COURSE SYLLABUS
CPSE 730 and IP&T 730: Multilevel Modeling
Spring Term, 2021

INSTRUCTORS
Lane Fischer, 801-422-8293  Richard Sudweeks, 801-422-7078
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Office Hours: Tuesdays 3-5, Thursday 3-4.  Office Hours: 10:00 a.m.-12:00 noon, M & W & 1:00 p.m.-2:00 p.m., M & W

CLASS MEETING SCHEDULE,
The class will meet online via Zoom from 12:00-2:50 p.m. every Tuesday and Thursday.

REQUIRED TEXTBOOK and COURSE PACKET
Course Packet for CPSE/IP&T 730 available at the BYU Store

EXPECTED LEARNING OUTCOMES
As a result of successfully completing this course, students should be able to do the following:

1. Explain the similarities and differences between ordinary least squares regression and multilevel regression in terms of (a) the kinds of data structures that can be most appropriately be analyzed by each, (b) the kinds of research questions that can be successfully investigated by each, (c) the main features that distinguish between single-level and multilevel models, and (d) the likely consequences of using each approach when the other would have been more appropriate.

2. Understand the basic concepts used in multilevel modeling including, but not limited to the following:
   • nested units of analysis and within-level dependencies
   • estimated intercept and slope parameters and residuals
   • within-group versus between-group variance
   • intraclass correlation coefficients
   • conditional versus unconditional models
   • fixed versus random effects
   • maximum likelihood versus restricted maximum likelihood estimation
   • within-level versus cross-level interactions
   • structured versus unstructured covariance matrices
   • cross-sectional versus longitudinal designs
   • time-varying versus time-invariant predictors

3. Build and evaluate alternative models to analyze hierarchically structured data.

4. Write the set of equations for a model of interest including the correct equations at each level and the combined equation.

5. Read and interpret the equations for two- and three-level models with confidence.

6. Demonstrate proficiency in using multilevel software to analyze hierarchically structured data sets including (a) preparing the data files, (b) writing the input command files, (c) executing command files, (d) debugging syntax errors, and (e) interpreting and evaluating output files.

7. Summarize, interpret, and critique written reports of completed multilevel studies completed by other researchers.
SOFTWARE

The use of Multilevel/Hierarchical Modeling techniques would not be feasible or practical without modern computer hardware and software. General purpose statistics packages such as \textit{SAS}, \textit{SPSS}, and \textit{Stata} each include specific procedures and routines that can be used to perform multilevel analyses. In addition, more specialized programs such as \textit{Mplus}, \textit{HLM}, and \textit{MLWin} can also be used for this purpose. In this class we will focus on using \textit{Mplus}. Each student is expected to become proficient in (a) preparing data files to be read into \textit{Mplus}, (b) writing \textit{Mplus} syntax to prepare input files, (c) debugging input files that fail to run properly, and (d) reading and interpreting \textit{Mplus} output files with understanding.

GRADING POLICY

Grades will be based on students’ performance on the homework exercises (20%), the two examinations (40%), and the two projects (40%).

COURSE PROJECTS

Each student is expected to successfully complete two of the three projects described below. All students are expected to complete Project 1. Students may choose to complete either Project 2 or Project 3.

1. Prepare a written summary and critique of a published journal article reporting the results of a research study that used multilevel modeling. The report should include a description of the purpose and context of the study plus your analysis and critique of how well multilevel modeling techniques were used in this study and to what extent the researchers’ conclusions are supported by the data.

2. Analyze a multilevel data set and write a summary report which describes—
   - the purpose of the study,
   - the research questions on which the study focused,
   - how the data were obtained and analyzed,
   - the models compared, and
   - the findings and conclusions of your study.

3. Prepare a written proposal to conduct a research study using multilevel modeling techniques. The written document should include—
   - the purpose for conducting the study,
   - the research questions that you plan to investigate,
   - a brief review of relevant previous research and a rationale for why the proposed needs to be conducted,
   - the kinds of data to be analyzed and how and from what source this data will be obtained,
   - the kinds of models that you expect to build and how you expect to evaluate them.
COURSE OUTLINE
The topics to be taught in this course include:

1. The nature of hierarchical data structures and the meaning of nesting
2. The limitations associated with using ordinary least squares regression models to analyze hierarchical data and the advantages of multilevel models
3. Basic concepts and notational symbols used in multilevel models with two and three levels
4. How to use Mplus software to analyze multilevel data
5. Analyzing two-level models
6. Developing a general strategy for analyzing multilevel data
7. Checking assumptions and assessing model-data fit
8. Strategies for building and testing alternative models
9. Analyzing models with three levels
10. Issues to consider when designing multilevel studies
11. Conducting multilevel analyses using generalized linear models
12. Using multilevel models to analyze longitudinal data
13. Alternative covariance structures

SCHEDULE

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BYU POLICIES

Academic Honesty

The first injunction of the BYU Honor Code is the call to be honest. Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life’s work, but also to build character. President David O. McKay taught that “character is the highest aim of education” (The Aims of a BYU Education, p. 6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

BYU Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university’s expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Preventing Sexual Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU’s policy against sexual harassment extends not only to employees of the university, but to students as well. If you encounter unlawful sexual harassment or gender-based discrimination, please talk to your professor; contact the Equal Employment Office at 422-5895 or 367-5689 (24-hours); or contact the Honor Code Office at 422-2847.

Students with Disabilities

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the Services for Students with Disabilities Office (422-2767). Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. Services are coordinated with the student and instructor by the SSD Office. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at D-285 ASB.
PUBLISHED TUTORIALS, PRIMERS, OVERVIEWS, AND OTHER INTRODUCTORY ARTICLES


**SUPPLEMENTARY RESOURCE MATERIALS**

The following books and articles are useful supplementary materials for students who desire to examine published applications of multilevel analysis or desire to gain a more in depth understanding of specific concepts or procedures used in multilevel/hierarchical linear modeling.


**Software Issues Related to Applications of Multilevel Models**


**Examples of Published Studies Using Multilevel Models**


