COURSE SYLLABUS
CPSE 730 and IP&T 730
Spring Term, 2019

INSTRUCTORS:
Instructors:
Lane Fischer
340-E MCKB
801-422-8293
Email: lane_fischer@byu.edu
Office Hours: Open Door

Richard Sudweeks
150-M MCKB
801-422-7078
Email: richard_sudweeks@byu.edu

Class Meeting Schedule:
M & W, 9:00-11:50 341 MCKB

REQUIRED TEXTBOOK
Packet Available at the BYU Store: Sudweeks, R., IP&T/CPSE 730, Hierarchical Linear Modeling, ISBN 978-0-70003-0152-2, $11.25 You will be lost without this packet!!!!

RECOMMENDED TEXTBOOKS
The following textbooks are recommended. They vary in approach and scope. You should access at least one of them. I will describe the advantages of each so you can choose which fits your needs.


The Finch and Bolin text is reasonably light on theory and does not go into too many weeds. It also provides clear instruction on using Mplus (if that is your favored syntax-based program. The downside, in my opinion, is that the parameter estimates in the Mplus output are hard to track. I had to do a lot of extra work to identify the components of the Mplus output in the book. The chapter on longitudinal HLM uses incorrect subscripting which can be confusing for a first time user. There are more errata that I expected to see, but overall, it is well written.

The Hox et al. text moves quickly through a wide range of material. However, it sometimes goes into details (the weeds) in the beginning of the text that are not particularly helpful to first time users. The Hox text has less errata than the other texts and is written well. It does not rely on a
single program. All examples have accompanying datasets that are formatted for multiple programs (SPSS, HLM, MLwiN, and Mplus). A major advantage for first time users is that the Hox text presents parameter estimates from each example in tables that are easy to follow. (None of the texts add the Greek and Arabic symbols into the tables as I would prefer, but Hox’s tables are easy to follow nonetheless.)

The Heck text is written simply without as much technical/theoretical material or breadth of coverage as the other two. There is an accompanying text by Heck. (An Introduction to Multilevel Modeling Techniques) that does cover more theory and is logically consistent with the applied text recommended here. The recommended Heck text provides excellent screenshots of the SPSS input process which are very helpful to first time users. The output for each example is reasonably isomorphic with the actual SPSS output which is also very helpful to students. The downside of the Heck text is that the chapter on longitudinal analysis is wrong…or at least the extended example is wrong. It is possible to simply use the example as it is erroneously executed and learn from it, but it is wrong. It is possible to run the analysis correctly and compare the results to the erroneous results, which is instructive but irritating, as it makes most of the explanatory text in the chapter irrelevant.

So if you already prefer to work in Mplus, the Finch text will be a very good choice. If you prefer to work in SPSS, the Heck text(s) is a good choice. If you prefer to work in R, the Hox text might be a good choice because the website will have multiple formats of the data that can probably be used in R.

I will try to illustrate concepts using data and examples from all three texts in both SPSS (in which I am more fluent) and Mplus (in which Rich is more fluent) and hope that my work prepares you to do your two projects using the software of your choice.

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 addressed 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 be more appropriate.

2. Understand the basic concepts and notational conventions used in multilevel modeling (e.g., nested units of analysis and within-level dependencies; estimated intercept and slope parameters and residuals; within-group versus between-group variance; intra-class correlation coefficients; conditional versus unconditional models; fixed versus random model components; within-level versus cross-level interactions; cross-sectional versus longitudinal designs; time-varying versus time invariant predictors; growth trajectories; etc).

3. Demonstrate proficiency in using multilevel software to analyze hierarchically structured data including (a) preparing the data files, (b) generating the input commands, (c) executing analyses, and (d) interpreting and evaluating the output.

4. Apply appropriate strategies to analyze hierarchically structured data sets by building and testing alternative models.
SOFTWARE

The use of Multilevel/Hierarchical Modeling techniques is not feasible or practical without modern computers and software. General purpose statistics packages such as *SAS*, *SPSS*, and *Stata* each include specific procedures and routines that can be used to perform multilevel analyses. In addition, more specialized programs such as *HLM*, *Mplus*, and *MLWin* can also be used for this purpose. (Dr. Fischer is a fan of MLwiN because it translates models well, but is it expensive, inaccessible for students and clunky to learn.)

The topics included in this course will be taught:

1. The nature of hierarchical data structures and the meaning of nesting
2. The disadvantages of using Ordinary Least Squares regression models to analyze hierarchical data and the advantages of multilevel modeling
3. Preparing data files for multilevel analysis
4. Basic concepts and notational symbols used in multilevel models with two levels
5. Analyzing two-level cross-sectional models
6. Checking assumptions and assessing model-data fit
7. Strategies for building and testing alternative models
8. Analyzing models with three level cross-sectional models
9. Issues to consider when designing multilevel studies
10. Using multilevel models to analyze longitudinal data
11. Alternative covariance structures
12. Analyzing generalized hierarchical models

<table>
<thead>
<tr>
<th>Session</th>
<th>Date</th>
<th>Readings</th>
<th>Topic</th>
<th>Homework</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 W</td>
<td>5/1</td>
<td>Heck 1 &amp; 2</td>
<td>Bridge &amp; Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hox 1 &amp; 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finch 1 &amp; 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 M</td>
<td>5/6</td>
<td>Heck 3</td>
<td>2-level Cross-sectional Modeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hox 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finch 3 &amp; 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 W</td>
<td>5/8</td>
<td>Heck 3</td>
<td>2-level Cross-sectional Modeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hox 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finch 3 &amp; 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 M</td>
<td>5/13</td>
<td>Heck 3</td>
<td>2-Level Cross-sectional Modeling Software Variations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hox 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finch 3 &amp; 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 W</td>
<td>5/15</td>
<td>Heck Chapter 4</td>
<td>3-level Cross-sectional Modeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finch 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 M</td>
<td>5/20</td>
<td>Finch 5</td>
<td>Practice and Prepare for Midterm Cushion</td>
<td></td>
</tr>
<tr>
<td>7 W</td>
<td>5/22</td>
<td>Midterm Exam</td>
<td>Midterm Exam</td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td>5/27</td>
<td>Memorial Day</td>
<td>Memorial Day</td>
<td></td>
</tr>
<tr>
<td>8 W</td>
<td>5/29</td>
<td>Heck 5 &amp; 6</td>
<td>Begin Longitudinal Modeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hox 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finch 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Day</td>
<td>Time</td>
<td>Event</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----</td>
<td>-------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>9 M</td>
<td>6/3</td>
<td>Heck 5 &amp; 6 Hox 5 Finch 6</td>
<td>Longitudinal Modeling</td>
<td></td>
</tr>
<tr>
<td>10 W</td>
<td>6/5</td>
<td>Heck 5 &amp; 6 Hox 5 Finch 6</td>
<td>Longitudinal Modeling</td>
<td></td>
</tr>
<tr>
<td>11 M</td>
<td>6/10</td>
<td>Heck 5 &amp; 6 Hox 5 Finch 6</td>
<td>Longitudinal Modeling</td>
<td></td>
</tr>
<tr>
<td>12 W</td>
<td>6/12</td>
<td>Hox 6 &amp; 7 Finch 7 &amp; 8</td>
<td>Generalized Hierarchical Modeling</td>
<td></td>
</tr>
<tr>
<td>13 M</td>
<td>6/17</td>
<td>Final Exam</td>
<td>Practice and Prepare for Final Exam</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>6/19</td>
<td>Final Exam</td>
<td>Final Exam</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9:00-11:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GRADING POLICY**

Grades will be allocated based on students’ performance on the two examinations (50%), and the two projects (50%).

**COURSE PROJECTS**

Each student is expected to successfully complete two projects:

1. Analyze a cross-sectional multilevel data set and write a report describing the findings and results of the analysis.
2. Analyze a longitudinal multilevel data set and write a report describing the findings and results of the analysis.
3. 

**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 422-5895, 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.


