EDC 586: Advanced Quantitative Methods: Hierarchical Linear Model (HLM)

Syllabus

Mon/Wed 4:00 – 7:45pm
Summer 2017

Instructor:
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Office hours:
Wednesdays 2:00 - 4:00 Or by appointments.

Required textbook:


Recommended Articles:

Introduction to HLM


Applications of HLM

Education


Psychology


Business Administration


Health


**Course Overview:**

Data in education, psychology, medicine, public health, business and other applied sciences are often clustered or show a multilevel (hierarchical) structure. For example in educational research, researchers frequently select a sample of schools from which a sample of classes are selected from which a sample of students are selected. Measurements of attributes or characteristics of schools, classes (teachers) and students are available. Most standard statistical models and tests rely critically on the assumption of independent observations. When data are clustered or show a multilevel structure, observations are typically correlated, which violates the standard independence assumption and invalidates conclusions based on standard statistical methods.

This course provides an introduction to the use of hierarchical or multilevel models which take into account dependencies between observations. Students will learn the basic ideas and theory of hierarchical linear models, as well as have many opportunities to apply the methods to real data from studies in education, psychology and social sciences.

Topics to be included:
- Introduction to HLM, 2-level, 3-level models
- Multilevel organizational research (individuals nested within groups)
- Longitudinal research (multiple waves of data for individuals – individual)
- Meta-analysis (individuals nested within studies)
- HLM for binary outcomes, count data
- Model adequacy

**Statistical software:**

For the first part of the course regarding regression, we will use SPSS which is available on campus. Among different software packages available for analyzing multilevel data, we will use HLM and free student edition of HLM version 7.01 is available for downloading from [http://www.ssicentral.com/hlm/student.html](http://www.ssicentral.com/hlm/student.html)

**Course requirements:**

**Data analysis worksheets:**

Four take-home worksheets will be assigned each Wednesday. These are due back to me by the following Monday class meeting.

**Project Report:**

**Due Date:**

**Technical Requirements:** 8-10 pages, typed, double-spaced, follow the APA style
Purpose: The purpose of this assignment is to give you an opportunity to work on a data analytic problem (relevant to your area of interest) using statistical techniques described in this course. This may involve a project on which you are currently or will be working. It may also be based on a problem you wish to explore. A key component of this project is to appropriately match the problem with the data analytic technique.

Data: You may use real data to which you already have access or you may use publicly available or previously published data.

The report must include the following:

1. Introduction: Background and purpose of the study; state concisely the research question(s).
2. Methods: Description of the sample, study measure and procedures
3. Results: Summarize the data and the statistical analysis of them. Include summary tables of the results from your analyses
4. Discussion: Evaluate and interpret the results and their implications. Also, discuss the adequacy of the data in addressing the research questions, as well as the adequacy of the analyses in addressing the research questions.
5. References

Please hand in the printouts of the syntax used to generate the analyses and output files clearly labeled along with the report.

The report will be evaluated for the appropriateness of the data analytic techniques for the problems presented as well as the accuracy of the analyses and clarity of the report.

Presentation:

Treat the project as if you were presenting at a conference. Prepare handouts for members of the audience, as well as overhead materials. Your work will be evaluated on the clarity of handouts, overheads, and general presentation. Prepare to speak for 15 minutes. Each speaker will be given approximately 5 minutes for discussion and questions.

Grades:

Course grades will be based on the following:

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<th>Component</th>
<th>Points</th>
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| Quizzes              | 40 pts.
| Project report       | 40 pts.
| Presentation         | 20 pts.
| Total                | 100 pts. |
Any student with a documented disability is welcome to contact me early in the semester so that we can work out reasonable accommodations to support your success in this course. You should also contact Disability Services for Students, Office of Student Life, 330 Memorial Union, 874-2098.
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Reading</th>
<th>Topic</th>
<th>Note</th>
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<tr>
<td>1</td>
<td>5/22 (M)</td>
<td>Handouts</td>
<td>General Linear Model (GLM): ANOVA, ANCOVA, MANOVA, Repeated Measures</td>
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<td>5/24 (W)</td>
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<td>General Linear Model (GLM): Linear Regression</td>
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<td>5/29</td>
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<td>Memorial Day (No Class)</td>
<td>Move to 6/2 (F)</td>
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<td>2</td>
<td>5/31 (W)</td>
<td>Articles 1, 2</td>
<td>Rationale for multilevel model</td>
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<td>R &amp; B Ch 1, 2</td>
<td>Logic of HLM</td>
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<td>3</td>
<td>Estimation and Hypothesis testing</td>
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<td>6/2 (F)</td>
<td>R &amp; B Ch 4, 5</td>
<td>Illustrative applications</td>
<td>2-Level HLM</td>
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<td>3</td>
<td>6/5 (M)</td>
<td>R &amp; B Ch 6, 7</td>
<td>Organizational research</td>
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<td>6/7 (W)</td>
<td>R &amp; B Ch 8</td>
<td>Research on individual change</td>
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<td>4</td>
<td>6/12 (M)</td>
<td>R &amp; B Ch 9, 10</td>
<td>Applications in meta-analysis</td>
<td>3-Level HLM</td>
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<td>6/14 (W)</td>
<td>R &amp; B Ch 10</td>
<td>Model adequacy</td>
<td>Hierarchical Generalized Linear Models (HGLM)</td>
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<td>5</td>
<td>6/19 (M)</td>
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<td>Hierarchical Generalized Linear Models (HGLM)</td>
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<td>6/21 (W)</td>
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<td>Presentation</td>
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The above schedule is only approximate and may change to allow for expanding or reducing the coverage of certain topics.