformation model represents a rich family of models that include the Cox proportional hazard model, Box-Cox normal model, and many other models as special cases. A Markov chain Monte Carlo method for parameter estimation is given, and may be used with sparse data obtained by computerized adaptive testing. In addition, the stepwise estimation for the non-parametric transformation is provided.

The Impact of Different Settings of Missing Value Options in WINSTEPS and PARSCALE on IRT Equating or Linking
Parallel Session: Response Time and Equating; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Zhiming Yang*, Educational Testing Service, USA
Maolin Ye, Management School of Jinan University, China
Ming Xiao, Partory School of Business, China

WINSTEPS® and PARSCALE® are often used for estimating parameters, scaling, and equating or linking. The impact of different settings of missing value options in WINSTEPS and PARSCALE upon the accuracy of the parameter estimates and the resulting equating or linking is examined through simulation studies. Several findings are established or confirmed. Recommendations, as well as some caveats regarding the settings of missing values in WINSTEPS and PARSCALE, are given in the conclusion.

A Bayesian Approach to Concurrent Calibration Analysis for Non-equivalent Groups with Anchor Test Design
Parallel Session: Response Time and Equating; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Lin-shan Yang*, ShenZhen Seaskyland Educational Evaluation Co.,Ltd
Yan Liu, ShenZhen Seaskyland Educational Evaluation Co.,Ltd
Chen Yang, ShenZhen Seaskyland Educational Evaluation

The primary purpose of this study was to explore the performance of bayesian approach to IRT concurrent calibration methods for NEAT (non-equivalent groups with anchor test) design. For a real data, six bayesian methods with different parameter priors of 2-parameter logistic model (2PL) and different missing data techniques (MDTs) were be used to obtain IRT parameters simultaneously. Comparelly, the real data was run by BILOG-MG to get a common merit. For method 1, the item difficulty had a standard normal distribution prior (the mean and standard deviation was zero and one, respectively), the responses not taken by particular group were regarded as not reached and noted 'NA' in WinBUGS. Similar to method 1, the item difficulty of method 2 had the same distribution prior, but missing responses were not conducted. For method 3, the subject ability had a standard normal distribution prior, and the missing responses were noted 'NA'. Compared to method 3, missing responses of method 4 were not conducted. For the last 2 methods, method 5 and method 6, both of item difficulty and subject ability had standard normal distribution priors, but missing responses were noted as 'NA' and not conducted , respectively. For each method, the item difficulty and subject ability parameters of each group were compared. The results showed method 1 and method 2 performed exactly and differed from another methods. It also suggested that method 3, method 4, method 5 and method 6 obtained the same parameters estimation. It should be recommended that method 7 (run in BILOG-MG) distinguished significantly from all methods above. So It was known that the parameter estimations of the all methods were affected by ability parameter prior, while the effect of missing data techniques was relatively small and could be ingnored .

Small N and Utility of An Extended Circle-Arc Equating Method
Parallel Session: Response Time and Equating; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-06
Jaehoon Seol, Prometric, USA
Shungwon Ro*, Kenexa, USA
Sarah Hagge, National Council of State Boards of Nursing, USA
Seonho Shin, Prometric, USA

There has been increasing demand for equating multiple test forms with small sample size in the certification and licensure testing settings. A circle-arc method by Livingston and Kim (2009) seems to provide a good solution addressing the small sample size issue. Based on a resampling study, they recommend the circle-arc equating method over 1) conventional mean equating for small N cases, 2) linear equating for situations with test forms in different difficulty and 3) equipercentile equating for small N and scarcity of data at the extremes of the score distribution.

There is also growing interest of preserving pass rates in many certification/licensure testing programs, in particular those small-scale programs with candidate volume of 20 – 250 per administration/testing window. This study introduces a new method, an extended circle-arc equating, to address the issue of preserving pass rates. With an introduction of a control parameter h, a resampling study with small N confirms Livingston and Kim's results – better performance over mean, linear and equipercentile equating. This study also proves utility of the new, extended circle-arc equating method for credentialing programs, requiring two conditions: 1) preserving the pass rates over time and forms and 2) small N, mainly for concerns over public relations.

The Wellbeing of Creepies and Crawlies on The Sea Bed: A Three-Way Correspondence Analysis
Parallel Session: Categorical Data Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Pieter M. Kroonenberg*, Leiden University, Netherlands

In ecology large contingency tables are produced in experiments to investigate the influence of man on animal life. Widdicombe & Austin subjected 98 buckets with homogenized sediment from the Oslofjord to a 7x7 design of organic enrichment and physical disturbance The effect on the biodiversity of the factors and their interaction was examined via three-way correspondence analysis using 3WayPack (Kroonenberg, 2008; Kroonenberg & De Roo, 2010).

An Extension of Proportional Odds Models: Using Generalized Ordinal Logistic Regression Models for Educational Data
Parallel Session: Categorical Data Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Xing Liu, Eastern Connecticut State University, USA
Jiarong Zhao*, Nanjing Normal University, China
Wei Xia, University of Connecticut, USA

The most well-known model for estimating the ordinal dependent variable might be the proportional odds (PO) model (Agresti, 1996, 2002, 2007; Armstrong & Sloan, 1989; Long, 1997, Long & Freese, 2006; McCullagh, 1980; McCullagh & Nelder, 1989; O'Connell, 2000, 2006; Powers & Xie, 2000). In this model, the effect of each predictor is assumed to be the same across the categories of the ordinal dependent variable. However, the assumption of proportional odds is often violated, since it is strongly affected by sample size and the number of covariate patterns (e.g., including continuous covariates as the

predictors) (Allison, 1999; Brant, 1990; Clogg & Shihadeh, 1994). It is misleading and invalid to continue to interpret results if this assumption is not tenable.
To deal with this issue, the partial proportional odds (PPO) model (Anath & Kleinbaum, 1997; Peterson & Harrell, 1990; O'Connell, 2006) and the generalized ordinal logit model (Fu, 1998; William, 2006) were developed. In educational research, the PO model is widely used. However, the use of the generalized ordinal logit model seems to be overlooked. Therefore, it is imperative to help education researchers better understand this model and utilize it in practice. The purpose of this paper is to illustrate the use of generalized ordinal logistic regression models, which allow the effect of each explanatory variable to vary across different cut points, to predict mathematics proficiency levels using Stata, and compare the results of fitting the PO models and the generalized ordinal logistic regression models.

Maximum Likelihood and Weighted Least Square Estimators in Estimating Nature-Nurture Models
Parallel Session: Categorical Data Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
I-Hau Hsu *, National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

The study is to examine performance of an adjusted Weight Least Square method and a Maximum Likelihood Estimator for estimating Nature-or-Nurture models. The "nature or nurture" model (Galton, 1875) can quantitatively evaluate the genetic behavioral effects and can be critical in many psychometrical applications also. The Weighted Least Square method to be employed is the Weight Least Square with Mean and Variance adjustment (WLSMV, Muthen, do Toit, & Spisic, 1997) that was shown to have robustness in estimating categorical data (Muthen et al., 1997). Meanwhile, the Maximum Likelihood estimator, multinomial threshold ML (MLT), is shown in Neal and Martin (1989) for estimating categorical variables. Less was studied in examining the two new methods in estimating the Nature-or-Nurture models. The current study conducts Monte Carlo experiments in evaluating performance of the two estimators in analyzing simulated Nature-Nurture models under various sample sizes (e.g., 100, 200, …) and model parameters (e.g., λ1:0.8 ,λ2:0.3, λ3:0.52). Using RMSEA (Browne & Cudeck, 1993) as model fit index and performance criteria, results show the two estimators differ in some experimental conditions and provide interesting and practical guidelines. Conclusions and suggestions will be outlined in the conference presentation and final research reports.

Predicting Discrete Macro-Level Outcome Variables with Micro-Level Explanatory Variables: A Latent Class Approach
Parallel Session: Categorical Data Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Margot Bennink*, Tilburg University, Netherlands
Marcel A. Croon, Tilburg University, Netherlands
Jeroen K. Vermunt, Tilburg University, Netherlands

Croon and van Veldhoven proposed a statistical model to predict outcomes at the macro-level (e.g. team performance) from explanatory variables at the micro-level (e.g. employee's motivation and skills). A factor analytic structure is used in which the scores of the lower-level units are seen as indicators of latent factors at the group level. The outcome variable is not regressed on the aggregated group mean(s) of the micro-level predictor(s) but on the latent macro-level variable(s). The main limitation of the approach is that the outcome variables should be continuous and normally distributed and that the relationships should be linear. When the outcome variables are discrete, these assumptions are obviously violated and in this case a latent class model can be used instead of a factor analytic model. Two basic models with discrete outcomes and two ways to obtain maximum likelihood estimates of these models are presented. Maximum likelihood estimators can be obtained with the "persons as variables" approach or by treating the models as two-level regression models with multivariate responses. In a simulation study the latent class approach is compared to more traditional approaches namely disaggregation of the macro-level outcome to the micro-level and aggregating the micro-level variable to the macro-level.

Within-Subject Analysis of Variance and Generalized Linear Mixed Models for Binary Outcome
Parallel Session: Categorical Data Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-07
Ehri Ryu*, Boston College, USA

Within-subject experimental design is popular in psychological experiments. Often the experiments involve binary outcome (e.g., recognition task). Many researchers still adopt analysis of variance (ANOVA) technique for analyzing such data. Binary outcome variables do not satisfy underlying assumptions of ANOVA. Generalized linear models provide more flexibility to handle alternative forms of outcomes. Within-subject design adds an additional complexity because the assumption of independent observations is violated. In order to appropriately handle binary outcome from within-subject design, multilevel extension of generalized linear models are required. I will conduct a simulation study to compare the

performances of the conventional within-subject ANOVA and two SAS procedures – GLIMMIX and NLMIXED – for generalized linear mixed models under various conditions. The purpose of the study is to examine how robust within-subject ANOVA is when applied to binary outcome, and to identify conditions in which within-subject ANOVA is robust and those in which applying ANOVA becomes problematic.

Exploratory Bi-Factor Analysis
Parallel Session: Factor Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08
Robert I. Jennrich, University of California at Los Angeles, USA
Peter Bentler*, University of California at Los Angeles, USA

Bi-factor analysis is a form of confirmatory factor analysis originally introduced by Holzinger. The bi-factor model has a general factor and a number of group factors. The purpose of this paper is to introduce an exploratory form of bi-factor analysis. An advantage of using exploratory bi-factor analysis is that one need not provide a specific bi-factor model a priori. The result of an exploratory bi-factor analysis, however, can be used as an aid in defining a specific bi-factor model. Our exploratory bi-factor analysis is simply exploratory factor analysis using a bi-factor rotation criterion. This is a criterion designed to produce perfect cluster structure in all but the first column of a rotated loading matrix. Examples are given to show how exploratory bi-factor analysis can be used with ideal and real data. The relation of exploratory bi-factor analysis to the Schmid-Leiman method is discussed.

The Infinitesimal Jackknife with Exploratory Factor Analysis
Parallel Session: Factor Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08
Guangjian Zhang*, University of Notre Dame, USA
Kristopher J. Preacher, University of Kansas, USA
Robert I. Jennrich, University of California at Los Angeles, USA

The infinitesimal jackknife (IJK), a nonparametric method for estimating standard errors, has been used to obtain standard error estimates in covariance structure modeling. The IJK automatically accommodates non-Gaussian data and model mis-specification. In this paper, we adapt it for standard errors of rotated factor loadings and factor correlations of exploratory factor analysis with sample correlation matrices. Both maximum Wishart likelihood estimation and ordinary least squares estimation are considered.

One-Stage Rotation Method for Second-Order Factor Analysis
Parallel Session: Factor Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08

Hsing-Chuan Hsieh*, National Chung Cheng University, Taiwan
Chung-Ping Chen , National Cheng Kung University,Taiwan

Traditionally, when dealing with second-order factor analysis, analysts first extract the first-order factors after the oblique rotation and then regard them as the new observed variables in order to extract the higher-order factors. This conventional procedure will cause problems, however, when in practice the analysts only focus on the second-order factors whose number is clear but didn't know the exact number of the first-order ones. Since the higher-order factors are determined by the first-order ones, if the selection for the first-order factors is inappropriate, then the selection for the second-order ones might not be expected suitable either. As a result, in order to extract the most suitable second-order factors, analysits might have to analyze the data for many times, each time with different possible number of first-order factors. This thus leads to my following research whose purpose is to extract all factors of both orders at a time for the sake of efficiency for the procedures. Speaking technically, I'd like to redefine a criterion for the simultaneous rotations for the two-order factors. We also demonstrate the efficiency of the renewed criterion by analyzing both the artificial as well as the real data.

Oblique Rotation Techniques with Clustering Of Variables
Parallel Session: Factor Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08
Michio Yamamoto*, Osaka University, Japan

Two new oblique factor rotation methods are proposed. The first one is a method which intends to find a simple structure in a factor loading matrix using prior information about the cluster structure of variables, and the second is a method which aims to find a simple structure and classify variables into optimal clusters simultaneously. A criterion consisting of the complexity of a factor loading matrix and the between-cluster dissimilarity is optimized using the GP algorithm and the k-means algorithm. Artificial and real data analyses demonstrate that the proposed methods can give a better simple structure and produce more interpretable results compared with those of widely known rotation techniques.

Dimensionality Assessment of Ordered Polytomous Items with Parallel Analysis
Parallel Session: Factor Analysis; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D1-LP-08
Marieke E immerman*, University of Groningen, Netherlands
Urbano Lorenzo-Seva, Rovira i Virgili University, Spain

Parallel analysis (PA) is an often recommended approach to assess the dimensionality of a variable set. PA is known in different variants, which may yield different dimensionality indications. We consider the most appropriate PA procedure to assess the number of common factors underlying ordered polytomously scored variables. As extraction method, the authors propose minimum rank factor analysis (MRFA), rather than the currently applied principal component analysis (PCA) and principal axes factoring (PAFA). A simulation study, based on data with major and minor factors, shows that all procedures consistently point at the number of major common factors. A polychoric based PA slightly outperformed a Pearson based PA, but convergence problems may hamper its empirical application. In empirical practice, PA-MRFA with mean threshold based on Polychoric correlations, or in case of non-convergence Pearson correlations with 95% threshold, appears to be a good choice to identify the number of common factors. PA-MRFA is a common factor based method, and performed best in our simulation experiment. PA based on PCA with 95% threshold is a second best, as this method showed good performances in the empirically relevant conditions.

Comparisons between the Universal Sampler and the Slice Sampler
Parallel Session: Computational Methods; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08
Jianhui Ning*, Central China Normal University, China
Yuchung Wang, Rutgers University, USA

We devise a simple algorithm to generate independent and identically distributed samples from the kernel of a probability density function without the normalizing constant. This approach generates samples from the exact, not approximate, target distribution, and it is applicable to both univariate and multivariate distributions. Thus, we name it the universal sampler. In the talk, we will explain (a) how the samples are generated; (b) its accuracy in sampling some of the commonly used distributions, such as normal, chi-square, and exponential; (c) its performance to sample some custom-made distributions. Because the slice sampler is also designed to draw (Markov-dependent) observations from any density function, we make comparisons between the two methods. The three examples from the book of Robert and Casella (2004, P.326-333) are used to illustrate the performance of the universal sampler. The comparisons are restricted to one-dimensional distributions. Multivariate generalization will be briefly mentioned.

An Evaluation of Algorithms on Generating Multivariate Non-Normal Data
Parallel Session: Computational Methods; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08

Hao Luo*, Uppsala University, Sweden
Fan Yang-Wallentin, Norwegian School of Management, Sweden

Non-normal variables are common in many empirical investigations in the social and behavioral sciences. Monte Carlo simulations requiring correlated data from non-normal populations are frequently used to investigate the small sample properties of competing statistics or the robustness of estimation methods. However, generating multivariate non-normal data with specified correlation matrices and marginal skewness and kurtosis is difficult. In this study, the following four algorithms are evaluated regarding their ability to generate multivariate non-normal distributions: Vale & Maurelli's multivariate extension of the Fleishman method, Headrick & Sawilowsky's (1999) refinement for calculating the intermediate correlations based on Vale & Maurelli (1983), Headrick's (2002) fifth-order polynomial transformation and Ruscio & Kaczetow's (2008) iterative algorithm. We empirically test the applicability of these algorithms in a Monte Carlo simulation. Algorithms are compared in terms of simplicity, generality, and reliability of the technique. The empirical size and power of some recently proposed tests for multivariate normality are also studied using generated non-normal samples. Based on the simulation results, recommendations regarding the application schemes of these algorithms are provided for applied researchers.

Bootstrap Confidence Intervals for the Meta-analysis of Correlations Corrected for Indirect Range Restriction
Parallel Session: Computational Methods; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08

Johnson Ching Hong Li*, University of Alberta, Canada
Ying Cui, University of Alberta, Canada
Mark J. Gierl, University of Alberta, Canada
Wai Chan, The Chinese University of Hong Kong, Hong Kong

The meta-analysis of Pearson correlations between two quantitative variables is commonly used to synthesize results published in a collection of primary studies conducted by independent researchers. These correlations, however, are typically subjected to indirect range restriction (IRR), thus resulting in biased estimators of their true population values. To correct for the bias, Hunter and Schmidt (2004) proposed a meta-analytic correlation corrected for IRR (i.e., HSir) and the associated confidence interval (i.e., HSirCI). In this paper, we evaluate the performance of the HSir and HSirCI, using two Monte Carlo simulation studies. The first generated data based on the fixed-effects model in which the population correlations across studies were set to be identical. The second generated data

based on the random-effects model in which the population correlations across studies were randomly selected from a "superpopulation". The manipulated factors include the number of primary studies, magnitude of population correlations, selection ratio, and variability of restricted sample sizes in primary studies. Results showed that the HSir was accurate but not the associated HSirCI. Hence, we propose a unified bootstrap procedure to construct the confidence intervals of the HSir in a meta-analysis study, as this procedure is found to be desirable for the correlation corrected for IRR in a single study (Li, Chan, & Cui, 2010). Results show that the proposed bootstrap confidence intervals improve the accuracy of the HSirCI in terms of their coverage probabilities. Implications of the proposed bootstrap procedure are also discussed.

Application of Bootstrap Methods In Psychological Research
Parallel Session: Computational Methods; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-08
Qingqing Xiong*,South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

In educational and psychological research and measurement,the traditional overreliance on statistical significance testing has been challenged on several grounds,including the sample size issue,the meaningfulness of the traditional null hypothesis,and questions involving the validity of theoretical assumptions underlying parametric statistical inferences.Instead of traditional method that rely on theoretical assumptions derived the sampling distribution of statistics , bootstrap selects experience distribution to estimate the distribution, and uses the observation data sampling sample information to estimate the statistical model.So the method avoids some of pitfalls of the traditional statistical significance testing. This analysis method is mainly used in social studies parameters and the standard error estimation, interval estimation, psychological measurement of the reliability analysis, mediation effect, describe sample results stability and reliability, and psychological statistics of correlation analysis and regression analysis, factor analysis. This paper reviews the application of the method in domestic and foreign psychology research, which indicates that, Bootstrap analysis,both as a tool for nonparametric statistical inference and as a tool for describing sample results stability and replicability.In respect of future development in the psychometric application, the method will be combined with other theoretical frameworks of measurement.

Quantitative Neurocognitive Measurements of Procedural and Conceptual Knowledge of Spatial Ability

Parallel Session: Test Development and Validation - Ability Measures II; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09

Ting-Yao Liao*,National Taichung University, Taiwan
Chih-Chien Yang, National Taichung University, Taiwan

To explore the connection between procedural and conceptual knowledge of spatial abilities in elementary levels, this research create a spatial ability task to measure the neurocognitive developments. Wai, Lubinski, and Benbow (2009) proposed that spatial ability is a critical ability in STEM (science, technology, engineering, and mathematics). They also concluded that spatial ability could be influential in student selection, curriculum design and in additional educational applications. The current study extends Wai et al.'s (2009) research to examine spatial abilities by using quantitative neurocognitive assessment instruments.The proposed instruments are created by modifying Feng's (2005) behavioral assessments of spatial ability for elementary students. Thirty-two 4th grade elementary students were recruited to join the neurocognitive assessments. Using E-prime to collect the quantitative neurocognitive datasets.This research discovered the positive connection between procedural and conceptual knowledge by analyzing the datasets. Interestingly, differences in student educational background are found as well as gender effects. Conclusions, interpretations and empirical suggestions for assessing spatial abilities in STEM as supports to Wai, Lubinski, and Benbow (2009) will be provided at the end of the study.

Establish an Adaptive Diagnostic Test System for "Calculus" Using "Finding Area By Integral" Unit as an Example

Parallel Session: Test Development and Validation - Ability Measures II; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09

Bor-Chen Kuo, National Taichung University , Taiwan
Mu-Yu Ting, National Formosa University, Taiwan
Hsiang-Chuan Liu, Asia University, Taiwan
Yu-Lung Liu*, Asia University, Taiwan

The purpose of this study is to develop a polytomous assessment model of adaptive diagnostic test system based on the Order Theory. In this study, we establish a diagnostic test system in the topic of "finding area by integral" and analyze its functional efficiency. Most diagnostic tests are shown in multiple choices. However, our system is designed for added constructed-response items in Calculus and adaptive propose. We will expect their misconceptions can be more precisely diagnosed.

A paper-and-pencil test was conducted on 159 university freshmen. Moreover, we can not only analyze the misconceptions, but also structure students' knowledge structure from the data. The diagnostic test system can provide the learning status of students.
This study uses the real data to simulate the computerized adaptive testing procedure. The system can save 70% of number of questions when the accuracy is 0.95, and can save 80% when accuracy is 0.9.
The experimental results show that the proposed methods improve the effect of saving time and remedial instruction. The system can diagnose misconceptions and offer remedial instruction to increase the effect of learning.

Standardization of Test Battery for Diagnostics of Motor Laterality Manifestation
Parallel Session: Test Development and Validation - Ability Measures II; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09
Martin Musalek*, Charles University, Czech Republic

The aim of this study was validation of new test battery for diagnostics of motor laterality manifestation for mentally well adult population. Diagnostics tool was administered to a sample of 400 designed selection high school students in the age of 17-19 (176 men and 224 women) from capital city of Czech republic, Prague. Whole test battery contains questionnaire part for hand and foot preference; task part for hand, foot preference and eye dominance; and proficiency part for diagnostics of fine motor of upper and lower limbs and accuracy of eye. Confirmatory factor analysis demonstrated that the structure of motor laterality manifestation with two general factors (preference and proficiency) led to a more refined measurement of the latent constructs of handedness, footedness and eye dominance. Reliability measured as Cronbach`s coefficient alpha and McDonald`s coefficient omega was between .84 and .95 for all sub constructs.

Expert Judgment for Content Validity: A Study of a Malaysian University Listening Skill Entrance Test
Parallel Session: Test Development and Validation - Ability Measures II; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09
Elia Md Johar*, MARA University of Technology (UiTM), Malaysia
Ainol Madziah Zubairi, International Islamic University Malaysia (IIUM), Malaysia
Mohamad Sahari Nordin, International Islamic Malaysia (IIUM), Malaysia

This paper presents the findings of a study of content-related evidence of a listening skill test that is used as part of a university entrance requirement. Coined on Bloom's theoretical cognitive complexity, a national level listening comprehension test is developed to gauge

the candidates' mastery of listening comprehension ability upon entering degree programs. The study employed the item rating procedures involving four content experts in the teaching and testing of English as a second language. The expert raters were subjected to rate the relevance and representativeness of the listening content domain of each of the 20 items in the listening test. Spearman's rho values were averaged and exhibited low interrater reliability. The traditional item-objective congruence method (Hambleton, 1984) was applied to determine whether each item had one valid listening objective. However, items were found to be measuring multiple objectives and therefore adjusted item-congruence equation (Turner & Carlson, 2002) was conducted. The analyses indicated that of the 20 items, 9 items were rated as multiple objectives and there was a perfect agreement that these items were basically testing the lowest cognitive level, i.e. knowledge. It was also found that 8 of the items should be considered for revision while one should be eliminated for lack of clarity of the objectives that they were supposed to measure. This paper discusses the findings of this study in relation to the utility of the Bloom's taxonomy for curriculum and test development.

A Simulation Study of Qmatrix Design to CAT Strategies for Cognitive Diagnosis
Parallel Session: Computerized Adaptive Testing and Cognitive Diagnosis Modeling; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Chun-Hua Chen*, National Taichung University, Taiwan
Bor-Chen Kuo, National Taichung University, Taiwan
Chih-Wei Yang, National Taichung University, Taiwan

In recent years, cognitive diagnostic models (CDMs) has been growing rapidly, which can diagnose examinees' mastery status of ability or specific areas. Many researchers also work on developing models and doing researches in practical application. Combining CAT with CDMs (called CD-CAT) that can diagnose latent classes of examinees is the important research topic in the literature. The Q matrix for test construction of cognitive diagnostic assessment is important. If each item measures more attributes, it may affects the estimation. Therefore, the purpose of this study is to investigate the effectiveness of estimation of DINA-based CD-CAT using Q matrices with different item parameters and expected number of attributes measured per item. We compare four item selection methods including the Random selected KL algorithm based on Kullback–Leibler information、SHE algorithm based on Shannon entropy and posterior-weighted KL(PWKL).
The experimental results as follow :
(1) The accuracy of estimation is better when the slipping and guessing parameters are lower.

(2) The accuracy of estimation is better when the expected number of attributes measured per item is smaller.
(3) The accuracy of the SHE item selection method is better when the slipping and guessing parameters are set at 0.05 or 0.25; The accuracy of the PWKL item selection method is better when the slipping and guessing parameters are generated from a Uniform(0.05, 0.25) distribution.

The Exploration of Item Selection Strategy for Cognitive Diagnosis_Computerized Adaptive Test
Parallel Session: Computerized Adaptive Testing and Cognitive Diagnosis Modeling; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Zhiyong Shang*, Jiangxi Normal University, China
Shuliang Ding, Jiangxi Normal University, China

A new item selection strategy in computerized adaptive testing with cognitive diagnosis(CD_CAT) is proposed in this paper to solve the problem that the size of item bank restricts the speed of item selection during the course of testing . The new method which calculate the expected pattern match rate (PMR) directly. Compared with Shannon's Entropy method or Kullbak_Leiber method,the experimental results show that this new method not only improves the measurement accuracy, but also increases the speed of item selection a lot .he new item selection strategy is achieved as follow: Firstly the item pool is partitioned to some sTub-pools according to the attribute pattern contained in the items , and the sub-pool parameters calculated as the mean of the items in the sub-pool before testing. Secondly, the "best" item set which based on the expected PMR is seached ; lastly , a item randomly or a item which has the highest rate of Shannon's Entropy from "best" item set for test in next step is selected .It increases the speed of item selection and keeps or improves the PMR by using the new strategy.

Controlling Item Exposure in Cognitive Diagnostic Computerized Adaptive Testing
Parallel Session: Computerized Adaptive Testing and Cognitive Diagnosis Modeling; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Xiuzhen Mao*, Beijing Normal University, China
Tao Xin, Beijing Normal University, China

Cognitive diagnostic computerized adaptive testing (CD-CAT) is based on the cognitive diagnostic theory. It provides the advantages and disadvantages of each student's knowledge state immediately after it administers a few items to the examinees. So, it is important to study and put CD-CAT into practice.

It is an important issue in computerized adaptive testing (CAT) that how to control item exposure, because item-exposure rates have a strong effect on test security and construction of item bank. Until now, researches on item selection rules in CD-CAT are primarily focus on putting forward and comparing item selection indexes. However, there are few research reports about controlling item exposure.

This study applies two item selection methods to control item exposure in CD-CAT. One is the stratified multistage item selection rule. In this approach, based on values of item selection index, the items in the item bank are stratified into a number of levels before it selects each item. The other is the generalized Monte Carlo method. Compared with some maximum item selection index (MISI) methods, the computer simulations experiments show that: (a) the stratified multistage method increases the exposure rates of most items and produces widely distributed item exposure; (b) the generalized Monte Carlo method greatly diminishes the maximum exposure rate and results in narrow distribution of item exposure. In a word, the two methods control item exposure well and raise the utilization rates of item pool considerably, but do not lower the correct classification rates of knowledge state obviously.

The Comparison of Item Selection Methods in Diagnostic Computerized Adaptive Tests using Rule Space Model

Parallel Session: Computerized Adaptive Testing and Cognitive Diagnosis Modeling; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10

Jian-Bing Wen*, East China Normal University, China

The computerized adaptive testing (CAT) has been moved from research to implementation during the early 1990s accompanied advances in computer technology and psychometrics (Weiss & Schleisman, 1999). In computerized adaptive tests, items were adaptively selected by computer according to examinees' responses to previously administered items. Computerized adaptive tests can estimate test takes' ability more accurately and efficiently than paper and pencil tests do. But most CATs are doing no more than giving grade or rank to students. Diagnostic testing was on the other end of testing. They can provide students more useful information by describe the presence or the absence of his skills. In this study we try to incorporating rule space model into CAT to set up a diagnostic computerized adaptive test.

Item selection methods in diagnostic CAT is different from which used in traditional CAT. Four item selection methods--Shannon Entropy Method (SH), Utility Score Method 1 (U1),Utility Score Method 2 (U2) and the Kullback-Leibler Information Method (K-L)--is compared in this study. The evaluation criterion is their efficiency in ability estimation using rule space model. In order to calculate and compare the accuracy of examinees'

attribute estimation, the Monte Carlo simulation method was used in both sets of studies. the detailed statistics and analyses will be presented in the Annual Meeting. Plots of exposure rate distribution for the items will also be provided too.

Computerized Classification Testing Under the DINA Model
Parallel Session: Computerized Adaptive Testing and Cognitive Diagnosis Modeling; Thursday, 21 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-10
Jyun-Ji Lin*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong
Shu-Ying Chen, National Chung Cheng University, Taiwan

The DINA model has been developed to assess whether or not examinees have mastered the latent binary attributes. In recent years, computerized adaptive testing (CAT) under the DINA model has been developed to make cognitive diagnosis assessment more efficient. However its accuracy is not very satisfied. The DINA model and CAT are very different concepts, because the former focuses on classification of latent binary attributes but the latter on estimation of latent continuous traits. In this study, we proposed computerized classification testing (CCT) under the DINA model, because CCT is more in line with the DINA model than CAT. A series of simulations were conducted to reveal the advantages of CCT over CAT. Three independent variables were manipulated: (a) procedure (CCT and CAT); (b) ability distribution of population (normal and uniform). The dependent variables were classification rate and test length required. Item selection was based on the KL information. The results show that CCT yielded a higher correct classification and required a shorter test than CAT, suggesting CCT under the DINA model is feasible.

The Application Exploration of Survival Analysis Method in Psychological research
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Chuan Chen*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China

This paper briefly describes the basic theory of survival analysis; based on the complete Wechsler test through the Child Survival Analysis, It can illustrate the feasibility of Applied in Psychology. And survival analysis with the traditional regression method and the traditional OLS, Logistic regression analysis compared with survival analysis techniques can better handle censored data, estimation error reduction; it also can handle time-varying explanatory variable effect.

Applying MCMC Algorithm in Estimating Variance Components for Generalizability Theory
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Kaiyin Guo*, South China Normal University, China
Min-Qiang Zhang, South China Normal University, China
Guangming Li, South China Normal University, China

Markov Chain Monte Carlo (MCMC) method, as a dynamic computer simulation technique, was first applied in psychometrics field in 1990s. To an extent, generalizability theory (GT) can be view as a combination of classical test theory and analysis of variance procedures. It helps to untangle different sources of error so that the efficiency of the measurement can be improved. As a result, the estimation of variance component is the key to GT. This paper summarized some studies about applying MCMC method on the estimation of variance component for GT. First, MCMC algorithm can be used in estimating the variability of estimated variance components for GT. The results show that, compared with other methods (Traditional, Bootstrap and Jackknife methods), it is quite suitable to apply MCMC method with prior information in estimating standard errors and confident intervals. Second, in GIRM (Generalizability in Item Response Modeling), which connects sampling model of GT with scaling model of IRT, the application of MCMC algorithm can separate the interaction of person and item from other residual errors in the p×i design, which has developed and extended the traditional estimating method of variance components for GT. Last but not least, using MCMC method to deal with missing data can avoid the information loss and improve the effectiveness of the measurement. In the view of these studies, applying MCMC algorithm in estimating variance components for GT is the main direction of its basic research.

The Criteria and Analysis of Subjective Assessments in Testing
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Rui Xiang*, Teachers College Columbia University, USA

The study intends to build a new statistical model to evaluate the subjective assessments such as essay scoring or oral tests, based on the quality control theory from industry statistics. We often see more than one scorer give subjective judgments to a test taker but it is sometimes not equal enough. For example, if only a part of the scorers are selected to give assessment on a test taker, different combinations of scorers may give different results. The purpose of my study is to provide a relatively equal and objective assessment to these subjective tests. The scores are assumed from a normal distribution with missing data. By applying the 3σ or 2σ principle, I build a statistical process and construct a control criterion for all the scores. If there is any outlier of the scores that goes beyond the range, the outlier score is considered inappropriate for its test taker. If outliers exist, then I build a model to adjust the scores. In the end, when the fluctuation of all scores goes within the criterion range, these scores could be the accepted as final scores. An empirical study on a dataset of scores from a university mathematical model contest in 2006 is also conducted. The data contains 11 scorers and 244 test takers, and 3 out of 11 scorers are selected randomly for each test takers. The model finds out unequal scores exist and adjusted scores are implemented. The control criterions are also repeatedly testified.

The properness about dimension of achievement goal and role of the autonomy in learning process
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Chia-Cheng Chen*,National Taiwan University of Arts, Taiwan

The theoretical and empirical work on achievement goals had developed from dichotomous and trichotomous into 2 × 2 achievement goal framework recently. One of the aims in this study is to examine how many dimensions of goal construct will fit the observed data well by using the method of structural Equation Modeling. Besides, we attempt to examine the relationships among the students` achievement goals, autonomy and pattern variables using the path model and the sample size is 602 from junior high schools in Taiwan. The conclusions in this research are as follows: (A) By using Confirmatory Factor Analysis, the dichotomous model fitted the observed data better than the trichotomous model. (B) The path model fitted the observed data well, but the direct effect between the autonomy and mathematic grade is not significant. (C) The direct effect of autonomy on math achievement is not significant, but it is significant as mediated by self- handicapping strategy. Based on

the findings of this study, implications for achievement goal theory and research methodology are discussed.

Students how to use self-regulated learning strategies in a web-based learning environment
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Chun-Yuan Chang*, National Taipei University of Education, Taiwan

The purpose of this research was to study third-grade students' self-regulated learning strategies and learning outcomes in a web-based learning environment. The subjects of the study are students from three classes of an elementary school in Jing Shan Dist, New Taipei City. When teaching the units of the natural science subject to the three classes, the researcher used a web-based learning environment to conduct teaching to all students in the classes. After teaching, students were given The Self-regulated Learning Strategies Inventory, Learning Science Attitude Questionnaire, and unit tests for the third unit. Finally, based on the results of the study, suggestions are offered as references for elementary school teachers using a web-based learning environment for administering self-regulated learning researches and teaching.

The Effect of Different Compensatory Relationships in the Variance-Covariance Structure on the Test of Fixed Effects in a Multilevel Linear Growth Curve Model
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Yuan-Hsuan Lee*, National Chiao Tung University, Taiwan
Oi-Man Kwok, Texas A&M University, USA
Jiun-Yu Wu, National Chiao Tung University, Taiwan

The importance of modeling a correct variance-covariance (V-C) structure for the repeated measures in multi-level linear growth curve models (MLGCMs) has gained growing attention in the methodological domain. Most studies, however, only focused on the impact of misspecification in the within-subject V-C structure given a correctly specified between-subject matrix. The current study aimed to evaluate the impact of compensatory V-C structures (simple between vs complex within / complex between vs simple within) on the test of the growth/fixed-effect parameters simultaneously. The study design adopted a first-order autoregressive structure (AR1) as the true within-subject V-C structure and a random intercept and slope model (UN1) as the between-subject V-C structure. Factors considered include the size of the AR1 parameters, magnitude of the fixed effect parameters, number of cases, and number of waves. The result showed that the commonly-used identity (ID) within-subject structure with unstructured between-subject matrix performed equally

well as the true model in the evaluation of the criterion variables. On the other hand, other misspecified conditions had biased standard error estimates for the fixed effect and lead to inflated Type I error rate or lowered statistical power.

Comparing Design-based and Model-based Latent Growth Models on Analyzing longitudinal data: A Monte Carlo Study
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Oi-Man Kwok*, Texas A&M University, USA
Jiun-Yu Wu, National Chiao Tung University, Taiwan

Multilevel longitudinal data are commonly found in educational and psychological studies (e.g., repeated measures nested within individuals and individuals further nested within some higher level clusters such as schools or clinics). When analyzing this type of data, one of the recommended analytical approaches is using the multilevel latent growth models (MLGMs). There are two major forms of MLGM, namely, design-based MLGM and model-based MLGM. The design-based approach takes the multilevel data structure into account by adjusting standard errors with the Huber-White correction. Previous simulation studies have also showed that, compared with the model-based approach, the design-based MLGM can result in higher convergence rate and statistical power with simpler model specification (i.e., only one model is needed for specification given the assumption of equal model structure across all levels). On the other hand, the model-based approach offers flexibility on specifying and analyzing different models at different data levels. Nevertheless, past research focused exclusively on cross-sectional data with considering only within-level covariates. In this study, we have compared the two approaches in analyzing longitudinal data with covariates from different levels in the same model simultaneously. The results showed that the fixed effects (or path coefficients) were in general consistent across simulation conditions while the standard errors of these effects from the design based approach were overly corrected, especially under the small sample size conditions. This, in turn, resulted in lower statistical power in testing these fixed effects. Implications of the findings and limitations are discussed.

The Recovery of Item and Person Parameters Estimated by the SCORIGHT
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Bor-Yaun Twu*, National University of Tainan, Taiwan
Jui-Chiao Tseng, Min-Hwei College of Health Care Management, Taiwan
Yen-Wen Yang, Min-Hwei College of Health Care Management, Taiwan

The conventional IRT models assume the local independence between items and are not able to model the dependency between items within a testlet. One of the solution to this issue is the testlet response theory (TRT) proposed by the Wainer, Bradlow, & Wang (2007). The SCORIGHT software, developed based on the TRT, not only can calibrate both dichotomous and polytomous items, but also takes the testlet effects into account. It is expected to be a very promising program.
Some study results showed that the SCORIGHT had good performance in terms of parameter estimation, but a few researches showed that SCORIGHT may need improvements in some special data collection design. According to Lin (2010) and Chang (2010), when the nonequivalent group anchor test (NEAT) and balanced incomplete block (BIB) designs are used, the SCORIGHT may not perform well as expected. This study will investigate the recovery of parameter estimation thoroughly and hopefully, provide some insight or suggestions to the field of psychometry.
Three data collection design (single form, NEAT, BIB), two test lengths (27, 54 items), three sample sizes (600, 1200, 2604 examinees), two ability distributions (N(0,1), bi-modal), four testlet effects (0, .5, 1.0, 1.5) as well as two burn-in periods will be manipulated in this study. Each combination of conditions will be replicated 50 times. Root mean squared error (RMSE) will be used to evaluate the recovery of SCORIGHT; in addition, the Q3 statistics will also be used to indicate if the data set was generated as it was planned.

Sample Size Determination in SEM with Nonnormal Data.
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Hsin-Yun Liu*, National Taiwan University, Taiwan
Li-Jen Weng, National Taiwan University, Taiwan

Sample size determination is a critical issue in applications of structural equation modeling (SEM). A number of authors have suggested that the ratio of sample size to the number of parameters to be estimated (n:q ratio) should be taken into consideration when determining the necessary sample sizes in SEM. Yet, there seems to be no consensus concerning the optimal rule for the n:q ratio when applied to structural equation modeling. The present simulation study was designed to search for possible optimal n:q ratios on correctly specified models with non-normally distributed variables by examining the performance of maximum likelihood chi-square test statistics, Satorra-Bentler scaled test statistics, and various fit indices used in SEM. Design characteristics included distributions of variables (normal, univariate skewness of 1 and kurtosis of 1, univariate skewness of 2 and kurtosis of 7, univariate skewness of 3 and kurtosis of 21), the n:q ratios for sample size determination (2:1, 5:1, 6:1, 7:1, 8:1, 9:1, 10:1, 15:1, 20:1), models of various sizes (6 models), and factor loadings (.6, .8). For variables of normal distribution, results showed

that n:q $\geqq$ 5 seemed a plausible rule of thumb as consistent with previous findings. For non-normally distributed data, the optimal n:q ratios needed to be larger to yield trustworthy test statistics and fit indices, especially as the degree of nonnormality in the data increased.

A Multi-dimensional Continuous Item Response Model for Probability Testing
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Yiping Zhang*, Center for Research on Educational Testing, Japan
Hiroshi Watanabe, Center for Research on Educational Testing, Japan

Probability testing (PT) is a way to respond to multiple- choice test items. In PT the examinee gives his/her subjective probability (the percentage that each alternative is thought to be the correct answer) to all the alternatives. By using PT more item information can be drawn from the subjects than the other scoring methods that can be used for multiple-choice items. In this presentation, a multi-dimensional continuous item response model for PT is proposed. The subjective probability given to the correct answer yields the item score. Although the score distributions of the items have various forms, they can be expressed by beta distributions. And they can be transformed into the standard normal distributions. In this model, the standard normal score is thought as the ability for answering the item. The joint probability density function of the abilities for answering the items and the latent traits of the test can be expressed by a multivariate normal distribution. In addition, the matrix of item response information function and parameter estimation, a method of estimating the subject's vector of latent traits are introduced.

Using Survival Analysis to Estimate Mediated Effects with Discrete-Time and Censored Data
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Jenn-Yun Tein*, Arizona State University, USA
David P. MacKinnon, Arizona State University, USA

Mediation analyses help identify variables in the causal sequence relating predictor variables to outcome variables. In many studies, the ‘timing’ or ‘occurrence’ of an event (e.g., disease onset, drug use initiation, first arrests) is the outcome of interest and survival analyses are applied. Tein & MacKinnon (2004) conducted a simulation study that applied the commonly used Sobel’s multivariate delta formula for estimating the mediated effects with survival data under the condition that the data were measured in a continuous scale and there were no censored data. This study extends the previous study in two aspects: 1) including data structures that are more commonly used in psychosocial research such as observations made in discrete time rather than recorded on a continuous scale and some

individuals in the sample do not experience the event of interest by the end of the observation period, and 2) comparing four statistical methods of testing mediation -- asymmetric confidence interval, percentile bootstrap, bias-centered bootstrap, and multivariate delta methods. We will conduct a simulation study to compare the performance of these four methods under four experimental conditions, varying: 1) sample sizes, 2) sizes of the regression coefficients making up the mediated effects, 3) proportions of right censored data, and 4) discrete time points of data collection. The methods will be compared in terms of Type I error rates, power, and the coverage of their confidence intervals for detecting mediated effects.

Sample Size Planning with AIPE on RMSEA Revisited: Width? Or Values?
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Tzu-Yao Lin*, National Taiwan University, Taiwan
Li-Jen Weng, National Taiwan University, Taiwan

A graphical method based on Kelley and Lai (2011) is presented for sample size planning in structural equation modeling (SEM). Kelley and Lai proposed to use the accuracy in parameter estimation (AIPE) approach for RMSEA to determine sample size in SEM. In the using of AIPE, researchers are able to obtain a corresponding sample size after deciding the confidence interval (CI) width. A narrow CI implies that the plausible values of RMSEA are confined in a relatively small range and the sample size needed could be large. However, inferences made from RMSEA depend on the estimated values of RMSEA. The range of values covered by the CI perhaps should also be examined in addition to the width. The graphs presented incorporated the actual values of RMSEA included in the CIs and the associated widths at a specified confidence level over various sample sizes. With limited resources available, it could be a useful tool for researchers to plan the sample size under acceptable costs and satisfactory range of RMSEA. Our approach that simultaneously considers the width and the values of CI might be an informative and practical method for sample size planning in SEM.

A Study of Standard Setting Method Using the Cluster Analysis
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Yeonbok Park*, Korea Institute for Curriculum and Evaluation, South Korea
Jiyoung Jung, Yonsei University, South Korea
Hee-Won Yang, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

This study aims to suggest a method to set performance standards by using cluster analysis and to review the validity and utility of the method. Similar standard setting procedures introduced by Sireci, Robin, and Patellis (1997) were adopted in this study, but somewhat different clustering approaches were investigated through hierarchical cluster analysis with Rand / Adjusted Rand Indexes. To investigate the validity and utility of the standard setting method using the cluster analysis, we reanalyzed data in which the Bookmark standard setting procedures were originally implemented. The data used in this study were obtained from the Korean National Diagnostic Tests of Basic Competency, which were composed of five subject areas.
The differences between cut scores from the Bookmark and cluster analysis methods were relatively small (0~3 score points compared to 30 score points in total) across five subject areas. We found very high percents of agreement between two methods ranging from 95 to 100. Kappa coefficients were 0.63 for the science and 1.00 for the mathematics. Classification consistency indices were computed within each method by assuming Beta or 4-Beta distribution for true score. Percents of agreement from the cluster analysis method ranged from 94 to 97 similar to those from the Bookmark method. In sum, the cluster analysis method can be considered as an alternative in setting performance standards when standard setting panelists cannot be easily obtained. At least, this method can be served as a criterion for another standard setting method to check external validity of the administered method.

The Longitudinal Analysis of Gifted Students' Science Self-Concept and Science Achievement: A Multivariate Multilevel Latent Growth Model
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Yaling Hou*, National Pingtung University of Education, Taiwan

The main objective was to gain more insight into the development of science self-concept and science achievement for junior high school gifted students. Data were consisted of 392 students were tested repeatedly every six months from eighth grade. Latent growth curve model (LGM) was shown that the students' science achievement presented a linear growth of 0.21 per six months; student's science self-concept was shown a nonlinear decline with time. The multivariate multilevel LGM was indicated a positive correlation (r = .71) between science achievement and science self-concept. In addition, the data was shown that the correlation decreased gradually during the junior high schooling. Science self-concept decreased and science achievement increased.
Comparing from the gender aspect, boy's and girl's science achievement was similar, but girl's science self-concept was evidently lower than that of boy's did (the gap among the original scores of each phase were from 3.3 to 5.6). The intercept of science achievement

and self-concept were positively correlated, but the correlation between the changing processes could not be confirmed. Having a good academic performance at early puberty might be a positive effect in academic self-concept, there might be other reasons that cause the self-concept to change over time.

The development of statistical thinking assessment
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Chien-Yi Huang*, National University of Tainan, Taiwan
Su-Wei Lin, National University of Tainan, Taiwan

In recent years, science and technology have growing importance in personal and social life, the integration of information has become an important indicator of the mathematically literate citizen. The probability and statistics are the important topics in mathematics education for many countries. It shows that knowledge of statistical is quite valuable to serve the needs of citizens and lifelong learning.
Statistical knowledge underpins statistical thinking, statistical understanding, statistical reasoning and statistical literacy. On the other hand, statistical knowledge cannot occur without statistical understanding and statistical thinking.
For most people, statistics refers to a theory that the experts from all sectors use to support the argument is correct or not, but for statistical professionals, statistics refers to the art and science of collecting, analyzing, presenting, and interpreting data.
According to the reference, we define that statistical thinking involves an understanding of why and how statistical investigations are conducted, the study attempt to develop an assessment used to measure statistical thinking. The structure of the assessment contains three dimensions, understanding, construct strategy, reasoning and interpretation. This assessment was used to examine the performance of statistical thinking of students in statistical related departments of the universities. The study also provided the psychometric characteristics of the assessment for reliability and validity evidences.

A Preliminary Validity Study for the On-line Literary Reading Assessment
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Lan-fang Chou*, National university of tainan, Taiwan
Pi-Hsia Hung, National University of Tainan, Taiwan

Adolescent readers vary tremendously in their ability to locate, understand, and use information online. A growing collection of research suggests that students require new comprehension skills and strategies to effectively read and learn from text on the Internet. Recently, Taiwan constructed some digital archives for well known local literary authors.

These resources are very valuable for enhancing students' online reading literacy. The purpose of this study is to infuse the digital archives to develop an Online Literary Reading Assessment (OLRA) for the 10th graders of Taiwan to explore the validity issues. The content specification table of OLRA is mainly based on the PISA Electronic Reading Assessment framework. Both multiple choice and constructed response items are included in OLRA. The students' school grades for different subjects and the scores of their high school entrance exams were collected as the related variables. There were around six hundred 10th graders sampled for the OLRA field trial. The inter-rater reliability for scoring and the convergent and discriminate validity issues will be discussed. The differences between genders on OLRA will also be investigated.

The Validity Issues of an Affective Scale Embedded in an Algebra Dynamic Assessment System

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Hui Ju Sun*, National University of Tainan, Taiwan
Pi Hsia Hung, National University of Tainan, Taiwan,

Children's mathematical worlds are complex places containing both cognitive and affective elements. One cannot ignore the affective domain if one wishes to understand children's mathematical learning (Walls, 2001). Examining student motivation and self-regulation is an important undertaking because these processes have consistently been shown to predict adaptive classroom and academic outcomes. The purpose of this study is to develop an affective scale for investigating the relationship between students' self-regulation and their learning progress on an algebra dynamic assessment system (ALDAS). The ALDAS integrated spreadsheets into algebra learning process for the 6th graders. The criterion variables for detecting the effects of ALDAS are the growth slopes on mathematics and affective scale in a 2 months interval. The affective scale is administered after each intervention. The correlation coefficient between the slopes of affective scale and mathematics performance will be discussed. The progressing characteristics of different level self-regulation students on ALDAS will be described. The implications of an embedded affective scale for mathematics intervention design will also be included.

A Study of the Effects of Non-equivalency of Equating Groups on Equating for Mixed-Format Tests

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Jiwon Choi*, Yonsei University, South Korea
Jeonghwa Oh, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

In recent years, tests containing a mixture of different item formats have often been used in many practical testing situations. When the equating groups are non-equivalent, this has significant effects on equating results. The present study is to investigate the effects of non-equivalency of equating groups on equating for mixed-format tests under the common-item nonequivalent groups design.
Simulation techniques were implemented to evaluate proper conditions for getting appropriate equating relationship. Several simulation factors, including non-equivalency of equating groups, proportions of anchor items, composition of multiple choice and constructed response items, and equating methods, were considered. This study applies both IRT (Item Response Theory) and CTT (Classical Test Theory) equating methods, such as Stocking-Lord Method and concurrent calibration, Tucker Linear Method, Levine Linear Method, and Frequency Estimation Equipercentile Method. Sample size is set to 3000, which can be considered as reasonably large to provide stable estimates for equating relationships.
It can be concluded that the equating methods yielded similar equating relationships when the equating groups were equivalent. Non-equivalent groups, however, produced somewhat different equating relationship. Moreover, the shorter the common items, the less accurate were the equating relationships.

A Speeded Item Response Model: Leave the Harder Till Later
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Yu-Wei Chang*, National Tsing-Hua University, Taiwan
Rung-Ching Tsai, National Taiwan Normal University, Taiwan
Nan-Jung Hsu, National Tsing-Hua University, Taiwan

A speeded two-parameter logistic item response model is proposed.We consider the situation where examinees may retain the harder items to the later period of the test in a speeded test. As a result of such a strategy, they may or may not finish answering all the items within the given time. Our proposed model tries to describe such a mechanism by incorporating a speeded effect term into a two-parameter logistic model. Bayesian estimation procedure of current model using Markov chain Monte Carlo is presented and its performance over the two-parameter item response model in a speeded test is demonstrated through simulations. At last, some limitations and possible extensions of the current model are discussed.

A Simulation Study to Evaluate IRT Scale Transformation Methods with Fixed c-parameters of Anchor Items

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Junbum Lim*, Yonsei University, South Korea
Hwangkyu Lim, Yonsei University, South Korea
Guemin Lee, Yonsei University, South Korea

Because parameter estimates for different calibration running under the Item Response Theory (IRT) model are linearly related, a linear equation can convert IRT parameter estimates onto another scale metric without changing the probability of a correct response (Kolen & Brennan, 2004; Lee & Fitzpatrick, 2008). Previous studies showed that the c-parameter in the three parameter logistic (3PL) model was unstable. Lee and Fitzpatrick (2008) proposed a new IRT scale transformation approach in the context of test score equating with fixed c-parameters of anchor items. A rationale for fixed c-parameters for Non-Equivalent Anchor Test design (NEAT design) can be established for the fact that the c-parameters are not affected by any linear transformation. This study is designed to expand their study using simulation techniques.
Simulation conditions include sample size, number of items, number of anchor items, and non-equivalency of equating groups. Data will be generated under the 3PL model using R-program. Each simulation condition will be replicated 100 times. RMSE (Root Mean Square Error) will be used as a major criterion to evaluate the performance of scale transformation methods of both fixed and non-fixed approaches.

The criterion-related validity coefficients of a situational interview (SI) and a behavior description interview (BDI) in Railway policeman selection field in China

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Yingwu Li*, Tsinghua University, China
Yongda Yu, Tsinghua University, China

Recently, structured interview is one of the leading methods in China National Civil Servant Examination (CNCSE). The criterion-related validity coefficients of a situational interview (SI) and a behavior description interview (BDI) were investigated in the 8 railway police departments in China. Both the SI and BDI had concurrent validity with job performance ($n = 1054$, $r = .29$, $r = .23$, $p < .05$, respectively). Only the SI, however, had incremental validity over and above the BDI in predicting job performance. Furthermore, the SI fully mediated the relationship between BDI and job performance. The discussion questions the extent to both SI and BDI provide unique or overlapping predictive validity when compared with mental ability tests.

A Multilevel Multidimensional Rasch Model with an Application to DIF by Hierarchical Generalized Linear Model
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Hsin-Ying Huang*, National Chengchi University, Taiwan
Fur-Hsing Wen, Soochow University , Taiwan
Min-Ning Yu, National Chengchi University, Taiwan

It is known that the two-level hierarchical generalized linear model (HGLM) is equivalent to the Rasch model. The purpose of this study is to show that the two-level HGLM can be extended to a multilevel multidimensional Rasch model along with differential item functioning (DIF). We attempted to identify DIF could be explained by both examinee and group characteristic variables under multidimensional condition with HGLM. HLM-6.04 software was implemented with empirical data. The results provided supporting evidence for the proposed multilevel multidimensional Rasch model. It was in particular suitable for the analysis of educational measurement.

Sufficient conditions of equivalence in measurement model
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Wei-Sheng Lin*, National Chung Cheng University, Taiwan
Chung-Ping Chen , National Chung Cheng University, Taiwan

This research aims to understand sufficient conditions of equivalence in measurement model. By expanding results of Tomarken and Waller (2003) and Raykov and Penev (2000), we explored four conditions to find sufficient conditions which make measurement models equivalent. In the first conditions, a model with correlated factors can be equivalent to other orthogonal model with correlated measurement errors. A model with correlated factors can be also equivalent to other orthogonal model with some indicators, which are loaded in the same factors in original model, loaded on different factors. In the third condition, a model with correlated errors of indicators within one factor can be equivalent with other model with more factors. A model with correlated errors of some indicators within one factor can be equivalent with the same model but with correlated errors of other indicators within the same factor. In addition, simulated data is used to examine if the fit indices of the original model and the generated equivalent model match. In conclusion, we discusses the influence resulted from model structure and causal relationship when measurement model comes into equivalence and the recommendation of avoiding having models in equivalence will be suggested.

Influence of pre-test design on the precision of the parameters estimation in the multidimensional items bank

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Po-Hsi Chen*, National Taiwan Normal University, Taiwan
Jar-Wen Kuo, National Taiwan Normal University, Taiwan
Yao-Ting Sung, National Taiwan Normal University, Taiwan

The goal of the research is to investigate the influence of the pre-test design and sample size on the precision of the parameters estimation in the multidimensional items bank. Three types of pre-test design, three types of sample size, three types of dimensionalities of the tests, and two types of correlation between latent traits were used as dependent variables. Data were generated using the multidimensional Rasch Model. The dependent variables were the root mean square of error (RMSE) of the item parameter and the latent traits. Results of the item parameters estimation demonstrated that the larger the sample size and the fewer the dimensionalities, the lower the RMSE of the item parameter. The balanced incomplete block (BIB) design and non-equivalent group with variable anchor test (NEVAT) design showed lower RMSE of the item parameter than non-equivalent group with anchor test (NEAT) design. Results of the latent traits estimation demonstrated that the fewer the dimensionalities the lower the RMSE of the latent traits. Three types of pre-test designs and sample sizes showed the same RMSE of the latent traits. The authors suggested that in the items banking stage of the multidimensional test, sample size should be large enough in order to get precise estimation of the items parameter. The balanced incomplete block (BIB) design and non-equivalent group with variable anchor test (NEVAT) are recommended to be used.

The Relationships between Health Responsibility, Emotional Well-being and Depression in Taiwan

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Po-Lin Chen*, National Chengchi University, Taiwan
Min-Ning Yu, National Chengchi University, Taiwan
Pei-Ching Chao, National Chengchi University, Taiwan
Jia-Jia Syu, National Chengchi University, Taiwan
Pei-Chun Chung, National Chengchi University, Taiwan

Purpose: Health responsibility is a resource used by people to cope with risk factor and maintain emotional well-being, and it also may have a positive impact on physical health and depression reduction. The main purpose of this study was to explore Taiwanese health responsibility, emotional well-being and depression.

Methods: There are 1934 people randomly selected from Taiwan. Responses from a survey via questionnaires ("Health Responsibility Scale", "Emotional Well-Being Scale" and "Taiwan Depression Scale"), of Taiwan residents aged 18 years and over, are used to explore the correlation among health responsibility, emotional well-being, and depression. Structural equation modeling (SEM) is applied to estimate parameters and to compare models.
Results: Findings are summarized as follows: 1. There are positive correlations existed among the health responsibility and emotional well-being. 2. Health responsibility and depression have been shown to be negatively correlated with one another. 3. Path analysis reveals a negative relationship between emotional well-being and depression.
Conclusions: Results of this study identify important influences useful to health professionals for promoting emotional well-being in Taiwan residents. Finally, some suggestions for counseling interventions and future researches are proposed.

A mathematical model for trans-cortical gamma synchronizations under different perceptual conditions

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Chien-Fu Lin*, National Chung Cheng University, Taiwan
Jay-Shake Li, National Chung Cheng University, Taiwan

In daily life, we have to rapidly and effectively deal with an ever-changing environment. In order to cope with this challenge, the operation of neural system requires not only fast reorganization but also good stabilization. Many researchers suggest that the transient connections between remote neuronal modules to form a neural assembly might be the solution for the task. It is hypothesized that synchronous neural activities are the mechanism for the formation of neural assemblies. Numerous evidences supporting this idea have been found in experimental studies. However, there is no satisfactory mathematical model to integrate all the empirical findings so that a comprehensive understanding about how the whole process might work can be achieved. In the present study, we build a mathematical model based on an early work of Lopes Da Silva et al. in 1974 to simulate the synchronization activity in neural assemblies. The model produces synchronous neuronal firings between modules in primary and associative visual cortex. The synchronization levels can respond to different features of input stimulus in a fashion similar to the experimental findings by Engel et al. in 1991. The degree of input signal overlapping can influence the synchronization between processing units located in remote cortical regions. Based on these results, we suggest that input overlapping is the underlying mechanism for the modulation of neural synchronization across cortical areas. Furthermore, the model

provides a possible solution for the binding problem known in the study of visual perceptions.

Model Specification for Latent Nonlinear Effects based on the Mean-Centering and Double-Mean-Centering Strategies
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Shu-Ping Chen*, National Chengchi University, Taiwan
Chung-Ping Chen , National Cheng Kung University , Taiwan

Estimating nonlinear effects between theoretical constructs is an important concern in the social sciences. In empirical studies, researchers often focus more on mediated moderation or moderated mediation as opposed to moderation by itself. In previous research, we generalized the constrained approach with noncentered observed variables to a matrix form that encompasses the latent nonlinear effects of not only exogenous variables, but also endogenous variables or a combination of the two. Constraints are of course specified in matrix form using Muthén's notation and the six matrices ($\boldsymbol{\alpha}$, $\boldsymbol{\nu}$, $\mathbf{B}$, $\boldsymbol{\Lambda}$, $\boldsymbol{\Psi}$ and $\boldsymbol{\Theta}$) are partitioned to fit into our nonlinear model framework. Going a step further, the current research takes advantage of the mean-centering and double-mean-centering (Lin, Wen, Marsh, & Lin, 2010) strategies to create simplified forms of the six partitioned matrices. Of the resulting submatrices, those which are used to estimate latent nonlinear effects are shown to be identical to their corresponding submatrix based on noncentered observed variables. Moreover, the simple slopes that are calculated from the latent nonlinear effects remain constant under scale transformation. Owing to these results, this research is able to provide a simpler model specification process and a more flexible framework to formulate complicated nonlinear models.

The development of the computerized imagination test
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Po-Hsi Chen, National Taiwan Normal University, Taiwan
Pei-Yu Lee, National Taiwan Normal University, Tanzania
Chun-Yu Hsu*, National Taiwan Normal University, Taiwan
Su-Ping Hung, National Taiwan Normal University, Taiwan
Jar-Wen Kuo, National Taiwan Normal University, Taiwan

The aim of the research is to develop a computerized imagination test system. In the prior study, one hundred and thirty-eight high school and college students were asked to write down the content of their imaging about the transportation vehicle 1,000 years in the future and rated by well-trained rater using eight indices. These eight indices were analyzed with

exploratory and confirmatory factor analysis. Results demonstrated that three factor of imagination were suggested, which were named as extend imagination, quantity of divergent imagination, and quality of divergent imagination. The computerized imagination test system then designed to include three parts of subsystem, the subject interface for typing the content of imagination, the automatic rating program for evaluating the extend imagination and the quantity of divergent imagination, and the rater interface for rating the quality of divergent imagination. Data of the computerized imagination testing will be collected and reanalyzed using the same three-factor model in the future.

Impact of Optimal Item Bank Design on Parallel-Form Tests for Making Pass-Fail Decisions

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Ting-Ting Yang*,Beijing Normal University, China
Yan Gao, Beijing Normal University, China
Mengjie He, Beijing Normal University, China
Tao Yang, Beijing Normal University, China

Optimal design methods have been widely applied to automated test assembly for decades. Furthermore, studies have shown that optimal design can offer great gains in item bank design, but little is known about how well it improves the measurement precision of resulting tests, especially for linear parallel-forms tests(LPFTs) . This paper aims to examine the impact of optimal item bank design on the psychometric properties of LPFTs while making pass-fail decision. Two sets of parallel forms were built respectively based on optimal and nonoptimal designed item banks. Then, the study compared three important indicators of the resulting parallel forms: test information functions(IFs), decision accuracy and decision consistency. This study was carried out using simulation techniques. Given that the potential effect of passing score, the study set two target IFs(centered on the passing score or the mean of the proficiency distribution)while conducting optimal item bank design. Considering the role of test assembly in decision accuracy, this study manipulated two variables related to test assembly: parallel test construction methods (simultaneous /sequential), the target IFs of test assembly (centered on the passing score or the mean of the proficiency distribution). Finally, the effects of these variables on the accuracy and consistency of pass-fail decision making were investigated. It's expected that (1)under the condition of optimal design, the measurement accuracy of the tests will be always higher than that of nonoptimal design condition;(2) The combined effects of target information functions of item bank and test design needs further practical study.

Confirmatory Factor Analysis of the 100-item IPIP measure on a large Facebook dataset

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Luning Sun, University of Cambridge, UK
Iva Cek*, University of Cambridge, UK
Sabine A. K. Spindler, University of Cambridge, UK
Michal S. Kosinski, University of Cambridge, UK
David J. Stillwell, University of Nottingham, UK
John N. Rust, University of Cambridge, UK

The 100-item IPIP measure of Costa and McCrae's (1992) five NEO domains is a commonly used set of items derived from the International Personality Item Pool (Goldberg, 1999). The present study aims to examine the psychometric properties of this measure. A subset of 11,660 females and 10,360 males was selected from over 3,000,000 cases available from the Facebook application 'myPersonality'. Cronbach's alphas of all the five domains (mean: 0.901) were high. Confirmatory Factor Analysis was conducted for both the overall measure and each individual domain, respectively. Save for the Openness domain which displayed a poor model fit, implying the potential existence of extra factors, the resulting domains showed reasonably good model fit. Subsequent exploratory factor analysis revealed a small number of items that had either low loadings on target factors or high cross-loadings on non-target factors. Based on this analysis, a smaller set of 20 items was identified that was relatively reliable (mean alpha: 0.769). Further analyses showed not only a comparable model fit but also an acceptable correlation (mean r: 0.869) with the 100-item measure, suggesting great potential use in future personality research. Taking the present study as an example, the advantages of collecting data through online means such as the 'Facebook' website are discussed, as well as the limitations.

A Tutorial on Structural Equation Modeling with Incomplete Observations: Multiple Imputation and FIML Methods Using SAS

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Wei Zhang*, SAS Institute Inc, USA
Yiu-Fai Yung, SAS Institute Inc, USA

This presentation demonstrates the use of the MI, MIANALYSIS, and CALIS procedures of SAS/STAT to fit structural equation models with incomplete observations (or missing data). The multiple imputation method and the full information maximum likelihood (FIML) method are two statistically proven methods for analyzing structural equation models with incomplete observations. This presentation illustrates the steps required to carry out these

two methods in the SAS system. Practical data examples are used throughout the presentation. Although the multiple imputation method and the FIML method yield similar estimation results, with its availability in the CALIS procedure the FIML method is more convenient to use. To help understand the source of missingness, the CALIS procedure provides detailed analysis of the missing patterns, including proportion coverage of sample moments and the mean profiles of dominant missing patterns. When the number of missing patterns is small, a multiple-group setup with the CALIS procedure can be used. This is also illustrated with a real data example.

Mixture Extensions of the Linear Logistic Test Model (LLTM) using Markov Chain Monte Carlo (MCMC) Estimation
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
In-Hee Choi*, University of California, Berkeley, USA
Mark Wilson, University of California, Berkeley, USA

The purpose of this study is to investigate the use of a Markov chain Monte Carlo (MCMC) for mixture extensions of the linear logistic test model (LLTM; Fischer, 1973). MCMC estimation has been shown to be advantageous for estimating complex IRT models (Patz & Junker, 1999). In particular, it is known to be useful in estimating mixture distributions (Diebolt & Robert, 1994). The flexibility of the MCMC algorithm allows one to estimate mixture extensions of the LLTM as well as the random weights LLTM (RW-LLTM; Rijmen & De Boeck, 2002), a more generalized and complex LLTM. The MCMC algorithm is implemented using WinBUGS (Spiegelhalter, Thomas, Best, & Lunn, 2003), and results from an empirical example using verbal aggression data (De Boeck & Wilson, 2004; Vansteelandt, 2000) are presented to illustrate fitting mixture models of the LLTM and random weights LLTM. The results indicate that the MCMC algorithm is successfully employed to estimate the mixture extensions of the LLTM and RW-LLTM and the mixture RW-LLTM provides a useful tool to detect latent classes differentiated in multidimensional aspects, general propensity and item property specific propensity.

Using bifactor model to detect testlet effect
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Szu-Cheng Lu*, National University of Tainan, Taiwan
Bor-Yaun Twu, National University of Tainan, Taiwan

The bifactor model (Holzinger & Swineford, 1937) had been indicated for a long while. This model was always used in confirmatory factor analysis and was seldom used for solving the real psychometric problems. When Gibbons & Hederker (1992) described the

full-information item bifactor analysis in the IRT context and had it been implemented in the TESTFACT program, the bifactor model became popular and receiving more attention. Researchers were able to use this method to investigate the issues related to testlet effects, dimensionality assessment, subscale score and rater effects. Among them, the testlet effect and dimensionality assessment seem to be the most studied topics.
In this study, we focused on the application of bifactor model to the related issues of testlet effect. Three different data sets will be simulated: full-independent data, full-testlet data, and partial- independent and partial-testlet data. Two test lengths (20, 40 items) and three testlet effects (0, 0.5, 1.0) will be manipulated and the sample size will be 1000 for each data set. The purpose of this study is to investigate the performance of bifactor model when it was apllied to model the testlet effect among items. At the same time, the Q3 statistics proposed by Yen (1984) will also be calculated for each data set to see if this statistic was able to indicate the dependency among items.

Establishing a Confirmatory Factor Analysis Model for the Self-Efficacy for Writing Scale

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Yi-Fang Wu, University of Iowa, USA
Chia-Ling Tu*, National University of Tainan, Taiwan

More than two decades ago, Bandura (1986) proposed a view of human functioning that emphasized the role of self-referent beliefs. Since then, many studies have been focused on the relationships between students' academic performance and the self-referent characteristics based on Bandura's sociocognitive perspective. For example, how self-efficacy component contributes to writing, one of the most important communication skills has been studied. The purpose of the current study is to review past studies and establish a confirmatory factor analysis (CFA) model for the Self-efficacy for Writing Scale (SEWS). SWES consists of three subscales, Comparison and Feedback, Social Psychological Status as well as Writing Process. It is a newly-developed measure with the purpose of classroom-based use for elementary teachers and students. Data has been collected from 641 girls and boys across grades 4 to 6 in Taiwan. Mplus (2007) will be used for constructing the CFA model; the results can provide the construct validity evidence for items designed to assess self-efficacy for writing. The study will also include the investigation of measurement invariance (Usher & Pajares, 2008; Kline, 2010) across gender and grade, respectively. Simply put, we gather evidence to improve the quality of SEWS and we also hope that the scale could be helpful to understand students' self-efficacy toward their writing ability in the future. With this piece of information, students may be

informed self-beliefs that enable them to exercise a measure of control over their thoughts, feelings, and actions in writing.

Utility of Local Linear Approximation in quantifying emotional trajectories of romantic partners

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Amy Schmid*, Columbia University Teachers College, USA
Noelle Leonard, New York University College of Nursing, USA
Amanda Ritchie, New York University College of Nursing, USA
Marya Viorst-Gwadz, New York University College of Nursing, USA

Objective: When individuals discuss stressful topics with romantic partners, their emotions may change The present study examined (1) mathematical methods of quantifying these emotional changes, and (2) the association between emotional changes and relationship; Method: Participants rated their relationship quality and were then videotaped during a stressful 5-minute conversation with their romantic; Afterward, individuals watched the video of their conversation and rated their emotional positivity at 15-second; Some participants had zero-slope emotional trajectories, others had stable slopes, and others had highly variable slopes (i.e., rapid up-and-down movement). We quantified each participant's trajectory using three methods. First, we took the mean rating over time. Second, we calculated the standard deviation (SD) of ratings. Third, we used a technique derived from Local Linear Approximation: we estimated the variability in the first derivative of the emotion ratings by calculating the root mean square of the time varying derivative of each individual's ratings ("velocity"). This calculation captured the speed at which participants' slopes changed course over time. Dyadic HLM models were used to predict relationship quality using mean, SD, and; Results: Low relationship quality was significantly associated with high velocity, high SD, and low mean (i.e., very negative emotions); All three predictors were highly correlated (alpha=.89) and produced nearly identical results. Conclusions: Rapid emotional changes during stressful conversations are associated with poor relationship. However, the mean, SD, and velocity of time series data had similar predictive value in this instance.

Incorporating response time to model test behavior in a structural equation modeling framework

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Shu-Chen Chan*, National Taiwan Normal University, Taiwan
Rung-Ching Tsai, National Taiwan Normal University, Taiwan

Item response time has been shown valuable in identifying different test behavior of the test takers. Recently, a mixture Rasch model with response time components showed that a two-class solution representing rapid-guessers and solution behavior examinees fit the test data better than one-class solution. However, inclusion of other additional classes, such as fast responders, might still be necessary for fulfilling the assumption of independence of item response and response time given latent class. In our study, we embed such a simultaneous analysis of both item responses and response time into structural equation modeling framework. Simulations are conducted not only to investigate the parameter recovery of the proposed latent class models for various test behavior, but also to examine possible estimation bias in item parameters when response time is unavailable and no guessing behavior is assumed in the data.

Effects of the Open Recruiting System for Principal Employment on the School Performance in Korea

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Hyejin Kim*, Pusan National University, South Korea
Chang-nam Hong, Pusan National University, South Korea
Gyeong-ryeon Gwak, Pusan National University, South Korea
Jiyoung Nam, Pusan National University, South Korea

Previous studies showed that leadership of school principals has become effective on bringing about positive impacts on performance of school organizations. In response to them, Korea has recently implemented the open recruiting system for principal employment, in order to examine and select the candidate, through a democratic procedure, who equips with new leadership and meets the needs of the school and the local community. This study analyzes effects of the open recruitment system for principal employment on the school performance in terms of two aspects: the principal's job performance and the school's organizational characteristics. By reviewing previous literatures, 6 domains of job performance are selected, including school vision set-up, teaching and learning support, management of school organization, human resource and capital resource and cooperation with families, local community and other schools, while characteristics of school organizations such as trust, teachers' collaboration, collective efficacy and job satisfaction are chosen. Surveys are conducted on a total of 230 teachers from 16 elementary schools in Busan which participated in the open recruitment system. And the paired two-sample t-test is used for comparing changes in variables before and after the system was implemented. The main results are as follows: (1) the open recruited principal is recognized to perform better in all domains; (2) teachers recognize improvement on their trust on the principal, collective efficacy and overall job satisfaction.

The Relationship between Perceived School Support and Teacher's Commitment
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Jiyoung Nam**, Pusan National University, South Korea
Chang-nam Hong, Pusan National University, South Korea
Hyejin Kim, Pusan National University, South Korea

The purpose of this study was to examine the relationship between perceived school support and teacher's commitment. Three research questions were selected to carry out this study. First, are there differences in perception between perceived school support and teacher's commitment in accordance with the background variables for elementary school teachers? Second, what is the correlation between school support and teacher's commitment? Third, what influence does the school support perceived by elementary school teachers have on commitment?
This study conducted a survey on 300 teachers from elementary schools in Daegu metropolitan city and the province of Gyeongsangbuk-do in Korea. Collected data were analyzed by t-test and one way ANOVA, while the relation between elementary school teachers' perception of school support and their dedication was identified through regression analysis.
Main results of the study are as follows: first, both the school support and the teacher's commitment perceived by the elementary school teachers had significant differences in accordance with background variables. Second, as to the correlation between perceived school support and teacher's commitment in general, perceived school support was closely correlated with their dedication. Third, the overall effect of school support on overall commitment to teaching was statistically significant.

The Longitudinal Structure of the Chinese version of Beck Depression Inventory II using a Latent State-Trait Model
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Pei-Chen Wu*, National PingTung University of Education, Taiwan, Taiwan

Measures are usually applied in counseling and psychology to assess one's trait or state. However, the extent to which the measure assesses differences accounting for trait or state is indefinite. The latent state-trait (LST) theory provides a framework for modeling changes by separating the stable, occasion-specific and error-specific influences (Steyer, Ferring, & Schmitt, 1992; Steyer, Schmitt, & Eid, 1999). In a 4-wave study, this study uses longitudinal panel data from the adolescents (high school students, N= 820) and early adults (college students, N=790) to estimate the state and trait variance to the reliable variance in

depression of the Chinese version of Beck Depression Inventory II (BDI-II-C; Chinese Behavioral Science Cooperation, 2000) within a LST model. Results have indicated that the longitudinal structure of the BDI-II-C changed considerably depending on the age and gender of participants. Adolescents' BDI-II-C performed an occasion-specific dimension more than a stable trait dimension; but early adults' BDI-II-C was more sensitive to a trait dimension than an occasion-specific dimension. The findings suggest that more attention should be put on the longitudinal structure of depression measures and change comparisons for particular purposes. For example, if we assess the change of trait-like depression (i.e., cognitive-styles), measures of trait-like depression should be chosen; when we evaluate the change of state-like depression, measures of state-like depression should be selected.

Setting a Target Test Information Fuinction for Assembly of IRT-Based Classification Tests

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Kentaro Kato*, Center for Research on Educational Testing, Japan

The test information function (TIF) is often used as an optimization criterion in assembly of tests based on item response theory (IRT). On the one hand, setting a target TIF entails considerations of various factors such as characteristics of items in the item bank and feasible measurement accuracy. More or less arbitrarity is inevitable in this process. On the other hand, it would also be helpful if one can set up a standard for the target TIF simply based on desired test characteristics, i.e., without regard to those which items at hand can provide. This study proposes a procedure to obtain a target TIF for IRT-based classification (i.e., pass/fail) tests. The problem is formulated by decision theory, in which pass/fail decisions are made by comparing maximum likelihood estimates of theta with a threshold value and the loss function poses penalty of one for misclassified cases. The resulting risk function is the misclassification rate given the true theta, which is a function of an unknown target TIF. Then the target TIF is sought so that the overall misclassification rate (i.e., the preposterior risk) falls below a prespecified threshold value. This cannot be done without appropriate constraints on the form of the target TIF. Possible functional forms for the target TIF and a computational method are discussed. A practical example is also presented.

A Comparison of Item Response Models for a Test Consisting of Testlets

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Naoya Toudou*, The University of Tokyo, Japan

A set of items that have a common stimulus (e.g., reading passage, information graph) is called testlet. Responses to the items in a testlet often violate the assumption of local

independence. Previous studies have indicated that this dependent structure causes bias in item parameter and latent trait estimates when standard IRT methods are used. Several IRT models that take local dependence into account have been proposed. These models can be classified into three types, but no comparison has been done among these types of models in terms of accuracy of parameter estimation. In this study, I performed a series of simulations to compare the models by varying such conditions as the proportion of locally dependent items and the degree of local dependence. Simulation results showed that in many conditions the magnitude of bias in latent trait estimates was smaller when a standard IRT model was applied rather than the models proposed to deal with local dependence, and that the proportion of locally dependent items and the degree of local dependence affected the accuracy of estimates. Finally, I confirmed the simulation results by a large set of real data.

Test of Independence by Asymptotic Lambda for Nominal Data using Bootstrap
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Yu Hin Ray Cheung*, The Chinese University of Hong Kong, Hong Kong
Lok Yin Joyce Kwan, The Chinese University of Hong Kong, Hong Kong
Wai Chan, The Chinese University of Hong Kong, Hong Kong

Asymmetric lambda is a common measure of association for nominal variables in a contingency table. It measures the improvement in the prediction of the column variable conditioned on the row variable, or vice versa. However, it is generally believed that the performance of the asymptotic standard error (ASE) is poor when the sample size is small. Moreover, given the same contingency table in which ties in the marginal probabilities occur, the ASE estimates may vary when the rows or columns are arranged in different order. In view of the above problems, this article proposed the use of bootstrap procedure as a substitute to traditional asymptotic method. The performance of the standard error estimates was assessed by a simulation study using R 2.12.2. Results showed that the percentage bias of bootstrap standard error (BSE) was small across all conditions and bootstrap percentile outperformed significant tests using ASE and BSE in most configurations. This paper provides an empirical support for applied researchers to draw statistical inference on the strength of association between two nominal variables as measured by asymmetric lambda using bootstrap procedures.

A Structural Equation Modeling Approach for the Analysis of Conditional Indirect Effects
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Lok Yin Joyce Kwan*, The Chinese University of Hong Kong, Hong Kong
Wai Chan, The Chinese University of Hong Kong, Hong Kong

In path analysis, an indirect effect explains the mechanism that underlies the relationship between an independent variable and a dependent variable through the inclusion of a third variable, known as a mediating variable (Baron & Kenny, 1986). A conditional indirect effect is said to be occurred when the strength of an indirect effect depends on the value of some other variables, known as moderating variables in the model. In psychological research, the conditional indirect effects are also termed as mediated moderation or moderated mediation (Muller et al., 2005). Researchers usually use regression-based method to study the conditional indirect effect (e.g. Preacher et al., 2007). Generally speaking, the conditional indirect effect can easily be estimated by fitting the conditional indirect effect model in structural equation modeling (SEM). However, few research studies have been done to evaluate SEM as a useful tool to study conditional indirect effects. This presentation discusses how conditional indirect effects are estimated and test for significance by using SEM technique. We demonstrate how conditional indirect effect models are estimated and test for significance using the asymptotic and bootstrap standard error under the SEM framework. A simulation study is conducted to compare the performance of the regression-based method with the SEM approach for studying conditional indirect effects. Results show that the SEM method works better than the regression-based method for the estimation of conditional indirect effect. Recommendations are given to applied researchers on assessing conditional indirect models using SEM.

Sampling discrete m x n matrices with fixed margins
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Kathrin Gruber*,Vienna University of Economics and Business, Austria
Reinhold Hatzinger, Vienna University of Economics and Business, Austria

In this article a generalization of Chen's algorithm (2005) for simulating binary data matrices with given row and column sums (and a set of structural zeros) will be presented. The aim is to sample discrete data matrices with fixed marginals to build exact nonparametric partial credit class tests. The challenge here is to plug in Masters' model and derive a computational fast and efficient algorithm which can be generalized to n categorical responses by recursive solving of a linear program with restrictions to the row sums. Based on the sequential importance sampling (SIS) algorithm (Snijder, 1991; Chen, Dinwood and Sullivant, 2006) by means of linear programming lower and upper bound intervals are derived, on which a hypergeometric distribution is used as proposal distribution. As an alternative approach modeling of the responses can also be done using a markov chain by defining a transition matrix (MCMC application). The main result of this article is a two stage sampling algorithm that is easy to implement and efficient. The

algorithm will be introduced as well as the SIS and MCMC approaches that are built in the linear program solution will be compared in computational and theoretical performance.

The Impacts of the Cognitive Components on the Variance of the Item Difficulties for the Quantities Compare Test
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Wen Chun Tai*, National University of Tainan, Taiwan

Various cognitive complexities which are manipulated in the items have the impacts on the students' performance on the test or items. In order to support the teachers' comprehensive view of the teaching materials and provide a better understanding of students' learning, it is important to provide such information of the manipulation of cognitive components. The primary purpose of this study was to examine a set of cognitive components that explicitly explain item difficulties for quantities compare items. There were eighteen quantities compare items in this study. Participants consisted of 417 first graders in 4 elementary schools. This study proposed three cognitive components, key statement, location of unknown in the equation, and direction of compare, to predict the item difficulty parameters. In order to validate cognitive sources of item difficulties for quantities compare items, the item difficulties were estimated by Rasch model, and adopted regression analysis to examine the impact of these three cognitive components on the variance of item difficulties. The results and implication will be discussed and will be helpful for the future mathematics teaching and researches.

Examination of Reliability, Convergent Validity and Discriminant Validity By Using Multitrait-Multimethod Matrix: Under The Constraint That Sum of The Method Factors Equal Zero in Correlated Trait Correlated Method Model
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Saori Kubo*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

The multitrait-multimethod (MTMM) matrix can be utilized as a means to examine the convergent and discriminant validity of psychological measurement. The confirmatory factor analysis (CFA) has become one of the most widely applied approaches for analyzing the MTMM matrix. In CFA model for MTMM matrix, it is possible to obtain each of the variance components due to trait, method, and error effect. The result of decomposition of variance components allows for calculation of reliability coefficient and consistency coefficients quantifying convergent and discriminant validity.

Despite their simplicity of use, some CFA models for MTMM matrix, however, are sufferd from several problems, for example improper solutions, non-identificarion, and difficulty of interpretation. CT-CM (correlated trait correlated method) model is easily-interpreted, but is often not identified. On the other hand, CT-C(M-1) (correlated trait correlated method minus one) model is globally identified, but the researchers have to arbitrary choose one method factor as comparison standard, and estimates change depending on the choice, that is, the estimated result is not unique for a specific data. This is a profound problem, considering the purpose of examining the reliability and validity of the measurement.
This study presents that the constraint that sum of the method factors equal zero in CT-CM model permits a increase of identified data compared to the original CT-CM model, and moreover requires no choice of researchers such as CT-C(M-1) model. The calculated reliability and consistency coefficients also show that the model under this constraint is useful for examine reliability and validity.

Scheffe-Type Paired Comparison Models to Examine Correlations Between Preferences for Alternatives
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Norikazu Iwama*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

An analysis of paired comparison data is one of the topics in structural equation modeling. In this presentation, we focus on Scheffe's paired comparison model for multi-valued paired comparison data. For Scheffe-type paired comparison models proposed before, it has been difficult to estimate and examine correlations between individual preferences for alternatives appropriately. In this presentation, two models that enabled it are proposed. One is a simple model that makes it possible to estimate correlations between individual preferences. The other is an improved model that makes it possible to extract independent components from those correlations.
Through the analysis of paired comparison data that were collected by a questionnaire survey, where preferences for several new-product names were asked, it was shown that we can estimate not only average preferences for alternatives, but also correlations between individual preferences and loading matrices for independent components. In addition, the effectiveness of proposed methods was confirmed by the interpretations of those estimates.

The Relationship between Parenting Styles and Emotional Intelligence of the Gifted Students and Ordinary Students at Elementary Schools
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Chieh-Ju Tsao*,National Taichung University, Taiwan

Bor-Chen Kuo, National Taichung University, Taiwan
Yu-Ting Chang, National Taichung University, Taiwan

Gifted students are powerful resources of a nation. People always emphasize gifted students' exceptional intelligence and learning performance, but overlook the fact they have psychological needs too. This study is to investigate the related factors which influence the emotional intelligence of the elementary gifted students.When they are labeled by others as gifted, consequently, mental pressure would be imposed on them which could affect their emotional development. This study is to investigate the related factors which influence the emotional intelligence of the elementary gifted students and elementary students . The purpose of this study is to understand the school factor of the gifted elementary students and elementary students : such as teachers' teaching behavior , interaction between peers. In order to provide a theoretical framwork for educational and counseling programs for gifted students, this study also explores how theses factors are related to the emotioanl intelligence of the students. This study uses the statistic analysis, including T-test analysis,regression analysis and Structure Equation Modeling to test research hypotheses.
Finally, the results of the study provide a conceptual framework for designing the educational and counseling programs and the future research in the area of gifted education.

Sequential and Nonsequential Specification Searches in Testing Factorial Invariance
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Myeongsun Yoon*, Texas A&M University, USA
EunSook Kim, Texas A&M University, USA

In testing factorial invariance, researchers have often used modification indexes to find adequate partial invariant models and thus identify noninvariant items when the full invariance model did not fit well. In using modification indexes for the purpose of detecting noninvariant items, some have respecified the models sequentially one at a time for the item with the largest modification index until the largest modification index did not exceed a chosen critical value (i.e., 3.84) and others have used nonsequential specification searches where all parameters with large modification indexes were relaxed at the same time. The purpose of the present study was to empirically examine two different approaches for specification searches in testing factorial invariance. The simulated data were generated to represent different sample size conditions, different item type (continuous and ordered categorical items), and various levels of partial invariant models. The results of the study showed that sequential specification searches outperformed nonsequential specification searches in correctly detecting noninvariant items across all simulation conditions. In nonsequential specification searches, invariant items were more often incorrectly identified

as noninvariant items. Implications of the findings are discussed along with the limitations of the study.

Practicality of Person Fit Statistics as a Diagnostic Tool in a Computerized Adaptive Testing Setting
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Shungwon Ro*, Kenexa, USA
Ji Eun Lee, University of Minnesota, USA

With the item response theory (IRT), person misfit refers to item response patterns not following the IRT model in a way the model expects. Computerized adaptive testing (CAT) is an advanced delivery mode of testing that adapts to each examinee. CAT is known to work against person misfit in its algorithm. Therefore, any statistics intended to estimate person misfit at the individual level does not seem to work very well. However, even under the CAT setting, person fit statistics can be used for detection of item collusion, item breach or overexposure. This paper looks into practicality of person fit statistics as a diagnostic tool to address test security issues in an adaptive testing condition. In particular, detection power of person fit statistics for item collusion will be investigated.

Predictive Data Mining as an Alternative to Standard Regression Modeling in Very Large Data Sets
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Hongwei Yang, The University of Kentucky, USA
Kathryn Akers*, The University of Kentucky, USA

The study reviews several data mining predictive models as an alternative to standard regression in the context of very large data sets. Data mining is usually defined as the process of discovering meaningful hidden patterns in large amounts of data. Many industries use data mining to address business problems, such as bankrupt prediction, risk management, fraud detection, etc. Such applications in data mining primarily rely on its ability to effectively make accurate predictions. Predictions in data mining are usually conducted in two types of models: Decision trees and neural networks. The tree model is designed to identify the most significant split of the outcome at each layer of the model across all predictors, whereas the neural network model is capable of modeling nonlinear associations between the outcome and predictors, which in most cases makes a better approximation of the reality (usually nonlinear) so that the predictive power of the model is improved. The study compares the two types of predictive models with standard regression using a benchmark business application for fraud detection where the data set is large

enough to be partitioned into separate sub-portions for model training, validation, and testing. Various ways of model tuning are used to improve the predictive ability of each model. All models are evaluated for goodness-of-fit at the final stage using fit statistics including those that are specific to data mining. The analysis was performed in SAS Enterprise Miner, an easy-to-use, readily available program usually provided free-of-charge to higher education users through academic licenses.

A Procedure to Derive the Response Model for a Polytomous Item
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Wenjiu Du*, Southwest University, China
Hanmin Xiao, Southwest University, China

Those early polytomous models such as GRM (Samejima, 1969) or NCM (Bock, 1972) can be applied to items with either ordered response categories or unordered. However, it's a common fact that many items are scored in both of these categories. In the paper, a definition of item node is firstly given. Based on item nodes and the assumption that the probability of a correct response on an item node is fit by the two-parameter Logistic model, three polytomous models are proposed. Especially, the response model for the first-type items which is with ordered levels of response is the same as GRM in the format. Simultaneously, a theorem about GRM is mathematically proved. Lastly, Some discussions about the procedure and other models, for instance, PCM, are described.
In conclusion, the model for a polytomous item can be derived when the nodes of the item and their relations are specified.

Issues in Testing Scalar Invariance in Structural Equation Modeling
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Chansoon Lee*, Sungkyunkwan University, South Korea
Soonmook Lee, Sungkyunkwan University, South Korea

There have been unresolved arguments about the requirement of scalar invariance as a prerequisite of testing factor mean difference across groups in multi-group analysis of structural equation modeling. To investigate this issue, we conducted simulation studies on three conditions: difference in response intervals between groups, difference in response thresholds between groups, and existence of a response set. Based on a simple model of one factor with one observed categorical variable, we compared results from X-ANOVA(analysis of variance on observed variables) and F-ANOVA(analysis of variance on factor scores). There are three findings. First, when response intervals were different and intercepts were identical between groups, both F-ANOVA and X-ANOVA were significant

in the same direction. In this case, X-ANOVA will be enough to infer factor mean differences. Second, when response thresholds were different and intercepts were different between groups, F-ANOVA was significant despite that X-ANOVA was not significant. Third, when a response set was expected and intercepts were different between groups, F-ANOVA was not significant despite that X-ANOVA was significant. In the latter two situations, testing factor mean difference is required even when scalar invariance does not hold across groups. Meanings and limitations of the study, and suggestions for further studies are discussed.

Testing for Measurement Invariance Using Linear and Nonlinear Confirmatory Factor Analysis
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Dexin Shi*, University of Oklahoma, USA
Hairong Song, University of Oklahoma, USA
A. Robert Terry, University of Oklahoma, USA

In research involved with multiple-group comparisons, measurement invariance should first be tested to assess whether the same construct is measured by same observed variables in a similar way across groups. In structural equation modeling framework, measurement invariance has typically been tested using linear confirmatory factor analytic models, while leaving nonlinear confirmatory factor analytic models relatively underused. This study is aimed to compare linear and nonlinear confirmatory factor analysis in testing for measurement invariance using empirical data. The data used in this study are depression scores measured by CES-D scale from the National Longitudinal Survey of Youth (NLSY) 1979: Child and Young Adult. There were 3168 females and 3105 males included in the analysis. Both linear and nonlinear confirmatory factor analyses were used to assess measurement invariance across gender groups. The results showed that both linear and nonlinear factor analyses concluded a partial strong invariance on CES-D across gender; however, the two analyses produced slightly different invariance patterns. Moreover, by assuming measurements are categorical, nonlinear confirmatory factor analysis is more conservative in establishing measurement invariance. Based on our results, implications and suggestions are provided to applied researchers regarding to the uses of the linear and nonlinear factor analyses in testing for measurement invariance.

Multilevel Analysis Reveals Increased Proactive Interference Among Low Working Memory Span Individuals
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Ye Wang*, University of Florida, USA

David Therriault, University of Florida, USA
James Algina, University of Florida, USA

Proactive interference (PI) is a reduction in the ability to retrieve new information because prior learning interferes with storage and processing of the material to be learned. High- and low-working memory (WM) span individuals may experience differences in how they experience proactive interference (i.e., individuals who are lower in working memory should also be more vulnerable to PI).
This study explored whether accuracy on later trials in the reading span task (i.e., a WM task that require participants to read sentences while also remember a series of letters) would be influenced by the buildup of PI. Seventy-five participants completed the task. A within-subject multilevel binominal model was employed. In the following formula, P is the expected proportion of correctly recalled letters in each trial, WM is the reading span score, Trial is the serial number of the trial (15 trials in total), and Size is the number of letters to be remembered in each trial (ranging from 3 to 7). The estimated model was Logit(P)=2.49+0.04*WM+(0.002*WM–0.12)*Trial–0.64*Size.
The results indicate that for a WM score equal to 45 (i.e., the score that defines the lowest quartile), the simple slope for Trial is (0.002*45 – 0.12) = -0.03. The simple slope is even smaller for scores less than 45. Therefore, controlling for Size and WM, comparing the fifteenth trial with the first trial, the odds ratio for correct letter recall is e^((-0.03)*14) = 0.66, indicating a decrease in the probability of correctly recalling letters from first trial to fifteenth trial for low-WM participants.

Long-term Change of Relational Aggression among Mexican American Youth
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Xiaolan Liao*, University of Oklahoma, USA
Rand Conger, University of California, Davis, USA
Gary Stockdale, University of California, Davis, USA

Relational aggression is defined as harming others through purposeful manipulation or damage to their peer relationships. Despite of many studies devoted to examine relational aggression, long-term change or developmental patterns of relational aggression is under studied. The goal of this study is two-folded: a) to assess the overall growth trajectory of relational aggression during adolescence among Mexican American children, and b) to examine the role of gender, parent-child conflict, parental involvement in child education, and child-teacher attachment in explaining the differences in growth trajectories of relational aggression during adolescence. Four waves of data were collected from 317 Mexican American families, starting at when children were in the 5th grade. The results

from latent growth curve modeling showed that relational aggression declines among Mexican American children from the 5th to the 8th grade, there were significant variations among children in initial levels of aggression behaviors as well as the rate of decline, and children with a higher level of relational aggression behaviors tended to decline with a lower rate. Regarding to the effect of a few covariates under investigation, the results indicated that parent-child conflict (negatively), parental involvement in child education (positively), and child-teacher attachment (positively) contribute to the differences in levels of relational regression. Moreover, parent-child conflict negatively influenced the rate of change in aggression-- children with higher level of conflicts with their parents has lower rate of decline. No gender difference was found in the growth trajectories of relational aggression among Mexican American youth.

The Validation of Measurement Invariance across Gender in Volitional Questionnaire Chinese-version

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Ming-Shan Yang*, National University of Tainan / National Chia-Yi Special Education School , Taiwan
Siou-Ying Wu, National Chia-Yi Special Education School, Taiwan
Yen-Chao Chung, National Chia-Yi Special Education School, Taiwan
Szu-En Pan, National Chia-Yi Special Education School, Taiwan
Chia-Wei Hsiao, National University of Tainan, Taiwan

Abstract   Meaningful comparison of scale responses by gender would necessitate evidence of measurement invariance between responses obtained from the different gender groups. Measurement invariance reveals the extent to which scale responses maintain their meaning across groups and is essential to psychological measures. The purpose of this study is to examine the measurement invariance of the Volitional Questionnaire Chinese-version across gender.   The Volitional Questionnaire was developed by de las Heras and was translated into Mandarin via 2 stage methodology in order to investigate the construct validity. Rasch analysis indicated that the VO-C encompasses a unidimensionality. The students, about 100 males and 100 female, who were diagnosed with mental retardation will be recruited and must be with sufficient comprehension, normal sensorimotor function in upper extremity and ages are above 13 years old. Cubes arrangement activities are manipulated and scored in order to examine the measurement invariance of the VO-C.   Structural equation modeling (SEM) will be used to investigate the measurement invariance of the Volitional Questionnaire Chinese-version across gender. The data will be analyzed by using Analysis of Moment Structures (AMOS) program.

Psychometric Evaluation of the Italian Version of the Qualid Scale: A Contribution to Cross-National Implementation of a Test for Qol in Late-Stage Dementia
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Tiziano Gomiero*, ANFFAS Trentino Onlus, Italy
Luc Pieter De Vreese, Health District of Modena, Italy
Ulrico Mantesso, ANFFAS Trentino Onlus, Italy
Elisa De Bastiani, ANFFAS Trentino Onlus, Italy
Elisabeth Weger, ANFFAS Trentino Onlus, Italy

OBJECTIVES: The aim of this study was to verify the reliability and validity of the Italian version of an instrument for rating quality of life in persons with Intellectual Disability with late-stage Alzheimer's disease and other dementing illnesses.
DESIGN: A group of professionals with experience submit the Quality of Life in Dementia Scale (QUALID), an 11-item scale. The window of observation for each subject was 7 days. A 5-point scale captured the frequency of each item. Lower scores reflected a higher quality of life (QoL). Validity was assessed by comparison with other measures.
SETTING: Residential services specialized in the care of people with ID.
PARTICIPANTS: Professional caregivers of 40 persons with ID, divided into two equal subgroups with and without dementia. The sample has a mean age of 56,4 ± 4,71 SD years, 22 persons are females, 60% have Down's syndrome.
MEASUREMENTS: QUALID and AADS-I, an informant-based questionnaire targeting the frequency and impact on management and quality of life (QoL) of dementia-related Behavioral Excesses and Deficits in adult and elderly persons with ID.
RESULTS: QUALID scores ranged from 11 to 55 points and were skewed toward higher QOL (lower scores). Internal consistency of items was high (Cronbach' alpha .795), as were test-retest reliability and consistency across recorders. There was relationship between QUALID and the Behavioral Excesses sub-scales scores of AADS-I but not with the Behavioral Deficit sub-scales.
CONCLUSION: The QUALID is a reliable and valid scale, administered to caregivers, for rating QoL in persons with ID in late-stage dementing illness.

Invariance of Equating Functions Across Gender Groups of the Taiwan Assessment of Student Achievement
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Hsuan-Po Wang*,National Taichung University of Education, Taiwan
Yu-Ju Lu, National Taichung University of Education, Taiwan
Bor-Chen Kuo, National Taichung University of Education, Taiwan

Chien-Ming Cheng, National Taichung University of Education, Taiwan

This study investigates whether the functions linking number-correct scores to the Taiwan Assessment of Student Achievement (TASA) scaled scores remain invariant over gender groups, using 10 forms from TASA 2007 in Mathematics (TASA-MAT) for the 8th grade students. The degree of population invariance was also compared across item response theory (IRT) true score and IRT observed score equating methods that are commonly used in the nonequivalent groups anchor test (NEAT) design. Equatability indices proposed by Dorans and Holland (2000) were used to evaluate population invariance over gender subpopulations. The root mean square difference (RMSD), the root expected square difference (RESD), and the root expected mean square difference (REMSD) three types of equatability measures were used to assess to what degree the linking functions were invariant over gender subpopulations.
The goals of this article were to compare the RMSD, RESD, and REMSD results obtained for the IRT true score equating and the IRT observed score equating. And there were various methods for obtaining this scale transformation: the mean / mean (Loyd and Hoover, 1980) method, the mean / sigma method (Marco, 1977), and the characteristic curve methods such as the Haebara (1980) and the Stocking and Lord (1983) methods. The Results indicated that the conversions obtained from gender groups were similar to the conversions obtained by using the total group, except the Form 7 transformed by the method of Mean/Sigma. And in this form, RMSD exceeds SDTM at the high score region when the Mean/Sigma method was applied.

Self-esteem and Individual Adaptability
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Huajian Cai*, Chinese Academy of Science, China
Hairong Song, University of Oklahoma, USA

In two studies, we examined that relationship between self-esteem and individual adaptability. In study 1, by using a cross-sectional design, it was found that self-esteem was significantly associated with individual adaptability, with low self-esteem associating with low individual adaptability. In study 2, by using a longitudinal design, cross-lagged regression analysis further revealed that self-esteem did not predicted subsequent levels of individual adaptability and neither did individual adaptability predict subsequent levels of self-esteem. These findings suggest that although self-esteem and individual adaptability are related to each other, they do not have any prospective effect on each other.

The DFTD Strategy with Likelihood Ratio Test method in Assessing DIF for polytomous items

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Guo-Wei Sun*, National Sun Yat-sen University, Taiwan
Hui-Ching Chen, National Taichung University of Education, Taiwan
Ching-Lin Shih, National Sun Yat-sen University, Taiwan

The type I error rate rates of most DIF assessment methods were inflated as the percentage of DIF items in the test increased. It should be noted that the power rate of DIF assessment method is meaningless if the type I error rate is not well-controlled. To deal with this problem, DIF-free-then-DIF (DFTD) strategy was recommended to implement in DIF assessment methods (Wang, 2008). It is important to develop reliable ways in selecting DIF-free items as anchor, otherwise, the matching variable may contain DIF items and the subsequent DIF analysis is affected.
Higher accuracies in selecting DIF-free dichotomous items was found by using the scale purification procedure in DFTD strategy If the same findings hold in polytomous items was investigated in this study. Through a series of simulation studies, the scale purification procedure was found can yield higher accuracy than other methods on identifying a set of DIF-free items, especially when the percentage of DIF item is high. Furthermore, it was found taking these selected items as anchor of DFTD strategy, the subsequent constant item method performed well in controlling Type I error rates of DIF assessment.

Development of Creative Life Style Check List

Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.

Wan-Ying Lin*, National Sun Yat-sen University, Taiwan
Ying-Yao Cheng, National Sun Yat-sen University, Taiwan
Li-Ming Chen, National Sun Yat-sen University, Taiwan
Ya-Hsueh Wang, National Sun Yat-sen University, Taiwan

A good scale of creative life styles not only provides feedback information about their creative thinking for students, but also offers them useful information in understanding their own creative behavior in life. This preliminary study aims to develop and validate the Creative Life Style Check List for diagnosing undergraduates' creative life styles toward themselves, and let people know what kind of styles they belong and how to increase creative life behavior. Participants were 304 undergraduates in Taiwan. A total of 30 draft items were generated by research team members based on literature of creativity. The items were checked by five experts from fields of education and psychological measurement.

Unidimensional Rasch analysis was employed to examine model-data fit, differential item functioning and the separation and order of item difficulty.
The results manifested that the Creativity Life Style Check List had a reasonably good model-data fit, moderate correlation among the subscales, and no significant DIF across gender. The Creativity Life Style Check List offers students a valuable tool for understanding undergraduates' creative live behavior for diagnosing students in need of making more creativity in life.

Test for the Number of Factors in Exploratory Factor Analysis: A Nonparametric Goodness-of-Fit Approach
Poster Session II: Thursday, 21 July, 5:30 p.m. – 7:00 p.m.
Kentaro Hayashi*, University of Hawaii at Manoa, USA

Finding the number of factors in exploratory factor analysis is an old problem. Yet, there has been no uniformly the best procedures. The most famous methods are based on eigenvalues of the correlation matrix, such as the Kaiser-Guttman (eigenvalue-greater-than-one) rule, the scree plot, and the parallel analysis. If you employ the maximum likelihood (ML) estimation, the likelihood ratio test (LRT) and information criteria such as AIC and BIC are available. However, it is known that, when the number of factors exceeds the true number of factors in the population, the factor loading matrix is no longer uniquely identified and thus the regularity conditions for the asymptotic chi-square distribution of the LRT no longer holds true. As a remedy for the afore-mentioned problem associated with the LRT, we propose the procedure based on a nonparametric goodness-of-fit method. Because the same phenomenon of possible violation of regularity conditions occur in many other situations such as the neural network models and finite mixture models, we think the applicability of the proposed method is quite wide.

Friday, 22 July, 2011

Modeling Heterogeneity in Dynamical Structures and Processes
Symposium: Friday, 22 July, 9:20 a.m. -- 10:40 a.m., D1-LP-03

Fitting Nonlinear Differential Equation Models with Random Effects Using the Stochastic Approximation Expectation-Maximization Algorithm
Sy-Miin Chow*, University of North Carolina at Chapel Hill, USA
Hongtu Zhu, University of North Carolina at Chapel Hill, USA
Andrew Sherwood, Duke University, USA

The past decade has evidenced the increased prevalence of irregularly spaced longitudinal data in social sciences. Often lacking, however, are practical tools that allow researchers to fit dynamic models to irregularly spaced data that may show heterogeneity in dynamical structures. A stochastic approximation expectation-maximization algorithm for fitting multivariate linear and nonlinear differential equations with random effects is presented. The performance of the proposed approach is evaluated using two benchmark nonlinear dynamical systems models, namely, the Van der Pol oscillator and the Lorenz equations. The empirical utility of the proposed technique is illustrated using a set of ambulatory cardiovascular data from 170 college students over the course of 24 hours. Pertinent methodological challenges and unresolved issues are discussed.

Modeling physiological emotion specificity with regime switching state space models
Tom Lodewyckx*, University of Leuven, Belgium
Francis Tuerlinckx, University of Leuven, Belgium
Peter Kuppens, University of Leuven, Belgium
Nicholas Allen, University of Melboune, Australia
Lisa Sheeber, Oregon Research Institute, USA

Although there is no doubt that physiology is intricately linked to emotion, there is ongoing debate about how physiological activation maps onto emotions. One theoretical view is based on the assumption that there is a discrete set of specific emotions, each having a typical physiological signature. Other views postulate distinct physiological signatures for sets of emotions, such as positive and negative emotions, or approach and avoidance emotions. When studying physiological emotion specificity, not only the particular categorization of emotions (degree of specificity) is of interest, but also which properties of the process are influenced by these emotional states (type of specificity). Until now, specificity has mostly been narrowed down to the investigation of differences in average

physiological activation, but even in the absence of mean differences, it might be that specificity occurs at the level of variability or dynamics of the physiological processes. To model both the degree and type of emotion specificity, we propose regime switching state space modeling as an appropriate statistical approach. The regime variable defines the degree of specificity, whereas the type of specificity is represented by which of the parameters are regime-specific. We performed a Bayesian implementation of the regime switching state space model consisting of traditional Gibbs sampling (to sample the system parameters) and forward-filtering backward-sampling (to sample the underlying states). This approach was applied to data consisting of second-to-second continuous physiological measures and discrete behavioral emotion codings (representing the regimes) from adolescents observed during emotion-eliciting interactions with their parents.

Exploratory Analysis of Heterogeneous Dynamic Models Using a Multi-sample SEM Algorithm

Lawrence L. Lo*, Pennsylvania State University, USA
Peter C. M. Molenaar, The Pennsylvania State University, USA
Michael J. Rovine, Pennsylvania State University, USA

Advances in idiographic approaches have enabled detailed study of individual dynamics in the psychological and neurobiological domains, yet there is increasing demand to unite these methods with nomothetic perspectives. Although recent advances in this combined approach have primarily occurred in fMRI research, there is potential for implementation in any psychological inquiry. This presentation presents a new multilevel exploratory algorithm for identifying and estimating dynamic relationships that may be shared among persons or specific to an individual. The framework is based on a generalization of the state space model that includes contemporaneous and lagged structural relationships within time series data. Estimation procedures utilize dynamic extensions of structural equation models and incorporate multiple persons by multi-sample methods. The algorithm identifies shared and subject-specific structural relationships by a combination of likelihood ratio and standard error statistics. A Monte Carlo simulation study demonstrates the accuracy of the exploratory algorithm in varying conditions of sample size, model complexity, and level of dynamic heterogeneity. A real data example using data from an fMRI study shows an empirical application of the approach. The algorithm is incorporated in a free program that has been written in R and conducts maximum likelihood estimation with the OpenMX package. The program has been designed to be easy to use, merely requiring a data set with no necessary additional commands; however, the program also contains several optional commands to allow for flexible modeling capabilities. This combination of ease and

flexibility is intended to facilitate research that combines idiographic and nomothetic perspectives.

The Modelling and Efficient Estimation of Locally Stationary Time Series
Sebastien Van Bellegem*, University of Toulouse I & University of Louvain, France

Understanding phenomena that evolve over time is the focus of many studies in the behavioral sciences. Typical models for time processes are based on the assumption that their statistical properties (such as the mean, the variance or, more generally, the second-order moment structure) remain constant over time. Although this stationarity assumption is mathematically convenient, it appears that most individual time series in empirical studies display a nonconstant statistical structure over time. As an example, one may consider the time dynamics of individual emotion components that may be subject to highly changing regimes (e.g., as a function of the amount of external stress). Those regimes are sometimes unobserved, and the resulting emotion components cannot hardly be described by stationary models.
In this talk several recent approaches to model non stationary time series are surveyed. Our approach is to model the human process as a stationary process only locally, although it is not stationary globally over time. Our goal is to propose a statistically efficient approach to fit models with a time-varying statistical structure to data at hand and, more importantly, to analyze the time-variation of statistical properties as a structural, explanatory characteristic of the phenomenon under study. In the case of individual emotions, this could mean, for instance, that the changing dynamics in emotion components, as estimated and understood in our models, may display a generic profile that may be considered itself as an important aspect of emotion dynamics.

Optimal Item Design in Multidimensional Two-Alternative Forced Choice Tests
Parallel Session: Multidimensional Item Response Theory – Methodology; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-06
Iwin Leenen*, Investigación y Evaluación, Mexico
Jimmy de la Torre, Rutgers University, USA
Vicente Ponsoda, Universidad Autónoma de Madrid, Spain
Pedro Hontangas, Universidad de Valencia, Spain

In the last decade, the use of forced choice items has regained interest as a possible way to develop more fake-resistant personality measures. In a typical two-alternative forced-choice test, each item is composed of two item components (e.g., personality adjectives) that pertain to different latent dimensions/traits. Respondents are asked to select the component

that they consider the best description of their personality. Traditional scoring counts the number of (positive and negative) components selected for each dimension and leads to compositional (or ipsative) data from which it is hard to deduce between-subject information. In contrast, the multi-unidimensional pairwise preference (MUPP) model can convey between-subject information (Stark, Chernyshenko, & Drasgow, 2005). Leenen, Ponsoda, de la Torre, and Romero (2010) have recently reconsidered the MUPP model within a Bayesian framework, and proposed a Markov chain Monte Carlo (MCMC) estimation procedure for the parameters.
In this study, we investigate how the design of the test relates to the quality of parameter recovery (based on MUPP and the MCMC procedure). In particular, we design a simulation study, where the following factors are varied: (a) test length, (b) the number of latent traits measured, (c) the number of different components per dimension, (d) the difference between (the location parameters of) the components in a pair, and (e) the proportion of unidimensional pairs (i.e., with both components from the same dimension) in the test. The correspondence between true and estimated parameter values is evaluated using several goodness-of-recovery statistics and compared across the conditions of the simulation design.

The Confirmatory Multidimensional Generalized Graded Unfolding Model
Parallel Session: Multidimensional Item Response Theory – Methodology; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-06
Shiu-Lien Wu*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

Most of existing unfolding IRT (item response theory) models for Likert items are unidimensional. When there are multiple tests of Likert items, or when a Likert item measures more than one latent trait simultaneously, unidimensional unfolding models become inefficient or inappropriate. To resolve this problem, we developed the confirmatory multidimensional generalized graded unfolding model, which is a multidimensional extension of the generalized graded unfolding model (Roberts, Donoghue, & Laughlin, 2000), and conducted a series of simulations to evaluate its parameter recovery. The simulation study demonstrated that the parameters of the new model can be recovered fairly well with the R package R2WinBUGS and computer program WinBUGS. The Tattoo Attitude Questionnaires with 3 scales of Likert items were analyzed to demonstrate the advantages of the multidimensional model over the unidimensional model. The results showed that the multidimensional model had a better fit than the unidimensional one (log PsBF = 27.2); the multidimensional model yielded higher reliability estimates (.92, .89, .83) for the 3 latent traits than the unidimensional one (.84, .85, .83); and the multidimensional

model yielded higher correlation estimates among the 3 latent traits (.20 ~ .84) than the unidimensional model (.04 ~ .30).

Pairwise Modeling Method for Longitudinal Item Response Data
Parallel Session: Multidimensional Item Response Theory – Methodology; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-06
Jian Tao*, Northeast Normal University, China
Zhi-Hui Fu, Shenyang Normal University, China
Ning-Zhong Shi, Northeast Normal University, China
Nan Lin, Washington University in Saint Louis, USA

Multidimensional item response theory (MIRT) models can be applied to longitudinal educational surveys where a group of individuals are submitted to different tests over time with some common items. However, computational problems typically arise as the dimension of the latent variables increases. This is especially true when the latent variable distribution cannot be integrated out analytically, as with MIRT models for binary data. In this article, based on the pseudo-likelihood theory, we propose a pairwise modeling strategy to estimate item and population parameters in longitudinal studies. Our pairwise method effectively reduces the dimensionality of the problem and hence is applicable to longitudinal IRT data with high-dimensional latent variables, which are challenging for classical methods. And in the low-dimensional case, our simulation study shows that it performs comparably with the classical methods. We further illustrated the implementation of the pairwise method using a development study of mathematics levels of junior high school students.

Random Item MIRID Modeling and its Application
Parallel Session: Multidimensional Item Response Theory – Methodology; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-06
Yongsang Lee*, UC Berkeley, USA
Mark Wilson, University of California at Berkeley, USA

The MIRID (Model with Internal Restrictions on Item Difficulty; Butter, 1994) model has been found to be useful for investigating cognitive behavior in terms of the underlying cognitive processes that lead to that behavior. The main objective of the MIRID model is to enable one to test how component processes influence the complex cognitive behavior in terms of the item parameters. The original MIRID model is indeed a fairly restricted model for a number of reasons. One of these restrictions is that the model treats items as fixed and thus does not fit measurement contexts where the concept of the random items is needed.

This paper proposes random item approaches to the MIRID model, and describes both simulation and empirical studies to test and illustrate the random item MIRID models.

Are there any Consequences of using Unidimensional IRT on a Multidimensional Test?
Parallel Session: Multidimensional Item Response Theory – Methodology; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-06
Marie Wiberg*, Umeå University, Sweden

Achievement tests which measure more than one ability are sometimes modeled with unidimensional item response theory (UIRT) although it is known that they are multidimensional. The aim with this paper was to examine if there are any consequences of using UIRT on a multidimensional college admission test. The test consist of five subscales and can be divided into two sections, i.e. it can be considered either as a 1D(imension) test (one test score is given), a 2D test (a verbal and a quantitative section) or as a 5D test (five subscales). The real test was examined using both UIRT and multidimensional IRT (MIRT). Further, simulations were used to examine item and ability parameter recovery when the unidimensionality assumption was violated and if overspecified or misspecified multidimensional models were used.
The result from the real test indicated that using UIRT for each section gave the smallest amount of bias, followed by using 2D MIRT models. The largest bias was obtained when using the 5D MIRT model. In the simulations, the item parameter recovery for multidimensional items had more bias if the MIRT models used were slightly misspecified compared with using UIRT models. When a test contained two sorts of unidimensional items together with 2D items the 3D MIRT model yielded less bias than to use the correct specified 2D MIRT model. In conclusion, UIRT models can be useful to use with multidimensional tests, especially when it is problematic to specify which dimensions an item belong to.

Evaluating the Quality of Rater-Mediated Assessments with a Multi-Method Approach
Parallel Session: Rasch Models - Applications in Ability Measures; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-07
Amy Hendrickson*, The College Board, USA
George Engelhard, Jr., Emory University, USA

The purpose of the study is to describe methods for examining the quality of ratings obtained on Advanced Placement (AP) exams. All of these exams include constructed

response (CR) tasks that require scoring by raters. Given the importance, visibility, and influence of the AP program, it is essential that the ratings meet a high level of psychometric quality.
Data from current reader-reliability studies are used to illustrate a multi-methods approach for analyzing ratings on the AP exams. Both Generalizability and Rasch measurement theory are used to evaluate the quality of ratings. This study focuses on two AP exams: English Language and Composition and Statistics. These exams include quite different types of rater-mediated tasks – essays versus mathematical word problems and different numbers of tasks – 3 versus 6. The level of rater consistency, thus, would be expected to be quite different across these exams.
Both Generalizability Theory (implemented with GENOVA) and multifaceted Rasch measurement (MFR; implemented with the Facets computer program) are used to assess and compare the rater functioning across the tasks on these exams. Several earlier studies (Engelhard and Myford, 2003; Wolfe, Myford, Engelhard, and Manalo, 2007) examined features of the AP exam processes with MFR models. In addition, rater consistency is regularly assessed for the AP exams using Generalizability Theory. This study compares and contrasts the results from both approaches, and it provides a rich picture of how to evaluate the quality of the ratings within these two measurement theories. This research helps inform best practices in exam development, rater training, and scoring methodologies for large-scale rater-mediated assessments.

Investigating Item Difficulty Change by Item Positions under the Rasch Model
Parallel Session: Rasch Models - Applications in Ability Measures; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-07
Luc T Le*, Australian Council for Educational Research, Australia
Van Nguyen, Australian Council for Educational Research, Australia

In operational testing programs using item response theory (IRT), item parameter invariance is one of essential requirements in common item equating designs. However, in practice, the stability of item parameters can be affected by many factors. Particularly, this study utilised data from the large-scale Graduate Skills Assessment (GSA) in 2010 to investigate the change of Rasch item difficulty by item positions. The test included 78 multiple-choice items and was presented in eight test forms by arranging the items in different orders. Items addressed three components of generic skills: Critical Thinking, Problem Solving and Interpersonal Understandings. Each test form was randomly admistered to about 8000 Colombian university students in November 2010. In the cohort there were roughly equal numbers of males and females.

For each component, a three-faceted Rasch model was applied to evaluate the variation of test form difficulty and item difficulty estimates by these forms. Then for each item, the difference of item difficulty etsimates from each pair of the forms was examined in relation to the position difference of the item in the forms.
Findings showed that there was a small variation in the test form difficulty. However, in general, items themselves became more difficult when they were located towards the end of the test. The change of the item difficulty correlated significantly with the corresponding change of its position in the test. Moreover, the correlation was highest for Problem Solving items and lowest for Interpersonal Understandings items. The correlations were higher for males than for females.

A Mixed-Methods Approach for Exploring the Accuracy of Writing Self-Efficacy Judgments
Parallel Session: Rasch Models - Applications in Ability Measures; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-07
George Engelhard*, Emory University, USA
Nadia Behizadeh, Emory University, USA

The purpose of this study is to describe a mixed-methods approach for examining accuracy of student judgments regarding their writing self efficacy. A mixed-methods approach is used in this study that includes: (1) calibration of a writing self-efficacy scale with a Rasch measurement model, (2) identification of discrepancies between writing self-efficacy judgments and teacher grades, and (3) detailed qualitative analyses (observations and interviews) to increase our understanding of the relationships among these variables. Accuracy is defined as the congruence and match between student confidence regarding writing (writing self-efficacy) and the actual performance on these writing skills as reflected in teacher grades (achievement). Eighth grade students in two classrooms (N=109) from a school located in a major southeastern city in the United States are included in the study. The Writing Self-Efficacy Scale is adapted from Pajares, Miller, & Johnson (1999), and it consists of 15 items with a nine-category rating scale. Rasch analyses were conducted with the Facets computer program (Linacre, 2007). The analyses indicate that students with higher writing self-efficacy tend to have higher teacher grades in writing, and that boys have slightly higher writing self-efficacy than girls. The analyses identified a small ordinal interaction between gender and teacher grades with boys who receive grades of B tending to be less accurate than girls with B grades. The qualitative analyses illustrate and support the results of the quantitative analyses. This study combines Rasch analyses with qualitative methods to obtain to deeper understanding of student confidence and accuracy related to writing.

Implementing a New Selection Model across 27 European Countries
Parallel Session: Rasch Models - Applications in Ability Measures; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-07
Markus Nussbaum*, European Personnel Selection Office, Belgium
Gilles Guillard, European Personnel Selection Office, Belgium

The European Personnel Selection Office (EPSO) delivers a staff selection service on behalf of the Institutions of the European Union. For each selection process candidates from the 27 member states are assessed in order to select the best for possible recruitment as EU Officials within the Institutions.
In 2008, EPSO initiated a major overhaul of its selection processes under the EPSO Development Programme (EDP). From a psychometric point of view the key feature was the shift from knowledge based to competency based assessment. The full document is available here: http://europa.eu/epso/doc/edp_11_2010.pdf.
In March 2010, the first competition for graduates under this model was launched and a total of 37,348 candidates were assessed against several competencies, including verbal, numerical and abstract reasoning. All of these competencies were measured through computer-based tests consisting of 20 items in verbal reasoning and 10 items each in numerical and abstract reasoning. The verbal and numerical reasoning items were drawn randomly from a database of approximately 2800 Rasch-compliant items in English, French and German, which the candidates undertook in their second language. In abstract reasoning there were 10 test forms with items compliant with the 2PL model and confirmed to be compliant with the Rasch model as well.
The challenges in implementing the new selection model were to ensure fair and equal treatment across the 27 member states with different cultures, education systems and 23 different languages. By applying a carefully selected mix of assessment methods and sound psychometrics, EPSO can ensure equal opportunities for all candidates.

Rasch Modeling of a Mindful Learning Scale
Parallel Session: Rasch Models - Applications in Ability Measures; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-07
Zhenlin Wang*, The Hong Kong Institute of Education, Hong Kong
Christine, X. Wang, University at Buffalo, USA

Understanding the nature of teaching and learning is vital for self-regulated learners (Frye & Wang, 2008). Children's understanding of teaching and learning goes through a transformation during early years: preschoolers often see teaching and learning as doing

without mental involvement; only with the acquisition of theory of mind, the ability to make mental state reasoning, do children start to comprehend that teaching and learning are mental activities that involve intention and knowledge change, and become mindful learners. To help understand this developmental path, we investigated children's understanding of mindful learning using Rasch modeling. Sixteen short stories were drawn from previous studies (Frye & Ziv, 2005; Wang, 2010; Ziv & Frye, 2004) to assess children's understating of intention and knowledge change in teaching and learning. Ninety-seven children from an east coastal U.S. city participated in this study, with mean age of 61.8 months. All children finished a theory of mind scale (ToM), a receptive language ability test (PPVT), an expressive language ability test (EVT), and the 16-item mindful learning scale. Rasch modeling of the mindful learning scale found that all items fit the scale well with fit statistics within -2 to +2. The item difficulty levels confirmed the theoretical prediction of the difficulty sequence. Suggestions are made based on the Rasch modeling on selecting items from the 16 stories to form a usable mindful learning scale for researchers and educators alike to measure children's developmental level. The relation among children's theory of mind ability, language ability, and mindful learning is discussed.

Transformation Structural Equation Models for Analyzing Highly Non-normal Data
Parallel Session: Structural Equation Modeling - Methodology II; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-08

Xinyuan Song*, The Chinese University of Hong Kong, Hong Kong
Zhaohua Lu, The Chinese Univesity of Hong Kong, Hong Kong

In behavioral, social, and psychological sciences, the most widely used models in assessing latent variables are structural equation models (SEMs). When analyzing SEMs with continuous variables, most existing statistical methods and software have been developed based on the crucial assumption that the response variables are normally distributed with constant variances. Although some recently developed parametric and nonparametric methods can partially address the violation of this assumption, they encounter serious difficulties in handling data with extremely non-normal distributions, such as highly skewed, U-shaped, and other irregular distributions. The transformation model is a useful tool for building a relationship between response variables and a bundle of explanatory variables, which will allow the resulting model to justify the model assumptions and thus produce more reliable results. One problem with the parametric transformation model is that the choice of transformation is usually restricted to the power or shifted power family. The limited flexibility of this parametric family could cause important features of the distribution to be missed. A more comprehensive approach is to estimate the transformation in a nonparametric way. We aim to develop a semiparametric transformation SEM.

Nonparametric transformation functions are modeled with Bayesian P-splines. Markov chain Monte Carlo algorithms are implemented to estimate transformation functions and unknown parameters in the model. The proposed methodology is applied to a real study on polydrug use.

Examination of Robustness of Heterogeneity of Residual Variance in Mediation Effect with Categorical Exogenous Variable
Parallel Session: Structural Equation Modeling - Methodology II; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-08
Heining Cham*, Arizona State University, USA
Jenn-Yun Tein, Arizona State University, USA

Mediation is defined as the the causal relation of variable X on outcome Y accounted for by mediator M (e.g., Baron & Kenny, 1986; MacKinnon et al., 2002, 2007; Shrout & Bolger, 2002). SEM framework provides a general representation of mediation models. A common mediation model is that variable X is categorical (e.g., gender, experimental groups). Very often, coding variable (e.g., dummy/effect codings) is used to represent categorical X, which assumes homogeneity of residual variances of M and Y among all categories of X. The use of coding variable of X impedes researchers to detect the violation of this assumption by examining global fit indices (e.g., RMSEA and CFI), modification indices, and outlier diagnostics (e.g., Cook's D, influence).
This works has two purposes. First, a simulation study is conducted to examine the robustness of the violation of homogeneity of residual variances of M and Y across categories of X in the mediation model. Relative bias of path coefficient estimates, relative bias of standard errors, coverage rate the percentile bootstrap confidence interval of the mediation effect, and Type-I error rate of the significance test of the mediation effect are investigated.
Second, multi-group SEM is proposed to establish the mediation model with allows the heterogeneity of residual variances of M and Y. Under this framework, researchers can also uses multivariate significance tests (Wald/likelihood ratio test), global fit indices, and outlier diagnostics. Such advantages over the coding variable framework is investigated in the simulation study and demonstrated with a real example.

A Poor Person's Posterior Predictive Checking of Structural Equation Models
Parallel Session: Structural Equation Modeling - Methodology II; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-08
Taehun Lee*, University of California at Los Angeles, USA
Li Cai*, University of California at Los Angeles, USA

Posterior Predictive Model Checking (PPMC) is a Bayesian method for assessing the compatibility of a posited model to data by comparing the observed data to (plausible) future observations simulated from the posterior predictive distribution. The PPMC method is predicated upon the idea that, if the model fit is reasonable, future observations should look "similar" to the observed data. In the present paper, we propose a Poor Person's version of the PPMC (hereafter PP-PPMC) wherein the posterior distribution of model parameters is replaced by a multivariate normal distribution with its center equal to the MLE of parameters, and a dispersion matrix equal to the inverse of the information matrix. PP-PPMC can be considered as an alternative to PPMC when one cannot afford (or is unwilling) to draw samples from the full posterior. Using only byproducts of likelihood-based estimation, the PP-PPMC offers a natural way of handling parameter uncertainty in model assessment, without resorting to asymptotic arguments (cf. likelihood ratio chi-square), and without further model-refitting (cf. parametric bootstrap). The proposed method can also be effective in outlier detection (cf. Cook's distance). Through simulation studies and real data analysis, we explore the viability of the PP-PPMC method in the context of structural equation modeling by employing various existing fit indices as discrepancy measures. In particular, distributions of tail-area probabilities of discrepancy measures are carefully examined under varying degrees of model mis-specifications for the purposes of drawing practical recommendations about the PP-PPMC method.

A New Family of Model Fit Indices in Confirmatory Factor Analysis: Information Complexity (ICOMP) Criteria
Parallel Session: Structural Equation Modeling - Methodology II; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-08
Hongwei Yang*, The University of Kentucky, USA
Eylem Deniz, Mimar Sinan Fine Arts University, Turkey
Hamparsum Bozdogan, The University of Tennessee, USA

This study adds to the literature of model selection in confirmatory factor analysis (CFA) by introducing a new family of model selection criteria called information complexity criteria, or ICOMP. CFA tests hypotheses about the relationship between items and factors specified using a priori model structure. A critical question in CFA is the choice of a champion model from several competing models that provides a good fit to the data. Such a model assessment and selection process should be primarily based on substantive, theoretical considerations. Besides, statistical fit indices complement theoretical justifications when evaluating competing models. Multiple model fit indices assess the fit of a CFA model from

multiple perspectives. Among them are information criteria (AIC, CAIC, AICC, etc.), a special case of relative fit criteria. ICOMP belongs to the group of information criteria. Similar to other criteria, ICOMP takes the form of a penalized log likelihood function plus a component that punishes model complexity. However, ICOMP is capable of taking into account more aspects of the model than other criteria when assessing model complexity: Inter-dependency of parameter estimates as well as number of model parameters, sample size for model estimation, etc. Such a more comprehensive approach has been successful in numerous applications, but its application to CFA has been limited so far. Therefore, this study examines the performance of ICOMP in CFA through large scale simulations. ICOMP criteria are compared with other well-established criteria in terms of the number of times the true model is identified under varying modeling conditions.

MetaSEM: An R package to Conducting Meta-Analysis using Structural Equation Modeling
Parallel Session: Structural Equation Modeling - Methodology II; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D1-LP-08
Mike W.-L. Cheung*, National University of Singapore, Singapore

Meta-analysis and structural equation modeling (SEM) are usually treated as two unrelated statistical techniques in the literature. Recently, it has been shown how meta-analysis can be integrated into the general SEM framework (Cheung, 2008; Cheung & Chan, 2005; 2009). metaSEM is an R package that conducts meta-analysis via OpenMx, a flexible SEM package. metaSEM can be used to conduct: (1) fixed- and random-effects univariate and multivariate meta-analysis; (2) fixed- and random-effects meta-analytic structural equation modeling (MASEM) on correlation/covariance matrices. This talk will illustrate with examples on how to conduct univariate and multivariate meta-analysis and MASEM with the metaSEM package. Future development will also be discussed.

Power and Robustness Analysis of Multilevel Modeling of Longitudinal Growth
Parallel Session: Longitudinal Data Analysis; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-08
Lihshing Wang*, University of Cincinnati, USA

When a non-random cluster design involves two or more groups where pretesting is possible but randomization is not, three common statistical procedures exist for modeling the treatment effects: Analysis of Covariance (ANCOVA), Repeated-Measures Analysis of Variance (RMANOVA), and Multilevel Longitudinal Growth Analysis (MLGA). MLGA

represents an appealing choice because it can produce unbiased results even when the data are unbalanced in time and/or contain missing observations.
The present study provides simulation evidence to support the use of multilevel longitudinal growth analysis in a non-random cluster design. Specifically, Type I error rate and power under different simulation conditions (distributional assumptions, sample size, and missingness) are compared across the three modeling approaches ANCOVA, RMANOVA, and MLGA. Normality and compound symmetry (including sphericity) assumptions were manipulated at two levels (met vs. not met). Cell sample size was manipulated at three levels (30, 100, and 500). Missingness was manipulated at two levels (complete vs. missing 50% at random on posttest). The experiment was replicated 1000 times to calculate the power at alpha = .1, .05, and .01.
Results suggest that within the current simulation framework, RMANOVA is more powerful than ANCOVA in detecting true effects, but the evidence of MLGA over RMANOVA is less compelling in a pre-post test design with only two time points. We conclude that multiple analytical approaches should be tested for convergence; when contradictory conclusions are found, judicious choice of the analytic method should be based on the data structure resulting from non-random clustering.

A Joint Model for Selection Bias and Measurement Error
Parallel Session: Longitudinal Data Analysis; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-08
Chueh-An Hsieh*, National Sun Yat-sen University, Taiwan

There has been a growing interest in observational studies in the use of propensity score methods for estimating treatment effects and policy evaluation. Propensity score analysis is a statistical technique which can be used to estimate causal effects, reduce bias, increase precision, and statistically mimic randomization for an observational study. Thus, in the present study we implement the propensity score approach, and demonstrate its application within a unified latent growth curve modeling framework using data from the Longitudinal Study of American Youth (LSAY; Miller, Kimmel, Hoffer, and Nelson, 2000). That is, as a simple demonstration, a longitudinal analysis was conducted to evaluate the influence of ability grouping and assess the corresponding changes in pupils' belief in their self-efficacy. It is expected that, through this extended case study, we can as intended demonstrate the breadth of the propensity score method, and address the issues of selection bias and measurement error in a more general analytic framework.

Fitting the Linear Mixed Models into the CLS Data with both Static and Dynamic Predictors

Parallel Session: Longitudinal Data Analysis; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-08

Ji Hoon Ryoo, University of Nebraska, USA
Arthur J. Reynolds*, University of Minnesota, USA

Growth in Iowa Test of Basic Skills (ITBS) reading and mathematics achievement scores from kindergarten to 8th grade were studied in 1,539 Chicago public school students who are at risk of educational and social difficulties due to economic disadvantage and are participants in the Chicago longitudinal study (CLS). We fit linear mixed models (LMM) into the longitudinal achievement data within a variety of functional forms of time variable including conventional polynomial model, trigonometric model, and fractional polynomial model. In addition to the variety of functional forms to time variable, it will be discussed how to model the change of scores when data include both static and dynamic predictors, where the static predictor is time-independent covariate and the dynamic predictor is time-dependent covariate. Instead of converting dynamic predictor to static predictor that has often been done in practice, we consider dynamic predictor as it is in the analysis. This study not only helps to document the patterns of students' achievement in CLS but also provides a unified framework on selecting a LMM for longitudinal achievement data when both static and dynamic predictors are present.

Lord's Paradox and the Use of Growth and Value-Added Models for School Accountability

Parallel Session: Longitudinal Data Analysis; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-08

Andrew Ho*, Harvard Graduate School of Education, USA

When comparing the pretest-posttest differences between treatment and control groups, a gain-score analysis and the analysis of covariance (ANCOVA) can yield conflicting results, even as these analytic approaches seem to address the same research question. This paradox was posed by Lord (1973) and clarified by Holland and Rubin (1983) in a formal causal model that identifies two distinct counterfactual assumptions. In this paper, I describe how similarly contrasting analytic approaches are used to support school accountability decisions in the United States. On the one hand, a "trajectory model" extends a student's gain score into the future and evaluates whether a future standard will be achieved. On the other hand, a "prediction model" uses a regression equation to predict whether the standard will be achieved in the future. The U.S. Department of Education classifies both as "growth models" and is encouraging their proliferation under a recent federal funding competition known as Race to the Top.

The contrasts between these models are stark and are well informed by Lord's original paradox and the Holland-Rubin causal model that disentangles it. I establish the extent to which the models will disagree under common data structures, and I articulate the assumptions that underlie their classification as "growth models." The analysis extends to multiple waves of data, where growth trajectories may be estimated across multiple points, or a prediction equation can be estimated with multiple prior years. Finally, I discuss the implications of Lord's paradox for models that estimate the "value added" of teachers and schools.

Measurement Invariance in Longitudinal Data with a Developmental Latent Trait over Time
Parallel Session: Longitudinal Data Analysis; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-08
Ji Hoon Ryoo*, University of Nebraska, USA

In longitudinal data, the primary goal is to understand the change in a latent trait by modeling observable indicators of the latent trait. In the process of estimating latent trait scores from observable behavior, it is often assumed that the measurement providing the observed variables is invariant over time. However, it has been discussed in the measurement invariance literature that true measurement invariance is often rejected if the premise is formally tested. The methodology for testing the invariance assumption using the factor analysis (FA) has been available for over two decades; however, it has been focused on testing measurement invariance at test-level while the testing result is mainly affected by invariance at item-level. On the other hand, the item response theory (IRT) includes same characteristics as FA, i.e., to investigate a latent trait by modeling observable indicators of the latent trait. In addition, the equivalence at some classes of models was proved by Takane and de Leeuw (1987), though there are additional classes in IRT models such as the three-parameter logistic model (Millsap, 2010). In spite of advantages of IRT approach, there are still many issues to unify the testing procedure. One of those issues would be the existence of development on the latent trait measured over time. In this study, I examine measurement invariance in longitudinal data measured by Test of Early Mathematics Ability, 3rd ed. (TEMA-3) and discuss testing procedure when the development of the latent trait is present.

Investigation and Validation of College Student Well-Being Property Scale
Parallel Session: Test Development and Validation - Nonability Measures I; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-09
Wei-Hao Chiang*, National Sun-Yat-sen University, Taiwan

Zuway-R Hong, National Sun-Yat-sen University, Taiwan

The purposes of this study were to validate an instrument of College Student Well- being Property Scale (CSWPS) and to investigation grade level, school, major, income, out-school activity, and gender differences in Taiwan's college students' well-being properties. A total of 130 college students completed CSWPS in 2011. Factor analyses, correlation analyses, t-tests, and ANOVAs were conducted to compare the similarities and differences among male and female students in different grade levels, schools, majors, income, and out-class activities. The initial findings were as follows: the CSWPS indicated has an adequate construct validity and internal reliability, eight components together accounted for 70.90% of the variance；the internal consistency of the total items was found a high Cronbach'sαof .92; there were non-significantly difference on the total scores of CSWPS; junior students had significantly higher scores on negative emotion, life satisfaction and communication than their sophomore counterparts; private college students had significantly higher scores on autonomous, academic/out-class activity and communication than their public college student counterparts; students who were majored in human and social science had significantly higher scores on positive emotion, and life satisfaction than those students who were majored in science and technology; high income college students had significantly higher scores on life satisfaction and academic/ out-class activity than these low income counterparts. Implication and limitation of these findings are provided and discussed.

On the Test-Retest Reliability of the 100-item IPIP Scales: Differential Temporal Stability of the Big Five Personality Traits
Parallel Session: Test Development and Validation - Nonability Measures I; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-09
Luning Sun*, University of Cambridge, UK
Michal S. Kosinski, University of Cambridge, UK
David J. Stillwell, University of Nottingham, UK
John N. Rust, University of Cambridge, UK

The 100-item IPIP scales (Goldberg, 1999) are commonly used to measure the NEO-PI-R five-factor model (Costa & McCrae, 1992). The present study aims at examining the temporal stability of the Big Five personality traits by analyzing the test-retest reliability of the 100-item IPIP scales. A large
sample of IPIP data was collected via the Facebook application 'myPersonality', of which 78,053 participants completed the questionnaire at least twice, with time intervals ranging from 1 day to 2 years. Test-retest correlations of all five personality domains are reported

for the intervals of increasing days and weeks from 1 day to 3 months after the initial administration. In order to control the effect of transient error, the correlation coefficients for intervals greater than 1 week are compared
with those for the first week, and resulted in different onsets of stabilized significant differences across personality traits. Accordingly, personality changes are shown to occur after different intervals across the five domains, suggesting differential temporal stability of the Big Five personality traits. Moreover, regression analyses reveal a gradual decay in the test-retest reliability at different speed across the five domains. Finally, a number of factors that might have an effect on the test-retest reliability are investigated, including the personality scores, the retest interval, the internal consistency of the scales, and the number of times the test has been taken before. Based on the results, an algorithm to predict the test-retest reliability is proposed and discussed.

Mathematics Anxiety Scale for Filipino Students (MAS-FS): Reliability, Validity, and Bias Detection
Parallel Session: Test Development and Validation - Nonability Measures I; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-09
Josefina Almeda*, University of the Philippines, Philippines

Many foreign-made instruments are found in the literature measuring Mathematics anxiety. However, the manner how these items were written is not the same as how Filipinos write items using the English language. Thus, an affective scale for Mathematics Anxiety was developed to measure the level of Math anxiety of Filipino students (MAS-FS). The objectives of the study were to test the reliability and validity of the instrument, extract underlying constructs, and determine if items are free from gender and course bias. Initially, two parallel forms consisting of 30-items each were developed. Then, the items from the two forms were combined and administered to 180 college students. The combined form was tested for internal consistency reliability using Cronbach's alpha coefficient and was found to be reliable with a coefficient of 0.969. The researcher tested the reliability of the parallel forms and both were internally consistent reliable with Cronbach's coefficient of 0.939 and 0.940. The two forms were valid using principal component factor analysis. Three factors were both extracted from the two forms: Attitude towards Math, Feeling towards Math, and Experience with Math. For item bias detection, chi-square and ordinal logistic regression were used. Some items in the MAS-FS display differential item functioning. Undergraduate male and female students do not differ significantly in their perspectives in answering the 30-item MAS-FS. Sciences and Social Science Courses have different perspectives in answering several items of the instrument. The models

demonstrate that subgroup sex and course have significant effect in answering the items of MAS-FS.

Development and Validation of College Students Perception toward Parenting Practice Scale
Parallel Session: Test Development and Validation - Nonability Measures I; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-09
Dong-Ting Zou*, National Sun Yat-sen University, Taiwan
Zuway-R Hong, National Sun Yat-sen University, Taiwan

The research reported in this study focuses on the development and validation of an instrument of College Students' Perception toward Parenting Practice Scale (CSPPPS). The investigator-developed 30-item of CSPPPS was modified and derived from "parenting styles scale" (Shiuejen, 1996). A total of 101 college students were randomly selected from a large sample size university in Southern Taiwan. All participants completed the CSPPPS in early spring 2011. Factor analyses, expert validity and internal consistency analyses were conducted to assess its reliability and validity. The initial findings were as follows: father's version of CSPPPS indicated an adequate construct validity and internal reliability, two components (i.e., request and response) together accounted for 57.47% of the variance；the internal consistency of the total items was found a high Cronbach's α of .94; mother's version of CSPPPS also indicated an adequate construct validity and internal reliability, two components (i.e., request and response) together accounted for 55.25% of the variance；the internal consistency of the total items was found a high Cronbach's α of .92. The present findings were coherent with Maccoby and Martin's study (1983). Implications and discussions of findings were provided and discussed.

Text Classification Frameworks for PTSD Screening Using N-Grams
Parallel Session: Test Development and Validation - Nonability Measures I; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-09
Qiwei He*, University of Twente, Netherlands
Bernard Veldkamp, University of Twente, Netherlands

The development of health information technology demonstrated breakthroughs on quality, continuity, and efficiency of health care during the past decade. One such promising application is the use of natural language processing to identify the clinical information contained in unstructured free text documents and to codify the qualitative data into structuralized quantitative data. This paper explored the benefits of using N-grams for the

classification of patients' self narratives in screening for posttraumatic stress disorder (PTSD) within the text mining system.
Unlike the traditional face-to-face structured interviews with itemized questionnaires, respondents were asked to write down their stories and symptoms online. Based on a collection of 300 self narratives, we developed three text classification frameworks using two standard machine learning algorithms, Decision Tree and Naïve Bayes, and one self-designed classification model named Product Score. Feature selection was performed using the Chi-square feature selection algorithm on a word-based space composed of unigrams, bigrams, trigrams and mixture of N-grams.
With the sample in hand, the baseline unigram representation in conjunction with the Product Score model performed the most effective and kept the highest consistency with psychiatrists' diagnoses. It was also notable that the classification accuracy was not enhanced significantly when a more complex mixture of N-grams was used, though the sensitivity and specificity were resulted in a more balanced way. This pilot study demonstrated that the text mining technique was very efficient in screening for PTSD and would be promising to be applied to a broader scope in education, psychology and epidemiology research.

Computerized Classification Testing under the Higher-Order Polytomous IRT Model
Parallel Session: Computerized Adaptive Testing; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-10
Kung-Hsien Lee*, National Chung Cheng University, Taiwan
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

Latent traits in the human sciences may have a hierarchical structure, for example, a second-order latent trait "language proficiency" covers four first-order latent traits: listening, speaking, reading, and writing. The higher-order IRT model has been developed to account for tests measuring hierarchical latent traits. Being an IRT model, computerized classification testing (CCT) and computerized adaptive testing (CAT) under the higher-order IRT model can be developed. In this study, we focused on the development of CCT algorithms. Specifically, item responses on the first-order latent traits were assumed to follow the generalized partial credit model. The current-estimate approach was adopted for item selection and the ability-confidence-interval approach was adopted for classification. The results of simulation showed that the CCT algorithms were efficient; the higher correlation between the first-order latent traits, the more points each item had, the fewer categories for classification, the more accurate and efficient the classification would be.

On-line Calibration Design for Pretesting Items in Adaptive Testing

Parallel Session: Computerized Adaptive Testing; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-10

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Hua-Hua Chang, Universsity of Illinois at Urbana-Champaign, USA

Among many issues that are currently of concern for large-scale computerized adaptive tests (CAT) program, on-line calibration is especially important. Administration of CATs requires pre-calibrating many new items, and therefore, it is crucial to be able to calibrate test items in large quantities efficiently and economically to maintain the operational item bank. Most current CAT programs tackle the problem by assembling new items into several blocks and assign the blocks to examinees. As a result, the calibration is non-adaptive. The objective of proposed research is to investigate whether an adaptive method is more effective than the traditional methods based on either pre-assignment or random assignment regarding to estimation consistency and item pool management. The adaptive approach tries to select the optimal examinees to calibrate pretest items (e.g., Stocking, 1990). To evaluate the performance of the new design, a simulation study is performed. An item bank of a real operational test, fitted by 3-parameter logistic model, is used. For CAT adminstration, maximum priority index (MPI; Cheng & Chang, 2009) is used to select 12-item tests and to satisfy their content constraints; MLE is used for scoring. Three pretest items are seeeded at preassigned positions using the different studied designs. Multiple-cycle EM procedure is used for estimating item parameters. Sample size and Item parameters recovery through bias and RMSE are used as evaluation criteria. Results, discussion, and future research are reported.

Applying Kullback-Leibler Divergence to Detect Examinees with Item Pre-Knowledge in Computerized Adaptive Testing

Parallel Session: Computerized Adaptive Testing; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-10

Hsiu-Yi Chao*, National Chung Cheng University, Taiwan
Jyun-Hong Chen, National Chung Cheng University, Taiwan
Shu-Ying Chen, National Chung Cheng University, Taiwan

Test security is always an important issue in computerized adaptive testing (CAT). When item sharing occurs, a test-taker may receive test information from previous examinees (i.e. informants), and his/her trait estimates may be over-estimated. The purpose of this study is to apply Kullback-Leibler divergence (KL divergence; Kullback & Leibler, 1951) to detect examinees with item pre-knowledge in CAT. The KL divergence has been successfully applied for cheating detection in traditional paper and pencil tests (Belov &

Armstrong, 2010), and may be a good alternative for detecting examinees with item pre-knowledge in CATs. Simulation studies were conducted to investigate the performance of the KL divergence on cheating detection in CATs. Type I error rate and detection power were evaluation criteria. Results indicated that under various conditions considered in this study, examinees with item pre-knowledge can be effectively detected by using the KL divergence.

Overestimation of Fisher information in Variable Length CATs due to Capitalization on Chance
Parallel Session: Computerized Adaptive Testing; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-10
Juan Ramon Barrada*, Universidad Autonoma de Barcelona, Spain
Julio Olea, Universidad Autonoma de Madrid, Spain
Francisco J. Abad, Universidad Autonoma de Barcelona, Spain

Previous research has shown that: (a) capitalization on chance (the tendency to select items with overestimated discrimination paramater) is present on computerized adaptive testing; (b) this leads to a minimal decrement of estimation of trait level accuracy; (c) looses in accuracy due to capitalization are higher at the extreme levels of theta; and (d) the estimated Fisher information in the estimated trait level is also overestimated. Taking this into consideration, variable length CATs whose termination criteria is estimated standard error will apply fewer items than needed to achieve the real requested accuracy. This problem will be illustrated with a simulation study where ratio test length/item bank size, sample size for the estimation of item parameters, stopping criteria and item selection rules (Fisher information, progressive and proportional methods).

Computerized Adaptive Testing and Adaptive Experimental Design
Parallel Session: Computerized Adaptive Testing; Friday, 22 July, 9:20 a.m. -- 10:40 a.m.; D2-LP-10
Yun Tang*, Ohio State University, USA
Jay Myung, Ohio State University, USA
Michael Edwards, Ohio State University, USA
Mark Pitt, Ohio State University, USA

Computerized adaptive testing (CAT) has been intensively and widely studied in educational testing. In CAT, an adaptive sequence of test items is chosen from an item bank so as to accurately infer the examinee's ability level with the fewest possible items. Recently in cognitive science, an experimental methodology dubbed adaptive experimental

design (AED) has been developed under the Bayesian decision theoretic framework. The goal of AED is to conduct a cognitive experiment such that a participant's mental process can accurately be inferred in the fewest possible experimental trials. Given these apparent similarities between the two adaptive methods, it would be useful to examine what could possibly be learned from each other, especially from the CAT side given its history of successful real world applications. Despite the recent demonstration of its feasibility, AED needs to overcome many challenges before being used routinely in cognitive experimentation. For instance, the huge computational cost of AED algorithm hinders its application in real-time experiment. In contrast, CAT has various ready-to-use toolboxes for speeding up the necessary computations. Addressing the computational issues in AED, we have explored the possibility of multi-stage experimentation, adopting the multi-stage testing method in CAT. The basic idea is that instead of trial-by-trial adaptation, experiment designs could be updated after a block of trials and the computation time between adaptations could be used flexibly to keep participants motivated. In this paper we present simulation results showing the advantages of the multi-stage setup in AED.

Heterogeneity in Latent Variable Models
Symposium : Friday, 22 July, 1:30 p.m. -- 2:50 p.m., D1-LP-03

Testing Statistical and Substantive Hypotheses on the Distribution of the Observed Data Within the Generalized Linear Item Response Model
Dylan Molenaar*, University of Amsterdam, The Netherlands
Conor Dolan, University of Amsterdam, Netherlands

In the generalized linear item response model (Mellenbergh, 1994), a continuous variable, Z, is regressed on an underlying common factor. Z can represent the approximately continuously distributed observed data (e.g., scores on 7 or more ordinal answer categories, or subtests scores), or a hypothetical continuously distributed variable underlying the observed polytomous item scores (e.g., Wirth & Edwards, 2007). In both cases (observed data are continuous or polytomous), Z is commonly assumed to be normally distributed. This distributional assumption implies specific assumptions in the regression of Z on the common factor. We present statistical tests on these specific assumptions and explain how violations of these assumptions can result in heterogeneity in the data. Additionally, we show how the resulting models are interesting from a substantive point of view. Specifically, we demonstrate how the models can be used in the field of intelligence (to investigate ability differentiation; Spearman, 1924), in the field of personality (to investigate schematicity; Markus, 1977) and in the field of behavior genetics (to investigate gene by environment interactions; van der Sluis et al., 2006).

A test for Cluster Bias: Detecting Violations of Measurement Invariance Across Clusters in Multilevel Data

Suzanne Jak*, University of Amsterdam, The Netherlands
Frans Oort, University of Utrecht, Netherlands
Conor Dolan, University of Amsterdam, Netherlands

In case of cluster bias, measurements do not represent the same construct for subjects from different clusters. We present a test for cluster bias, which can be used to detect violations of measurement invariance across clusters in multilevel data. Using multilevel structural equation modeling, separate models can be formulated for the within (subject) level and between (cluster) level covariance matrices. Cluster bias is investigated by testing whether the factor loadings at the within and between level are equal, and the residual variance at the between level equals zero. The test is illustrated with an example from school research. With simulations, we investigated the performance of the test for cluster bias in terms of detection rate, false positives and estimation bias for different sample sizes and different magnitudes of bias. Overall, the cluster bias test has sufficient power to detect cluster bias, and the proportions of false positives are around the chosen alpha values.

Using Factor Analysis to Assess the Number of Factors in Measurements

Mariska Barendse*, University of Groningen, The Netherlands
Marieke Timmerman, University of Groningen, Netherlands
Frans Oort, University of Utrecht, Netherlands

If data are collected from a heterogeneous sample, then heterogeneity may yield additional (unexpected) dimensions in the data set. Exploratory factor analysis can be used to determine dimensionality as the number of common factors in a set of observed items. Model selection can be based on fit indices. In a simulation study, we will compare various methods of exploratory factor analysis, under various conditions. In generating the data we vary the response scales (continuous, dichotomous, polytomous), the model approximation error (zero, low), the size of the factor loadings (medium, high), and the inter-factor correlations (zero, high). For each condition, 500 sets of data are generated and analysed with exploratory factor analysis, with the following estimation methods: maximum likelihood, robust maximum likelihood, weighted least squares, and full information maximum likelihood. Frequently applied fit indices such as chi-square, standardized root mean square residual, and root mean squared error of approximation will be used to decide the number of factors. In addition, we will also use the (adjusted) chi-squared difference test to decide the number of factors. The performance of the different estimation methods and fit

indices is evaluated by the proportions of correctly assessed number of factors. Results will be presented.

Analyzing Longitudinal Survey Data: A Bayesian IRT Model with Occasion-Specific Item Parameters

Josine Verhagen*, University of Twente, The Netherlands
Jean-Paul Fox, University of Twente, Netherlands

Questionnaires are often administered repeatedly to measure changes in attitude, performance or quality of life. To study individual latent growth given repeated measurement data, a common assumption is that the measurement characteristics are invariant over time. However, for several reasons, repeated testing can cause changes in the characteristics of items, and in these cases it is not justifiable to use the same measurement model for each occasion.
A Bayesian IRT model will be proposed which combines a longitudinal multilevel structure on the latent variable with random occasion-specific item parameters. Linear or non-linear time effects and time-varying covariates can be incorporated on both levels to explain growth in the latent trait or systematic item parameter shifts. The model also allows for measurement invariance tests without the need for anchor items. A Bayes factor can be used to compare models with and without variance in occasion-specific item parameters, while a highest posterior density region test can be used to detect differences in the estimated occasion-specific item parameters. The result is a comprehensive model to analyze longitudinal survey data. Examples of applications to longitudinal questionnaires in a medical setting will be given.

Assessing the Response of Sports Training Items Using Within-Item Multidimensional Modeling

Parallel Session: Multidimensional Item Response Theory – Applications; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Shyh-ching Chi*,National Taiwan Sport University., Taiwan

The purpose of the study was to assess the Response of Sports Training Scale was based on within-item multidimensional model. The scale includes 7 dimensions. As regards selection, training, competition, medical science, leadership and management, counseling coach character, there came up with multidimensional problems, and it is estimated that a high correlation exists between dimensions (.954 to .993). First Alpha Factors was applied to extract the common factors. For the determination of the dimensions in terms of attribution of questions, 89 observations had been ruled out because of missing; and SAS multiple

imputation is applied on the process. And then we used ConQuest multidimensional model to estimate the test questions. The findings show: (1) test questions were fit to model. (2) within-item multidimensional separation reliability 0.972 was better than between-item multidimensional 0.875. (3) In the estimation of test questions in terms of standard errors, the within-item multidimensional average 0.017 was also more accurate than the between-item multidimensional average 0.028 (4) In the estimation of test questions in terms of difficulty range, the within-item multi- dimension -0.198 to 0.478 was wider than the between-item multi-dimension -0.163 to 0.188. (5) In the estimation of test questions in terms of homogeneity test card square value, the within-item multidimensional 2474.95 was greater than the between-item multidimensional 467.61. The conclusion of this study is that the Response of Sports Training Scale is fit to the within-item multidimensional model.

Measuring Change and Response Format Effects in Large Scale Educational Testing with LLRA

Parallel Session: Multidimensional Item Response Theory – Applications; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Thomas Rusch*, Vienna University of Economics and Business, Austria
Ingrid Dobrovits, Vienna University of Economics and Business, Austria
Birgit Gatterer, Vienna University of Economics and Business, Austria
Reinhold Hatzinger, Vienna University of Economics and Business, Austria

Linear logistic models with relaxed assumptions (LLRA) are a flexible tool for item-based measurement of change as well as multidimensional Rasch-type models. Their key feature is to allow for multidimensional items and mutual dependencies of items as well as imposing no assumptions on the distribution of the latent trait in the population. Inference for such models becomes possible within a framework of conditional maximum likelihood estimation (CML). We will use the flexibility of different versions of the LLRA to analyze large scale educational test data (n=781) stemming from an introductory course on accounting at WU. Here, we have a repeated measurement design with two time-points. The items used form three theoretically distinct groups, each possibly comprising a homogeneous scale. Additionally, the items were presented in two different response formats (multiple choice and open answer). A number of subject-specific covariates that are of interest for differential trend and item effects are available. Specifically we will use LLRA to (i) estimate effects over time e.g. learning effects (ii) investigate the effect of using different response formats (iii) assess if the dimensionality of items is as theoretically expected (iv) find out if there are differential effects due to subject specific-covariates.

The Measurement of Civic Knowledge and the Response Process Behind: A Multidimensional Mixture IRT Modeling Approach
Parallel Session: Multidimensional Item Response Theory – Applications; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Joseph Kui-Foon Chow*, The Hong Kong Institute of Education, Hong Kong
Kuan-Yu, Jin, The Hong Kong Institute of Education, Hong Kong

This paper was based on the International Civic and Citizenship Education Study (ICCS) conducted by the IEA, where 14-year-old students responded to more than 120 attitudinal items on civic and citizenship. As a typical outcome of large scale assessment, traditional Rasch analyses produce single scale scores for each participating country for comparison in a league table. In order to make realistic assessments of students' level of trust, the heterogeneity in the sample should be explored since there is evidence that unobserved heterogeneity may provide multiple classes with unique characteristics (Willse, 2011).This study, therefore, brings in the idea of "sub-populations" within a population. We will demonstrate with empirical datasets to examine the use of the mixture Rasch model as an alternative to the traditional Rasch model, especially when misfit items are observed and/ or when there is a signal of threat to uni-dimensionality of the measurement scale.
We analyzed the dataset on students' trust of political institutions (6 scaled items). By "unmixing" the unobserved sub-populations, the mixture Rasch analysis showed that a majority of students showed relatively more trust to the police but the minority showed less trust; however, these two groups showed similar trust towards other institution. It should be thus noticed that these unobserved groups within a sample may be very important to identify especially when they represent a sizable proportion of the sample. Left unanalyzed, heterogeneity may result in severe distortions and any implications drawn would be misleading.

Modeling the PISA 2006 Science Data by Using Additive MIRT Model
Parallel Session: Multidimensional Item Response Theory – Applications; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06
Mingchiu Chang*, National University of Tainan, Taiwan
Hueying Tzou, National University of Tainan, Taiwan

Many educational and psychological assessments are inherently multidimensional. However, in practice, examinees' proficiencies are estimated by using all test items in conventional unidimensional IRT (CU-IRT) analysis while ignoring the issue of multidimensionality. Under the unidimensional IRT framework, examinees' proficiencies in each domain/dimension are estimated repeatedly by using different subsets of items. However,

the overall ability estimate may not be valid because of the extent to which the unidimensional assumption is violated. Meanwhile, the ignoring of correlation between domains/dimensions, the proficiency estimate in each domain is unreliable when the number of items in each domain is limited. (Ackerman, 1992; de la Torre & Patz, 2005; Wainer et al., 2001).
It's impossible to obtain the overall and content specific ability estimates n one calibration by using ConQuest. Thus, two five-dimensional scaling models were used in the PISA 2006 main study. The first model was used for reporting overall scores, and the second model was used to generate scores for the three science subscales. Moreover, PISA used much ancillary information into the estimation process.
The additive MIRT model proposed by Sheng and Wikle (2009) incorporates both general and specific ability dimensions in the same model, and has been shown to perform better than the CU-IRT model. The purpose of this study is to investigate the benefit and flexible in the additive MIRT model to modeling the PISA 2006 science data. It is hope that we can get accurate and effective estimation result in one calibration without ancillary information.

The Measurement of Chinese Language Proficiency based on Higher Order IRT Model

Parallel Session: Multidimensional Item Response Theory – Applications; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-06

Rih-CHang Chao*, National Taichung University, Taiwan
Yahsun Tsai, National Taiwan Normal University, Taiwan
Bor-Chen Kuo, , National Taichung University, Taiwan

According to CEFR, language competences consist of general language competences (GLC) and communicative language competences (CLC). GLC are those not specific to language, but which are called upon for actions of all kinds. In contrast, CLC consists of 3 different dimensions; linguistic, sociolinguistic and pragmatic, are those which empower a user or learner to act using specifically linguistic means. In respect to the language proficiency framework which is referring to as a two-level hierarchical assessment structure. Therefore, a higher order item response model (HO-IRT) is applied to analyze the test data. The objective of this study was to assess the language proficiency in Chinese for Chinese heritage students (CHS) who enrolled in preparatory Chinese language programs at National Taiwan Normal University. The performances of unidimensional IRT (UIRT) and HO-IRT are compared in this study. There were 486 CHS taken Chinese Culture Test (CCT). The results indicated that HO-IRT model fit these data and is able to explain these data well compared with UIRT.

Psychometric Validation of the Health-related Child Body Questionnaire (HRCBQ) to Assess Chinese Caregiver Body Perception

Parallel Session: Rasch Models - Applications in Nonability Measures; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07

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Aims: It is likely that caregivers tend to base their ideas on personal subjective experience, optimistic views and biased-cognition to the body questions raised. The HRCBQ was developed to assess caregiver's perception of child body image.
Methods: The HRCBQ consists of 17 health related child body questionnaire. Based on Stunkard et al. (1983)'s work, similar drawings for a child body figures, depicting a child aged 2-4 and a young adolescent aged 16-18 years old, ranging from very thin to very fat (1-9 scales). The psychometric performance of the HRCBQ was validated in several stages based on Rasch model, to identify items measuring biased-cognition, degree of items of biased-cognition, favorable biased-cognition items and demographics among caregivers.
Results: 508 mothers and 1055 preschool teachers from 50 vary socio-economic background of kindergartens completed the HRCBQ. Eight out of 17 items had been identified as items of biased cognition; no misfit item was observed (critical range of 0.6 to 1.4). Among these 8 items, the easier bias item (item difficult= -1.52) and the most difficult bias tem (item difficult=-1.28) were also identified. Home-maker mothers, student-teachers and teachers from China had more bias than full time working mothers, practice-teachers and teachers from Hong Kong ($p<0.001$). Mothers with lesser education, poor incomes had more bias than the better groups ($p<0.001$).
Conclusions: The results of psychometric analyses confirmed that the HRCBQ had consisted 8 items of biased cognition scientifically. More comprehensive items should be further developed to confirm the HRCBQ and its impact on socio-cultural responsive reliability.

Item Banks of Quality of Life Measures on Young Adult Survivors of Childhood Cancer

Parallel Session: Rasch Models - Applications in Nonability Measures; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07

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Gwendolyn Quinn, Moffitt Cancer Center, USA
Zhushan Li, Boston College, USA
Elizabeth Shenkman, University of Florida, USA

This study aims to develop health-related quality of life (HRQOL) item banks for young adult survivors of childhood cancer (YASCC) based on items derived from three existing instruments. We identified YASCC who were between 21 and 30 years old and had been off therapy for more than 2 years without cancer. Data were collected (N=151) via telephone interviews. Three stages were utilized to develop item banks: mapping items from three instruments into a common HRQOL construct, checking dimensionality using confirmatory factor analyses (CFA), and equating items using Rasch modelling. Specifically, we conducted CFA to analyze unidimensionality and local independence. Comparative Fit Indices (CFI), Tucker-Lewis-Index (TLI), and Root Mean Square Error of Approximation (RMSEA) were used to determine the assumption of unidimensionality. Residual correlation was used to determine the assumption of local independency. Item fit was examined through Rasch modelling using the index of information-weighted/outlier-sensitive fit statistic mean square (INFIT/OUTFIT MNSQ). Items with the MNSQ >1.3 or <0.7 were removed from the item banks. We assigned 123 items to an HRQOL construct comprised of six generic and eight survivor-specific domains. CFA retained 107 items that meet the assumptions of unidimensionality and local independence. Rasch analysis retained 68 items that satisfied the fit index. However, in terms of difficulty parameters, items in most banks were relatively easy for the subjects, whereas YASCCs' underlying HRQOL was at the middle to lower levels. Future studies are needed to refine the item banks, especially including more challenging items.

Teacher Quality of Work Life in Primary School Comparison of Psychometric Properties Using Rasch Model

Parallel Session: Rasch Models - Applications in Nonability Measures; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07

Nordin Abd. Razak*, Universiti Sains Malaysia, Malaysia
Ahmad Zamri Khairani, Universiti Sains Malaysia, Malaysia
Mahaya Salleh, Teacher Training Institute, Malaysia

The aim of this study is to examine and evaluate the psychometric properties of an instrument which used to measure the Teacher Quality of Work Life and its dimensions across the Malaysian major ethnic groups which is represented by the Malay, Chinese and Indian teachers in three different types of Malaysian primary schools namely the National Type Primary School (NTPS), the National Type Chinese Primary School (NTCPS), the National Type Tamil Primary School (NTTPS). Teacher Quality of Work Life construct consists of four main dimensions which are the Psychological Needs, the Social Needs, the Political Needs and the Economical Needs and every main dimension has several subdimensions except the Economical Needs. The sample used in this study contained

1080 respondents from 90 primary schools in Penang and Kuala Muda/Yan District in Kedah and 360 teachers were selected randomly from each type of primary schools. The study was conducted by administering the questionnaires developed by Nordin et al. (2009) and the psychometric properties were examined from several aspects such as fit statistic, unidimensionality, item reliability and person score, Differential Item Functioning (DIF) and comparing the similarities and differences of Teacher Quality of Work Life across ethnic groups. Items were analysed using Rasch Measurement Model. The findings indicated that four items did not fit the Rasch Model and as a result the items were omitted from the scale. Subsequent analysis indicated that all the items fitted the model and measuring one dimensional construct after omitting the four misfit items from the Teacher Quality of Work Life instrument. The presence of Differential Item Functioning (DIF) items and the results from one-way analysis of variance (ANOVA) showed that cultural orientation had its influence on the responses from respondents of three etnic groups, namely the Malay, Chinese and Indian of the construct being measured.

A Rasch Analysis of Positive Academic Affect Scale
Parallel Session: Rasch Models - Applications in Nonability Measures; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Jingjing Yao*, The Hong Kong Institute of Education, Hong Kong

Positive academic affect is regarded as an important indicator in successful school performance. There are many studies on positive or negative affect scales in the context of America or other western culture, but seldom take place in China. Although there is abundant literature on emotion and affect, most of the existing scales are constructed to measure mood or emotion purely, and many of them with low reliability or poor validity. To develop a brief and valid measure, we developed positive academic affect scale. Pilot test data were collected from 134 high school students. The Rasch rating scale model was used to analyze the data. Information on item fit, item diddiculty and internal consistency was examind. The scale displayed satisfactory psychometric properties.

Validating an Instrument for Measuring Leadership Responsibilities of Hong Kong Vice-Principals – A Rasch Analysis
Parallel Session: Rasch Models - Applications in Nonability Measures; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-07
Paula Kwan*, The Hong Kong Institute of Education, Hong Kong
Joseph Kui-Foon Chow, The Hong Kong Institute of Education, Hong Kong

Literature has substantiated a growing trend in the recognition of the important role vice-principals play in schools which is evident in the increasing amount of work focusing on their roles and responsibilities, job satisfaction, and career aspiration. Amongst the empirical studies, factor analysis is the most frequently used statistical tools. A possible drawback of using factor analysis is the lack of a common framework based on which comparison and consolidation of research findings produced by various researchers can be made as different researchers literally adopt different sets of responsibility roles derived in their studies. A more serious deficiency of using factor analysis is the lack of an objective measure in the analysis.
The study aims to validate an instrument to measure Hong Kong secondary school vice-principals' responsibilities using Rasch Analysis. Based on responses from 331 vice-principals, Rasch analysis was applied to assess the model-data fit of the 56 4-point Likert items , which included checking for optimal response categories usage, person ability-item difficulty targeting, person and item reliabilities, principal component analysis of standardised residuals and test of differential item functioning (DIF). The overall results showed that except for a few misfitting items all other items can meaningfully contribute to measuring a single construct at good reliability. In particular, among the items on the area of "instructional leadership", where there is lack of consensus among schools as the literature suggested, DIF analysis was also performed to evaluate the differential performance among respondents from different school subsidy types and school bandings.

Fitting Direct Covariance Structures by the MSTRUCT Modeling Language of the CALIS Procedure
Parallel Session: Structural Equation Modeling - Applications II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Yiu-Fai Yung*, SAS Institute Inc., USA

This presentation demonstrates the applications of the MSTRUCT modeling language implemented in the CALIS procedure of SAS/STAT (version 9.22 and later). The MSTRUCT modeling language provides direct specifications of the structural parameters in covariance matrices. As an educational tool, the MSTRUCT model specification technique can be used to illustrate how the analysis of structural equation models is formulated explicitly as the fitting of structural parameters to covariance matrices. More importantly, The MSTRUCT modeling language provides links to many classical tests of covariance patterns (for example, compound symmetry, intra-class correlation, and Type H pattern) that are not implied by the functional relationships between variables. This presentation demonstrates these tests by using the MSTRUCT model specifications. Because of its flexibility, the MSTRUCT modeling technique can extend and modify the classical tests of

covariance patterns rather effortlessly. Practical data examples are used throughout this presentation.

Testing the Effectiveness of Three Multilevel Modeling Approaches in Addressing Data Dependency with Empirical Data under Structural Equation Modeling Framework

Parallel Session: Structural Equation Modeling - Applications II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08

Jiun-Yu Wu*, National Chiao Tung University, Taiwan
Yuan-Hsuan Lee, National Chiao Tung University, Taiwan

This study aims to examine the effectiveness of three modeling approaches (Design-based, Model-based and Maximum modeling) in addressing the data dependency issue under the structural equation modeling framework, which subsumes other conventional parametric statistical methods. For the first two commonly used SEM multilevel modeling methods, design-based based method adjusts the standard error of the fixed effect with Huber-White Sandwich standard error estimator, while model-based approach specifies the statistical model according to the multilevel sampling scheme. These two approaches, however, still have their shortcomings: design-based approach usually yields biased parameter estimates when analyzing multilevel data, and model-based approach generates inconsistent parameter estimates with multilevel data with insufficient higher-level sampling units. This study proposes the third SEM modeling method called "maximum modeling" to address data dependency. Two empirical data（Taiwan students' 2007 TIMSS performance data and American students' Harter academic competence belief） will be used to demonstrate the disadvantages of the two commonly mentioned approaches and to suggest the use of maximum modeling to better address the fallacy of statistical inferences when dependent data is analyzed with SEM modeling method.

Measuring the Effects of School Reading Curriculum on Students Achievements by Using Multilevel Structuring Equation Modeling

Parallel Session: Structural Equation Modeling - Applications II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08

Daeseok Kim*, The University of Gerogia, USA
Jongmin Ra, The University of Gerogia, USA

The goal of this study is to measure the effects of school reading curriculum on students'performances by using multilevel structuring equation modeling.

Research Model: Curriculum as a process of education is a variable that affects the students'achievements. The basic purpose of this study is to examine the impacts of school curriculum factors as determinants of student achievements. With regard to research question to measure the effect size of school curriculum on students'achievements, we considered students nested within schools. This research analyzed the effects of 1) content/knowledge, 2) teaching methods, 3) learning time on students' outcomes by Level-1(student) variables. As Level-2(school) variables, 1) schools resources, 2) school extra curricular activities, 3) school curriculum and assessment were analyzed. Because constructs were assessed at both student and school level, this model could be described as multilevel SEM. We tested the hypothesis that the effects of curriculum factors on performance in reading were different in each state.
Sample: Empirical data were obtained through PISA 2009 database (www.pisa.oecd.org). This extensive data set combines student questionnaires, school questionnaires and parent questionnaires. The samples were drawn from South Korea and Finland. Cases with missing value will be dropped from the analysis by the use of listwise deletion.

Self-Esteem, Depression and Rebellion in Adolescence: Application of Latent Moderated Structural Equation Model
Parallel Session: Structural Equation Modeling - Applications II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08
Jen-Hua Hsueh*, National Taiwan Normal University, Taiwan

The present study explored the interaction effect between self-esteem and depression on rebellion of adolescents in Taiwan, and the multidimensionality of self-esteem was taken into account. Latent Moderated Structural equation approach (LMS) (Klein & Moosbrugger, 2000), which models interaction effects between latent variables without introducing productive indicators, was used for analysis. LMS takes measurement error into account, hence constructs a more proper model than conventional moderated regression. The data used was derived from a longitudinal survey conducted by Taiwan Youth Project (TYP), which is sponsored by Academia SINICA and the Institute of Sociology. The sample for analyses consists of 2696 seventh grade adolescents. The results indicated that there are three dimensions of self-esteem, named sense of control, sense of positive value, and sense of negative value, and the interaction effects between self-esteem and depression on rebellion were entirely different when distinct dimensions of self-esteem were considered. Factor scores and interaction effect figures were presented to elaborate the direction and slope of the interaction. Probable mechanisms and suggestions for research and practice were proposed and discussed.

Domain-Specific Risk Taking Scale: A Factor-Analytic Study with Chinese University Students

Parallel Session: Structural Equation Modeling - Applications II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D1-LP-08

Joseph Wu*, City University of Hong Kong, Hong Kong
Hoi Yan Cheung, City University of Hong Kong, Hong Kong

Factor analysis is one of the most widely applied statistical methods in social sciences to examine the dimensionality of an instrument. Moving from unitary to multi-facet is a trajectory commonly observed in the development and refinement of many instruments which goes hand in hand with an advancement of understanding on its underlying construct. The Domain-Specific Risk-Taking (DOSPERT) scale (Blais & Weber, 2006) is a multidimensional instrument that was recently developed to assess risk-taking attitudes. Its construction anchored on a conceptualization that one's perceptions on risky events should be content-related and there should be intra-individual differences as well as inter-individual differences across domains. In this study, the factor structure of DOSPERT is examined with a sample of Chinese university students through both exploratory and confirmatory factor analyses. Overall speaking, the multidimensionality of the DOSPERT gained support from the results of this study. Recommendations on refinement of this instrument are offered.

Distinguishing the Signal from Noise with the Binary Latent Type Variable

Parallel Session: Mixture Modeling; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08

Levent Dumenci*, Virginia Commonwealth University, USA

Well-fitting measurement models are commonly used to make inferences about latent trait(s). However, fit statistics are not informative of distinguishing a homogeneous population involving a latent variable model from a heterogeneous population consisting of (a) a latent variable model and (b) null model because the proportionality constraints implied by the latent variable model holds in both types of models. A mixture model with the binary Latent Type variable has been proposed to fit the latter model (Dumenci, 2011). In this presentation, it is demonstrated with simulated data that the entropy measure and posterior probability distribution of class membership can be used to determine whether or not a well-fitting latent variable model includes a null subpopulation. Implications for low-stake testing are discussed.

Bayesian Inference for Growth Mixture Models with Latent Class Dependent Missing Data

Parallel Session: Mixture Modeling; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Zhenqiu Lu*, University of Notre Dame, USA
Zhiyong Zhang, University of Notre Dame, USA
Gitta Lubke, University of Notre Dame, USA

Growth mixture models (GMM) with non-ignorable missing data have drawn increasing attention in research communities but have not been fully studied. The goal of the project is to propose and to evaluate a Bayesian method to estimate the GMM with latent class dependent missing data.
An extended growth mixture model is first presented, in which class probabilities depend on some observed explanatory variables and data missingness depends on both the explanatory variables and a categorical latent class variable. A full Bayesian method is then proposed to estimate the model. Through the data augmentation algorithm, conditional posterior distributions for all model parameters and missing data are obtained. A Gibbs sampling procedure is then used to generate Markov chains of model parameters for statistical inference. The application of the model and the method is first demonstrated through the analysis of mathematical ability data. A simulation study considering three main factors (the sample size, the class probability, and the missing data ignorability) is then conducted and the results show that the proposed Bayesian estimation approach performs very well under studied conditions. Finally, some implications of this study, including the convergence problem, the sample size, the sensitivity of the model, and the future directions of the approach, are discussed.

How to Find Hopeful Customer using Zero-Inflated Poisson Model with Latent Class
Parallel Session: Mixture Modeling; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08
Kotaro Ohashi*, Waseda University, Japan
Hideki Toyoda, Waseda University, Japan

In this paper we will present an example to manage zero-inflated data which is regarded as count data with excess zeros. Customer's frequency of repeat visiting to M, which was one of major department stores in Japan, was analyzed and the frequency was expected zero-inflated condition in comparison with usual Poisson process. Therefore zero-inflated Poisson (ZIP) model was considered. Generally, a customer who visits repeatedly is good customer, so to find such good customer in this zero inflated condition we assumed two latent classes of observations, hopeful customer class which was supposed to be Poisson random variable with probability 1-p and hopeless customer class which was supposed that only possible observation is zero with probability p. Even a customer's frequency of repeat visiting to M was zero, if she were hopeful customer she has possibilities to visit again

following Poisson process. To separate two latent classes, customer's characters such as each customer's mean daily times of accounting in M we prepared from ID-POS data which was registered buying history were used. We use Markov Chain Monte Carlo (MCMC) in analysis, and as the result we found about 2,000 hopeful customers whose frequency of repeat visiting had been zero yet from randomly selected 10,000 customers.

Model Selection and Evaluation in Factor Mixture Modeling using A Two-Stage ML Approach

Parallel Session: Mixture Modeling; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08

Xiaoling Zhong*, The Hong Kong Institute of Education, Hong Kong
Ke-Hai Yuan, University of Notre Dame, USA

Finite factor mixture modeling is used to model the covariation between observed variables within component. Major issues involved with factor mixture modeling include determining the number of components in a mixture, and evaluating the overall model. However, problems arise when using the conventional single-stage ML approach to fit a factor mixture model. In particular, the determination of the number of components is confounded with model misspecification. Besides, the single-stage ML approach only allows relative model fit indices such as AIC and BIC, which do not support tests of model evaluation, hence tests for factorial invariance across components are not available.
To circumvent these problems, this paper studies behavior of a newly-proposed two-stage ML approach in model selection, and provided several fit indices for evaluating the overall model. Results suggest that (1) The two-stage approach identifies the model with the correct number of components more frequently when the model is misspecified or when the distribution assumption is violated; (2) Even when the model and distribution are both correctly specified, the classification-based criteria perform better with the two-stage approach when all components share the same factor loadings; (3) Most provided fit indices for overall model evaluation perform well, while the conventional chi-square difference test statistics associated with either ML or GLS methods rejects the correct models too frequently and can not be trusted.

The Mixture Item Response Model for Ability Decline during Testing

Parallel Session: Mixture Modeling; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-08

Kuan-Yu Jin*, The Hong Kong Institute of Education, Hong Kong
Wen Chung Wang, The Hong Kong Institute of Education, Hong Kong

In a long test or a low-stakes test, examinees may lose their interests or become tired as the testing progresses. That is, examinees do not demonstrate fully their maximum ability

throughout the test such that their performances decline gradually. If such effect of ability decline during testing exists but is not taken into consideration by fitting a standard IRT model, the difficulties of items presented toward the end of the test will be overestimated, and as a result, the person measures will be biased. In this study, we developed a new mixture IRT model that accounts for such effect directly. Parameter recovery was assessed through simulations. The results showed that the parameters could be recovered fairly well using WinBUGS. The simulation also demonstrated that: when test data had such effect, fitting standard IRT models would overestimate item difficulties for items presented toward the end of the test; whereas fitting the new model yielded accurate parameter estimates; when test data did not have such effect, fitting the new model yielded parameter estimates that were very similar to those obtained by fitting standard IRT models. In sum, the new model is very useful when ability declines during testing and does little harm when such effect does not exist.

Development and Validation of Students' Attitude toward Math Scale
Parallel Session: Test Development and Validation - Nonability Measures II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Hsiang- Chun Wang*,National Sun Yat- sen University, Taiwan
Zuway-R Hong, National Sun Yat- sen University, Taiwan

The research reported in this study focuses on the development and validation of an instrument on Elementary School Student Attitude toward Math Scale (ESSMS).
The investigator-developed 44-item of ESSMS was modified and derived from five related attitudes toward mathematics scales. A total of 98 fifth grade students were randomly selected from a large sample size elementary school in Southern Taiwan, they completed the ESSMS in early spring 2011. Factor analyses, expert content validity ratio (CVR, Lawshe, 1975) and internal consistency analyses were conducted to assess its reliability and validity. The initial findings were as follows: ESSMS indicated an adequate construct validity and internal reliability, five components (i.e., self-confidence in learning mathematics, learning mathematics is useful for people, anxiety in learning math, self-concept toward mathematics and motivation in learning mathematics) together accounted for 53.53 % of the variance; each dimension's internal consistency of the total scores were Cronbach'sαof 0.81, 0.76, 0, 87, 0. 71, and 0.70, respectively; the internal consistency of the total items was found a high Cronbach'sαof 0.96. Implications, limitations and discussions of findings were provided and discussed.

An Investigation and Validation of Elementary School Students' Positive Thinking Scale

Parallel Session: Test Development and Validation - Nonability Measures II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Chia-Jung Lin*, National Sun Yat- sen University, Taiwan
Zuway-R Hong, National Sun Yat- sen University, Taiwan

The purpose of this study was to validate an instrument of Elementary School Student Positive Thinking Scale (ESPTS) that measure students' positive thinking. An investigator-developed 54-item scale that derived from "Questionnaire of Emotional Traits" (Chang, 2002),"Positive thinking scale" (Chou, 2010), "Multidimensional Students Life Satisfaction Scale" (Huebner, 2001), and "Self-esteem Scale" (Rosenberg,1962), respectively. A total of 76 5th and 6th grades children completed the ESPTS in January 2011 in Southern Taiwan. We conducted factor analyses, correlation analyses, analysis of variance (ANOVA), and Bonferroni post-hoc comparisons to compare the similarities and differences between boys and girls with different parental practices families. The initial findings were as follows: the ESPTS indicated has an adequate construct validity and internal reliability, five components (i.e., positive emotion, self-confidence, school-self, identity-self, and peer relationship) together accounted for 61.11% of the variance; the internal consistency of the remaining items was found a high Cronbach's α was .96; children's father with democratic practice had significantly higher scores on positive thinking than mothers with less democratic practice. In addition, there were non-significantly gender differences on children's positive thinking scores. Implications of the study included the recommended use of family education were provided and discussed.

A Investigation and Validation of College Students Reading Motivation Scale
Parallel Session: Test Development and Validation - Nonability Measures II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09

Tien-Chi Yu*, National Sun Yat-sen University, Taiwan
Zuway-R Hong, National Sun Yat-sen University, Taiwan

The purposes of this study were to validate an instrument of College Students Reading Motivation Scale (CSRMS) and to investigate objectives of reading, reading material styles and gender differences in Taiwan's college students reading motivation. The investigator-developed 47-item was modified and derived from Baker and Wigfield (1999) and Wigfield and Guthrie's (1997) Motivations for Reading Questionnaire (MRQ) by investigators. A total of 28 female students and 72 male students were randomly selected from a large sample size university in Southern Taiwan, they completed CSRMS in early spring in 2011. Item analysis, factor analysis, t-tests and analysis of variance (ANOVAs) were conducted to compare the similarities and differences between male and female

students in different objectives of reading and reading material styles. The initial finding were as follows: the CSRMS indicated an adequate construct validity and internal reliability, eight components (i.e., reading self-efficacy, recognition, active involvement, curiosity, social interaction, acceptance of challenge, importance and competitions with others) together accounted for 69.61% of the variance; the internal consistency of the total items was found a high Cronbach's α of .94; female students had significantly higher CSRMS total scores than those male counterparts; students who were frequently reading novels had significantly higher CSRMS scores than students who reads novels less frequently; students who were eager to acquire information had significant higher CSRMS scores than those less interested in acquiring information. Implication and limitation of these findings were provided and discussed.

Patterns of Evidence in Teacher Observations: The View through Five Lenses
Parallel Session: Test Development and Validation - Nonability Measures II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Catherine McClellan*, Educational Testing Service, USA
Steven Holtzman, Educational Testing Service, USA

Observation of classroom instruction is a widely-used tool for evaluation of efficacy of teaching. This likely has been the case since the very beginning of what is thought of as "formal" instruction. Recently, strong interest in ways to structure and formalize this observation into a measurement system has led to the development of protocols focusing the observer on specific aspects of instruction and classroom interactions.
One aspect of interest is the presence of temporal structures that may be common across classrooms. Since the majority of classroom observation protocols require the observer to monitor several dimensions of performance at once, it also is of interest to evaluate whether patterns of evidence are common or distinct across dimensions within an instrument. Data patterns, when combined with expert knowledge and interpretation, may lead to insights and relationships between dimensions that were not obvious before. If such patterns could be located, it could lead to modifications in the protocols, changes in the training of observers, and recommendations for altering the focus of the observer at specific time periods of a classroom session.
In this study, five observation protocols will be included. Data from approximately 50 classroom sessions each was coded in great detail by expert users of each instrument. Time markers for meaningful occurrences for each scale were recorded. The frequency of evidence for each scale, any apparent patterns of data occurrence, and commonalities and differences across scales and instruments will be discussed.

Ubuntu Game: An Educational Mechanism for Fostering Trust in a Divergent World
Parallel Session: Test Development and Validation - Nonability Measures II; Friday, 22 July, 1:30 p.m. -- 2:50 p.m.; D2-LP-09
Sunday Jacob*, Federal College of Education, Nigeria

The word 'Ubuntu' originates from one of the Bantu dialects of Africa, and it is pronounced uu-Boon-too. It is a traditional African philosophy that offers people an understanding of themselves in relation to the world. It means that a person is only a person through other persons. We affirm our humanity when we acknowledge that of others. I am human because I belong. It speaks about wholeness and compassion. It is based on this premise that Ubuntu game was developed as an educational mechanism to help in ameliorating the problems emanating from cultural, religious, political, socio-economic and ethnic differences common in most parts of the world today. The specific objectives of the game, among others, is to enable the students and other participants to: appreciate the diversity among human beings, trust the differences among people for peaceful co-existence, share experiences and ideas that will help in building trust and cohesion, internalize the principles of trust, justice, fairness, respect, equality and dignity. The materials developed for playing the game are: The Ubuntu board, a manual containing rules/regulations and playing procedures as well as different sets of cards reflecting what they stand for. Other materials are a dice, plastic cup and symbols of 4 different colours.

Nonparametric Method for Estimating Conditional Standard Error of Measurement for Test Scores
Parallel Session: Nonparametric Statistics; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09
Louis Roussos*, Measured Progress, USA
Zhushan Li, Boston College, USA

The standard error or measurement (SEM) for raw score on an assessment is typically estimated using a Classical Test Theory formula that yields a constant. Lord's Binomial model and its multinomial extension have been proposed to obtain SEM conditional on test score, but these methods assume all test items with the same maximum score will behave the same, item responses are statistically independent, and SEM=0 at the extreme scores. We propose a new method that makes none of these assumptions. For every item , we calculate its variance conditional on all proportion-correct scores on the remaining items. These scores stand in for proportion-correct on the total test. The variance associated with proportion-correct scores of 0 or 1 will not necessarily be zero. When statistical

independence can be assumed, the conditional variance of the total score will be the sum of the conditional variances of the item scores; otherwise, we estimate the conditional covariances of all possible item pairs for all possible rest scores (leaving out the two items of the pair). The conditional variance of the total score is then the sum of the conditional item variances minus twice the sum of all the pairwise conditional covariances. The efficacy of the proposed method is evaluated in a simulation study using both unidimensional and multidimensional item response theory models. Results are compared with empirical SEM from the multiple trials as well as with SEM from the standard classical test theory formula.

Multivariate Nonparametric Two-Sample Tests for Mixed Outcomes
Parallel Session: Nonparametric Statistics; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09
Denis Larocque*, HEC Montreal, Canada
Jaakko Nevalainen , University of Turku, Finland
Hannu Oja, University of Tampere, Finland

The literature on multivariate methods is abundant. However, most methods are designed for the case where all outcomes are of the same type, either all continuous or all categorical. The case where some outcomes are continuous and some categorical is referred to as mixed outcomes. The literature about this specific situation is very sparse in general and almost inexistent for nonparametric methods. In this talk we will present a brief review of the different ways to model mixed outcomes. We will then focus on the two-sample problem, that is, the problem of comparing two populations on the basis of a set of mixed outcomes. We will introduce a new class of nonparametric tests along with its basic properties, show the results from a simulation studies and present some illustrations with real data sets.

A Branch-and-Bound Max-Cardinality Algorithm for Exploratory Mokken Scale Analysis
Parallel Session: Nonparametric Statistics; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09
Michael J. Brusco*, Florida State University, USA
Hans-Friedrich Koehn, University of Illinois at Champaign-Urbana, USA
Douglas Steinley, University of Missouri-Columbia, USA

Exploratory Mokken scale analysis can be conceptualized as a combinatorial optimization problem: from a set of candidate items, a maximal subset must be selected such that (1) the (normed) pairwise item covariances, H_jk, are all strictly positive; (2) the item

scalability coefficients, H_j , of all items selected exceed a predetermined threshold, c; (3) the set of selected items maximizes the scale coefficient, H. Mokken proposed a stepwise, bottom-up algorithm, relying on a greedy search strategy, termed Automated Item Selection Procedure (AISP), that has been implemented in the commercially distributed software package MSP (the statistical software package Stata also contains a module for Mokken analysis). Recently, AISP has been made freely available in the R package mokken that, as a new development, also offers a genetic algorithm for exploratory Mokken scale analysis. Among the class of object selection problems, maximum cardinality subset selection requires finding the largest possible subset of objects that satisfies one or more constraints. We present an exact branch-and-bound algorithm for maximum cardinality subset selection tailored to exploratory Mokken scale analysis of a set of binary items. Computational results are reported for simulated data with max. 80 items generated from (1) the DINA model; (2) the five-parameter acceleration model; (3) the Rasch model (using different item discrimination parameter settings for generating data sets that mix item subsets all satisfying the double monotonicity condition, while the entire data sets do not) — thus, these data sets represent incrementing challenges to the proposed algorithm.

2 and 2 Equals 4 !
Parallel Session: Nonparametric Statistics; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09
Rudy Ligtvoet*, University of Amsterdam, Netherlands

In item response theory (IRT), inferences are made about the ordering of subjects on the basis of their scores on the test items, where each subject is characterized by a value on a latent variable. In practice, however, the simple sum of the item score is often used instead as a basis for subject comparison. For polytomously scored item scores such practice is problematic as most of the polytomous IRT models do not imply a stochastic ordering of the latent variable by the sum score (known as the SOL property). For such IRT model, the ordering of subjects on the basis of their sum scores may be different from the ordering of subjects' latent values. Moreover, those IRT models that do imply SOL are often too restrictive to fit the data. In this presentation, an isotonic (i.e., nonparametric) IRT model is presented for polytomously scored items that guarantees that the subjects' latent values are stochastically ordered by the subjects' sum score. It is further shown how the assumptions underlying the isotonic model can be empirically tested. If the isotonic model fits the data, empirical support is obtained for the use of the sum score as a basis for ordering subjects.

Assessing Dimensionality through Mokken Scale Analysis: What Happens When Questionnaires Do Not Have Simple Structures?

Parallel Session: Nonparametric Statistics; Tuesday, 19 July, 4:00 p.m. -- 5:20 p.m.; D2-LP-09

Iris A.M. Smits*, University of Groningen, Netherlands
Marieke E Timmerman, University of Groningen, Netherlands
Rob R. Meijer, University of Groningen, Netherlands

The assessment of the dimensionality structure is an important aspect of scale evaluation. Methods based on nonparametric item response theory may be attractive, since they rely on less strict assumptions and therefore are more likely to fit data than parametric methods. In this study, we evaluate procedures proposed in the context of Mokken Scale Analysis, using the recently proposed genetic algorithm (van der Ark, 2010). In a comparative simulation study, the performance of the procedures in various theoretically and empirically relevant conditions will be examined. Among others, strictly unidimensional and multidimensional structures and structures deviating from strict uni- or multidimensionality will be considered. The latter is highly relevant in empirical practice, since many questionnaires are designed to scale persons on both a total score and (multiple) sub scores. Implications for the use of MSA procedures to assess the dimensionality structure in empirical practice will be discussed.

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General Information

Time Limit of Each Presentation

To accommodate as many presentations as possible, 4 or 5 presentations are included in each 80-minute paper parallel session. For 4-presentation parallel sessions, each presentation runs for 18 minutes, including 15 minutes of talk and 3 minutes of Q&As. For 5-presentation parallel sessions, each presentation runs for 15 minutes, including 12 minutes of talk and 3 minutes of Q&As.

For symposia including discussants, the organizer is responsible for time limit of each presentation.

For poster presentations, poster board with size 1.8 X 1.2 meters are available for each presentation.

Shuttle Bus Schedule

Conference shuttle are arranged for conference participates. The shuttle picks up participates at Mass Transit Railway (MTR) University Station and drops off at Tai Po campus of The Hong Kong Institute of Education, the conference venue.

The shuttle bus pick-up schedule is listed in the following:

Tuesday,	19 July, 2011	8:00 a.m.	8:20 a.m.
Wednesday,	20 July, 2011	8:20 a.m.	8:40 a.m.
Thursday,	21 July, 2011	8:20 a.m.	8:40 a.m.
Friday,	22 July, 2011	8:00 a.m.	8:20 a.m

In addition to the above schedule, participates may take the campus shuttle bus departing from Tai Po campus to MTR University Station and departing from MTR University Station to the Tai Po campus. The campus shuttle bus runs every 10 or 15 minutes during conference time.

Contingency Plan in Case of Inclement Weather

According to Severe Weather Arrangements, the contingency plan in case of inclement weather is arranged as follows:

- If Tropical Cyclone (No.8 or above) or Black rainstorm warning is in force at or after 7:00 a.m.in the morning of 18 July, the morning session of the workshop will be cancelled. If the above signals remain hoisted at 12:00 noon, the afternoon sessions will be cancelled.
- If Tropical Cyclone (No.8 or above) or Black rainstorm warning is in force at or after 7:00 a.m.in the morning of 19, 20 or 21 July, the morning sessions and events will be cancelled. If the above signals still hold at 11:30 a.m., the afternoon sessions and events will be cancelled.
- If Tropical Cyclone (No.8 or above) or Black rainstorm warning is in force at or after 6:30 a.m.in the morning of 22 July, the morning sessions and events will be cancelled. If the above signals still hold at 11:30 a.m., the afternoon sessions and events will be cancelled.
- The announcement about the program that are rescheduled or cancelled in the event of inclement weather will be put on the website to notify conference participants.

Internet Access

For conference participates who do not have a valid HKIEd network account and password, they could use the HKIEd wireless network without encryption. Please note that using this connection method, data is not encrypted while transferring over the air. Users should not use public wireless network unencrypted for sensitive transactions. In addition, computer rooms are available for use.

Emergency Number

In emergency situations, you can contact the local police, ambulance service, fire department and other emergency services by calling 999.

Hospitals

As an international city, Hong Kong has world-class hospitals providing outstanding care. Visitors using Accident and Emergency services in Hong Kong public hospitals are charged a set fee of HK$570 per visit, but will always be treated even if they cannot pay immediately.

The nearest hospital from the conference venue is:

Alice Ho Miu Ling Nethersole Hospital (with 24-hour Accident and Emergency Service)
Address 11 Chuen On Road, Tai Po, NT
Tel: (852) 2689 2000
Fax: (852) 2662 1690
E-mail ahnh_enquiry@ha.org.hk
Website http://www3.ha.org.hk/ahnh/

NOTES

SEASKYLAND

Our History

Founded in 1997, SEASKYLAND is a leading company in China which provides professional products and high-quality services in education, testing and assessment area. Since its establishment over the last decade, SEASKYLAND has being maintained steady growth by applying state-of-the-art technologies and outstanding services for education authorities, academic institutions, numerous schools and tens of millions of test candidates. SEASKYLAND is ranking as No.1 globally in terms of the accumulated quantity in examination data processing service.

Our Mission

Our mission is to provide professional products and high-quality services that realize fairness, justice and high efficiency of education and improve teaching and learning via assessment solutions.

Our Vision

Our vision is to be a leading provider of testing technologies and assessment solutions in China with global reputation. If you are education authority, test administrator, academic institution, or education researcher, SEASKYLAND is the best partner for you. For more information please contact research department at research@cntest.com.

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