Course Outline

Part I

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

- **P**rofessional **E**xcellence;
- **E**thical **R**esponsibility; **&**
- **I**nnovation.

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:

$CILO_1$ Understand the key concepts and issues involved in multilevel models;

$CILO_2$ 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;

$CILO_3$ Use R computer software to analyse multilevel data to address innovative research questions;

$CILO_4$ 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	$CILO_{1-2,4}$	Lectures, Group Discussions
2. Research and policy questions in educational contexts that can be addressed using multilevel models	$CILO_{1-2,4}$	Lectures, Group Discussions

3. Variance component models: examples from education; data structure; model specification; data analysis using R; residual analysis	$CILO_{1-4}$	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 R; residual analysis; model assessment; model interpretation	$CILO_{1-4}$	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 R; testing assumptions and model evaluation	$CILO_{1-4}$	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	$CILO_{1-4}$	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	$CILO_{1-4}$	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 R	$CILO_{1-4}$	Lectures, Group Discussions, Class Exercise, Hands-on Workshop
9. Strength and weaknesses of commonly available models including HLM and SEM	$CILO_{1-4}$	Lectures, Group Discussions, Class Exercise, Hands-on Workshop

4. Assessment

Assessment Tasks	Weighting (%)	CILO
(a) A series of mini-projects and computer lab work	30%	$CILO_{1-4}$

	completed during class time on real data sets		
(b)	A module project on the application of multilevel models to a policy issue identified by the candidate	70%	$CILO_{1-4}$

5. Required Text(s)

Finch, W. H., Bolin, J. E., & Kelley, K. (2019). *Multilevel modeling using R* (2nd ed.). Chapman & Hall.

6. Recommended Readings

張雷、雷霆、郭伯良 (2003)。《多層線性模型應用》。教育科學出版社。

温福星 (2009)。《階層線性模式: 原理, 方法與應用》。雙葉書廊有限公司。

Heck, R., & Thomas, S. L. (2020). *An introduction to multilevel modeling techniques* (4th ed.). Routledge.

Hox, J., Moerbeek, M., & van de Schoot, R. (2017). *Multilevel analysis: Techniques and applications* (3rd ed). Routledge.

Khine, M. S. (Eds). (2022). *Methodology for multilevel modeling in educational research: Concepts and research*. Springer.

Little, T. D., Schnabel, K. U., & Baumert, J. (2000). *Modeling longitudinal and multilevel data*. Erlbaum.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods.* Sage Publications.

Singer, J. D., & Willet, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence.* Oxford University Press.

Van de Vijver, F. J. R., van Hemert, D. A., & Poortinga, Y. H. (Eds.) (2008). *Multilevel analysis of individuals and cultures.* Lawrence Erlbaum Associates.

West, B., Welch, K. B., Galecki, A. T. (2022). *Linear mixed models: A practical guide using statistical software* (3rd ed.). Chapman & Hall.

7. Related Web Resources

Centre For Mulilevel 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 Advanced Research Computing: Statistical Methods and Data Analytics

- https://stats.oarc.ucla.edu/other/examples/

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 Faulty 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.

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

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

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

TPg Courses with other Study Modes

Programme Title : Doctor of Education
Course Title : Applying Multilevel Models to Educational Assessment
Course Code : EMA8004
Offering Unit : Psychology
Credit Points : 3

Delivery mode:

☐ **Online learning as the primary delivery mode**

Range of classroom-based contact hours (0-15)	Range of hours for online learning (24-39)	Total No. of Contact Hours
		39

☑ **Directed study mode**

Range of classroom-based contact hours (4-15)	Range of guided independent learning hours (24-35)	Total No. of Contact Hours
15	24	39