

**The Hong Kong Institute of Education**

**Department of Curriculum and Instruction**

**Project:**

**Educational Provision for Ethnic Minority  
in Hong Kong**

**Structural Equation Model Across Chinese and  
Non-Chinese Students**



**2008**

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# Comparison of the Original and Modified SEM

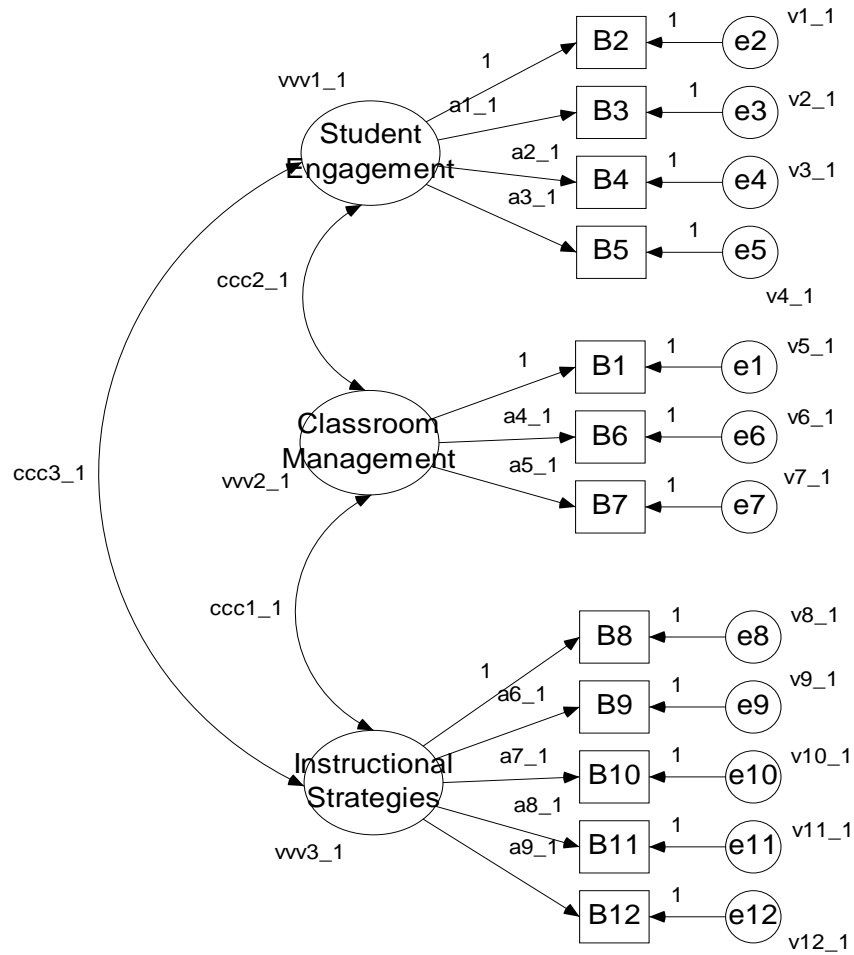


Figure 1: Original SEM

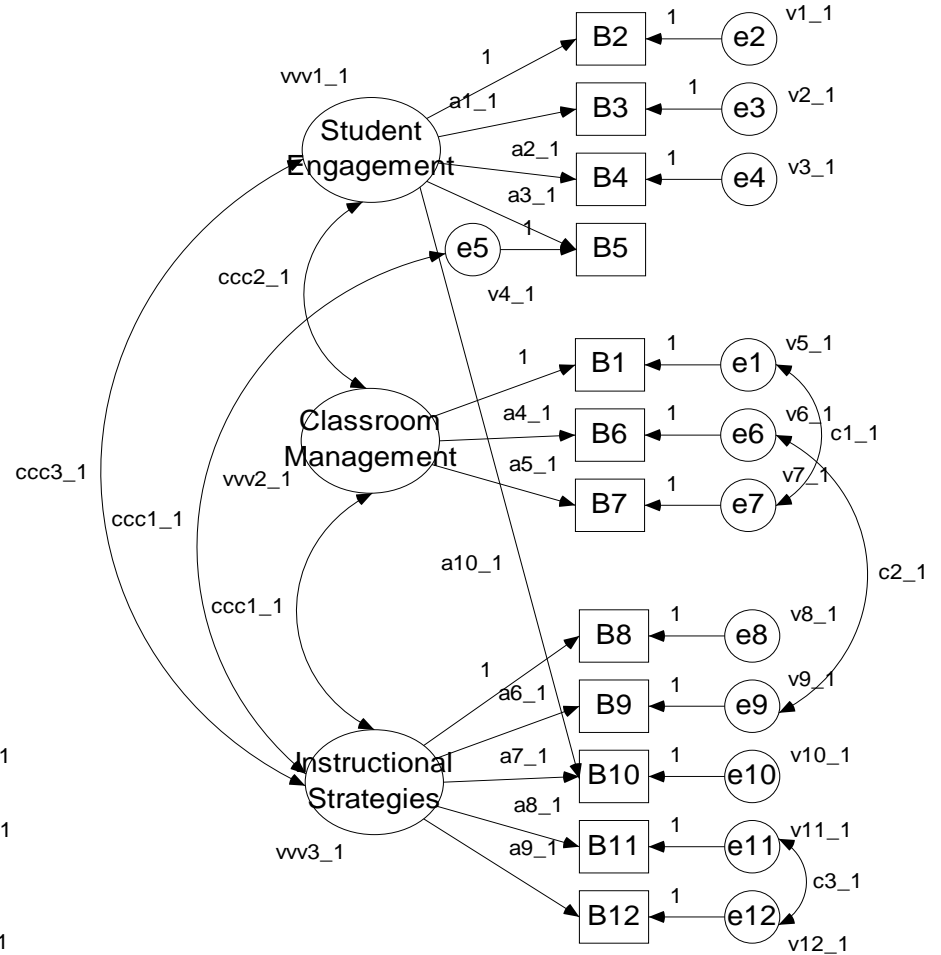


Figure 2: Modified SEM

## Comparison of the Original and Modified SEM

**Table: Comparison of the original and modified SEM**

Indicator	Initial	Modified	Criterion
$\chi^2/\text{df}$	3.047	2.044	< 2
GFI	0.913	0.945	>0.9
CFI	0.923	0.964	>0.95
TLI	0.900	0.949	>0.95
RMSEA	0.062	0.044	<0.05

The above table revealed that GFI, CFI and TLI slightly increased 4.5% on average. In addition, the chi-square over degree of freedom and RMSEA plunged around 30% to 2.044 and 0.044 respectively. These imply that the construct validity of the modified SEM has been improved.

# Test of Invariance Across Chinese and Non-Chinese Students

## Hypotheses:

H1 : Invariance of Factor Loadings Across Chinese and Non-Chinese Students

H2 : Invariance of Factor Variances and Covariances Across Chinese and Non-Chinese Students under H1

H3 : Invariance of Error Variances and Covariances Across Chinese and Non-Chinese Students under H2

## Results:

**Table: Goodness-of-Fit Statistics for Tests of Invariance Across Chinese and Non-Chinese Students**

Model	df	$\chi^2$	$\Delta$ df	$\Delta\chi^2$	P-value	CFI	$\Delta$ CFI	RMSEA	TLI
Unconstrained	94	192.161	-	-	-	0.964	-	0.044	0.949
H1	104	198.586	10	6.425	0.778	0.965	0.001	0.041	0.956
H2	110	199.480	6	0.894	0.989	0.967	0.002	0.039	0.960
H3	125	216.059	15	16.579	0.345	0.966	-0.001	0.037	0.965

*H1 : Factor loadings constrained equal*

*H2 : Factor variances and covariances constrained equal under H1*

*H3 : Error variances and covariances constrained equal under H2*

## Test of Invariance Across Chinese and Non-Chinese Students

### Model assessment (H1):

As indicated in the above table, findings revealed all factor loadings to be equivalent across Chinese and Non-Chinese students, as reflected in a chi-square difference between the model tested (H1) and unconstrained model, which was not statistically significant.

### Model assessment (H2):

From the above table, findings revealed all factor variances and covariances to be equivalent across both groups under H1, as reflected in a chi-square difference between the model tested (H2) and H1, which was not statistically significant.

### Model assessment (H3):

The above table showed that all error variances and covariances were equivalent across both groups under H2 because a chi-square difference between the model tested (H3) and H2 was not statistically significant.

### Conclusion:

As indicated by the above statistics, the RMSEA dropped from 0.044 to 0.037, all the TLI and  $\Delta$ CFI were higher than 0.95 and lower than 0.01 respectively, this SEM was found to be well described by a three-factor model for both Chinese and Non-Chinese students. In addition, all estimated parameters of each factor were fully invariance. Therefore, all measures of this SEM are operating in the same way for both groups.

## Appendix

Table: Relationship

Item no.	Corresponding factor	Question	Related item
B1	Classroom Management	Control disruptive behavior in the classroom	B7
B2	Student Engagement	Motivate students who show low interest in school work	-
B3	Student Engagement	Get students to believe they can do well at school work	-
B4	Student Engagement	Help your students value learning	-
B5	Student Engagement	Craft good questions for your students	Instructional Strategies
B6	Classroom Management	Get students to follow classroom rules	B9
B7	Classroom Management	Calm a student who is disruptive or noisy	B1
B8	Instructional Strategies	Establish a classroom management system with each group of students	-
B9	Instructional Strategies	Use a variety of assessment strategies	B6
B10	Instructional Strategies	Provide an alternative explanation or example when students are confused	Student Engagement
B11	Instructional Strategies	Assist families in helping their children do well in school	B12
B12	Instructional Strategies	Implement alternative strategies in your classroom	B11