

## Course Outline

---

### Part I

<b>Programme Title</b>	: Doctor of Education
<b>Programme QF Level</b>	: 7
<b>Course Title</b>	: Applying Multilevel Models to Educational Assessment
<b>Course Code</b>	: EMA8004
<b>Department</b>	: Psychology
<b>Credit Points</b>	: 3
<b>Contact Hours</b>	: 39
<b>Pre-requisite(s)</b>	: Students are expected to have completed basic training in quantitative research method (such as hypothesis testing and multiple regression analysis) before taking this course.
<b>Medium of Instruction</b>	: EMI
<b>Course Level</b>	: 7

---

### Part II

The University's Graduate Attributes and seven Generic Intended Learning Outcomes (GILOs) represent the attributes of ideal EdUHK graduates and their expected qualities respectively. Learning outcomes work coherently at the University (GILOs), programme (Programme Intended Learning Outcomes) and course (Course Intended Learning Outcomes) levels to achieve the goal of nurturing students with important graduate attributes.

In gist, the Graduate Attributes for Undergraduate, Taught Postgraduate and Research Postgraduate students consist of the following three domains (i.e. in short "PEER & I"):

- Professional Excellence;
- Ethical Responsibility; &
- Innovation.

The descriptors under these three domains are different for the three groups of students in order to reflect the respective level of Graduate Attributes.

The seven GILOs are:

1. Problem Solving Skills
2. Critical Thinking Skills
3. Creative Thinking Skills
- 4a. Oral Communication Skills
- 4b. Written Communication Skills

5. Social Interaction Skills
6. Ethical Decision Making
7. Global Perspectives

### 1. Course Synopsis

Data collected for accountability purposes often involve nested or hierarchical data structure. For instance, students are nested within classes, and classes within schools. Since the late 1980's multilevel modelling has been used as a standard approach to handle such nested data structure. This module aims to study the application of multilevel modelling for educational assessment and to enable candidates to analyse data requiring such model structure to address innovative research questions. Examples will be drawn from the value-added indicator system of the Hong Kong Special Administrative Region, and other relevant situations where multilevel modelling is deemed appropriate. Strengths and weakness of multilevel modelling will be discussed in the analyses of these real data.

### 2. Course Intended Learning Outcomes (CILOs)

*Upon completion of this course, students will be able to:*

- CILO<sub>1</sub> Understand the key concepts and issues involved in multilevel models;
- CILO<sub>2</sub> Apply multilevel models to designing and executing research studies in a professional manner in order to address policy questions from a variety of educational context;
- CILO<sub>3</sub> Use the MLwiN computer software to analyse multilevel data to address innovative research questions;
- CILO<sub>4</sub> Evaluate critically the strengths and limitations of multilevel models in handling data from educational assessment and measurement.

### 3. Content, CILOs and Teaching & Learning Activities

Course Content	CILOs	Suggested Teaching & Learning Activities
1. Rationale for using multilevel models	CILO <sub>1-2,4</sub>	Lectures, Group Discussions
2. Research and policy questions in educational contexts that can be addressed using multilevel models	CILO <sub>1-2,4</sub>	Lectures, Group Discussions
3. Variance component models: examples from education; data structure; model specification; data analysis using MLwiN; residual analysis	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop

4. Random coefficient models: School Value-Added Indicator System (SVAIS) and other applications in educational contexts; model specification; data analysis using MLwiN; residual analysis; model assessment; model interpretation	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop
5. Model building: adding another level; adding more fixed effects; higher level residuals; complex level-1 variation; interpretation of outcomes from MLwiN; testing assumptions and model evaluation	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop
6. Discrete response model: University entrance and other applications in education; estimation models including MCMC; proportion as response; multiple response categories model; models for counts; models for ordered response	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop
7. Repeated measures model: Tracking growth and development in education; scaling across time; analysis of longitudinal data	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop
8. Multivariate multilevel data: Analysis of A Level Examination results and other applications of multivariate multilevel data; rotation designs; principal component analysis; model assessment; interpretation of outcomes from MLwiN	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop
9. Strength and weaknesses of commonly available models including HLM and MPlus	CILO <sub>1-4</sub>	Lectures, Group Discussions, Class Exercise, Hands-on Workshop

#### 4. Assessment

Assessment Tasks	Weighting (%)	CILO
(a) A series of mini-projects and computer lab work completed during class time on real data sets	30%	CILO <sub>1-4</sub>
(b) A module project on the application of multilevel models to a policy issue identified by the candidate	70%	CILO <sub>1-4</sub>

## 5. Required Text(s)

- Goldstein, H. (2010). *Multilevel statistical models* (4<sup>th</sup> ed.). Hoboken, N.J.: Wiley.
- Rasbash, J., Steele, F., Browne, W.J. and Goldstein, H. (2019). *A user's guide to MLwiN, v3.03*. Centre for Multilevel Modeling, University of Bristol.

## 6. Recommended Readings

- 張雷、雷震和郭伯良 (2003)：《多層線性模型應用》，北京，教育科學出版社。
- 溫福星 (2009)：《階層線性模式：原理，方法與應用》，台北市，雙葉書廊有限公司。
- Bickel, R. (2007). *Multilevel analysis for applied research: It's just regression*. New York: Guilford Press.
- Cheong, Y.F., & Raudenbush, S.W. (2000). Measurement and structural models for children's problem behaviors. *Psychological Methods*, 5(4), 477-495.
- Gelman, A., & Hill, J. (2007). *Data analysis using regression and multilevel/hierarchical models*. Cambridge; New York: Cambridge University Press.
- Heck, R. H., & Thomas, S. L. (2009). *An introduction to multilevel modeling techniques* (2<sup>nd</sup> ed.). New York: Psychology Press.
- Hox, J. (2010). *Multilevel analysis: Techniques and applications*. New York: Routledge.
- Kreft, I. I., & de Leeuw, J. (1998). *Introducing multilevel modeling*. London: Sage Publications.
- Little, T. D., Schnabel, K. U., & Baumert, J. (2000). *Modeling longitudinal and multilevel data*. Mahway, NJ: Erlbaum.
- Luke, D. A. (2004). *Multilevel modeling*. Thousand Oaks, Calif: SAGE Publications.
- O'Connell, A. A., & McCoach, D. B. (Eds). (2008). *Multilevel modeling of educational data*. Charlotte, NC: IAP.
- Rasbash, J., Charlton, C., Jones, K., and Pillinger, R. (2019). *Manual supplement to MLwiN v3.03*. Centre for Multilevel Modeling, University of Bristol.
- Raudenbush, S.W. (2000). Synthesizing results for NAEP trial state assessment. In D.W. Grissmer & Michael Ross (Ed.), *Analytic issues in the assessment of student achievement*, Washington, DC: National center for Educational Statistics.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage Publications.
- Raudenbush, S. W., & Willms, J. D. (1991). *Schools, classrooms, and pupils: International studies of schooling from a multilevel perspective*. San Diego: Academic Press.
- Singer, J. D., & Willet, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press.

- Steele, F. & Goldstein, H. (2006). Multilevel models in psychometrics, in C. R. Rao & S. Sinharay (Eds.), *Handbook of statistics: Psychometrics*. Amsterdam: Elsevier, 26, 401-420.
- Van de Vijver, F. J. R., van Hemert, D. A., & Poortinga, Y. H. (Eds.) (2008). *Multilevel analysis of individuals and cultures*. New York: Lawrence Erlbaum Associates.
- Verbeke, G. & Molenberghs, G. (2000). *Linear mixed models for longitudinal data*. New York: Springer.
- West, B., Welch, K. B., Galecki, A. T. (2007). *Linear mixed models: A practical guide using statistical software*. New York: Chapman & Hall/CRC.
- Yang, M., Goldstein, H., Browne, W. J., & Woodhouse, G. (2002). Multivariate multilevel analysis of examination results. *Journal of the Royal Statistical Society, Series A*, 165, 137-153.

## 7. Related Web Resources

Centre For Multilevel Modeling (CMM)

- <http://www.bristol.ac.uk/cmm/>

Examples on multilevel modeling software for several textbooks can be obtained from the developing resources at UCLA Academic Technology Services website

- <http://www.ats.ucla.edu/stat/examples/>
- See also <http://www.ats.ucla.edu/stat/examples/imm/default.htm>

Professor Tom A. B. Snijders, Professor of Statistics in the Social Sciences at the University of Oxford and Professor of Methodology and Statistics in the Faculty of Behavioral and Social Sciences at the University of Groningen, has placed a number of resources at:

- <http://www.stats.ox.ac.uk/~snijders/multilevel.htm>

One of the most interesting features is the PINT programme to do power analysis for the estimation of sample size for two-level designs.

Hox, J. (1995). *Applied multilevel analysis*, Amsterdam: TT-Publikaties can be downloaded at

- <http://joophox.net/publist/amaboek.pdf>

This website of Harvard Graduate School of Education contains good references for Applied Longitudinal Data Analysis (ALDA).

- <http://gseacademic.harvard.edu/~alda/>

This website contains commercial purchase venues for the latest version of the HLM software.

- <http://www.ssicentral.com/>

**8. Related Journals**

*Journal of the Royal Statistical Society Series A Statistics in Society*  
*Journal of Educational and Behavioral Statistics*  
*Journal of Applied Psychology*  
*Multivariate Behavioral Research*  
*School Effectiveness and School Improvement*  
*Computational Statistics and Data Analysis*  
*Organizational Research Methods*  
*Quality and Quantity*  
*Psychometrika*  
*Psychology Methods*  
*Structural Equation Modeling*  
*Sociological Methodology*  
*Behavior Research Methods*  
*Educational and Psychological Measurement*  
*Journal of Educational Psychology*  
*Studies in Educational Evaluation*  
*American Educational Research Journal*  
*Sociological Methods and Research*

**9. Academic Honesty**

The University adopts a zero tolerance policy to plagiarism. For the University's policy on plagiarism, please refer to the *Policy on Academic Honesty, Responsibility and Integrity with Specific Reference to the Avoidance of Plagiarism by Students* (<https://www.eduhk.hk/re/modules/downloads/visit.php?cid=9&lid=89>). Students should familiarize themselves with the Policy.

**10. Others**

Nil