

## Course Syllabus Psy 526/626: Multilevel Regression Spring 2024

### Instructor

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### Meeting Times and Location

Class: Tu, Th 10:00–11:50 AM, 307 Cramer Hall (CH).

### Text<sup>1</sup>

Snijders, T.A.B., & Bosker, R.J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling (2<sup>nd</sup> Edition)*. London: Sage. ISBN: 184920201X

### Recommended Text

Raudenbush, S.W., & Bryk, A.S., (2002) *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage. ISBN: 076191904X

### Optional (not at the PSU bookstore)

Heck, R. H., Thomas, S. L., & Tabata, L. N. (2022). *Multilevel and longitudinal modeling with IBM SPSS, Third Edition*. Routledge. ISBN: 0367424614

Huang, F. L. (2023). *Practical Multilevel Modeling Using R*. Sage Publications. ISBN: 1071846124

### Overview

This course is intended to introduce students to multilevel regression techniques (also known as hierarchical linear models, random coefficient models, or mixed models) and will cover the fundamental concepts and application of the techniques. By the end of the course, students should be able to apply, write about, critique applications of, and read methodological articles about multilevel regression analysis.

### Prerequisites

This course assumes that students have taken a graduate statistics course that covers simple and multiple regression.

### Readings and Commentaries (5%)

There will be several readings assigned each week taken from the text and supplemental sources. The readings will often include an example article that applies MLR. Please read the material prior to class and be prepared for discussion. Students will be required to turn in a **one-page commentary** on the readings for that week on each Tuesday by 9 AM via email. The commentaries should be an informal set of questions, comments, or summary information (summarize only if you cannot think of anything else to say) about the articles. The purpose of the commentaries is to make sure the class is prepared for discussion and to help the instructor identify discussion topics and sources of confusion in the readings. I will assign 2 (complete and well-considered), 1 (did not read some/lacking effort), or 0 (did not read most/minimal effort/late/nothing) points to each, with one freebie.

### Homeworks

There will be three homework assignments consisting of data analysis and reporting of multilevel regression problems using R, SPSS or the HLM package (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2019; Scientific Software International). A temporary trial license for the HLM 8 package will be available to the students enrolled in this class (details forthcoming). It is unlikely that you will need to refer to the manual

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<sup>1</sup> Unfortunately, we do not have free electronic access to this book. This text is available in the book store, used copies are available online starting at \$26, and there is a print copy at the library. It also can be rented for \$26 for 90 days at <https://us.sagepub.com/en-us/nam/multilevel-analysis/book234191>.

(much of the information is available under the help menu), but it is available for download here:  
<https://www.hearne.software/getattachment/a104646a-d78e-4ccd-88cf-cf04a78b47f2/HLM8-Manual.aspx>.

**Homework due dates are:** Late assignments are not accepted without penalty (10% per day late) except for cases of significant illness or family emergencies. **See reading schedule below for due dates.** Please contact me ahead of time if at all possible if you are going to miss the deadline for any reason.

### **Grades**

Grades are based on an average of the three homework assignments with total percentages assigned the following grades:  $\geq 90 = A$ ,  $85-89.9 = B+$ ,  $80-84.9 = B$ ,  $75-79.9 = C+$ ,  $70-74.9 = C$ .

### **Other Resources**

There are a number of useful electronic links on the class website.

### **Disabilities**

I am happy to make any necessary arrangements with students who have a disability and are in need of academic accommodations. If you have not done so already, please contact the Disability Resource Center, 116 Smith Memorial Student Union, <https://www.pdx.edu/disability-resource-center/>, Email: [drc@pdx.edu](mailto:drc@pdx.edu), for assistance and any arrangements. I would appreciate it if you would check with me as soon as possible to discuss any needed accommodations and to make sure that I have received a faculty notification letter. If any aspects of instruction or course design result in barriers to your inclusion or learning, please let me know.

### **Diversity, Equity, and Inclusion**

Portland State University's Department of Psychology is fully committed to diversity, equity, and inclusion. Our department fosters a vibrant intellectual environment in which human diversity is recognized and valued in all its forms. We support learning, research, and outreach activities that promote the values of diversity, equity, and inclusion. My goal is to create a learning environment that is accessible, equitable, inclusive, and welcoming. I am committed to fostering mutual respect and full participation for all students. If there are any incidents or conditions that you feel do not conform to these goals, please discuss them with me.

### **Sexual Harassment, Sexual Violence, and Discrimination**

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals or contact a confidential advocate at the Women's Resource Center <https://www.pdx.edu/womens-resource-center/contact/contact> and 503-725-5672. For more information about Title IX please see <https://www.pdx.edu/diversity/title-ix>.

## Course Readings Psy 526/626 Multilevel Regression, Spring 2024

All supplemental readings available online at the class website: <http://web.pdx.edu/~newsomj/mlrclass> (password protected zip file—check with me for the password)

**Commentaries are due at 9 AM on Tuesday of each week** (second date listed in each topic section below)

**Book Sources:** S & B = Snijders & Bosker text. **Singer & Willett**, (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press. **Kreft, I., & de Leeuw, J.** (1998). *Introducing multilevel modeling*. London: Sage. **Hox, J.** (2010). *Multilevel analysis: Techniques and applications, second edition*. New York: Routledge.

### 4/4,4/9 Regression Review & Overview of Multilevel Regression

- S & B, Chapter 1 & Chapter 2.

- Kreft & de Leeuw, pp. 1-8

*Optional:* • Chapter 2, "Simple linear regression and correlation," Pedhazur, E.J. (1997). *Multiple regression in behavioral research: Explanation and prediction (3rd Edition)*. Fort Worth, TX: Harcourt Brace.

*Optional:* Chapter 5, "Elements of multiple regression analysis: Two independent variables" in Pedhazur, E.J. (1997). *Multiple regression in behavioral research: Explanation and prediction (3rd Edition)*. Fort Worth, TX: Harcourt Brace.

### 4/11,4/16 Random vs. Fixed Coefficients, Random Intercept Models, Intraclass Correlation Coefficient

- Kreft & de Leeuw, pp. 10-12.

- S & B, Chapter 4, Sections 4.1 - 4.5 and Section 4.9 only. (*Optional: Chapter 3*).

- From Hays, W.L. (1973). *Statistics for the social sciences*. New York: Holt, Rinehart, & Winston. (pp.535-536). (ICC)

- From Steele, R.G.D., Torrie, J.H., & Dickey, D.A. (1997). *Principles and procedures of statistics: A biometric approach (3rd Ed.)*. Boston, MA: McGraw-Hill. (pp. 297-299). (ICC)

- *Example Article:* Beauchamp, M. R., Bray, S. R., Fielding, A., & Eys, M. A. (2005). A multilevel investigation of the relationship between role ambiguity and role efficacy in sport. *Psychology of Sport and Exercise*, 6, 289-302.

### 4/18,4/23 Full Multilevel Regression Models, Part I: Varying Slopes, Hypothesis Tests, Explained Variance, Model Building

- S & B, Chapter 5, except Sections 5.2 and 5.3.1, Chapter 6.

- Roberts, K.J., Monaco, J.P., Stovall, H., & Foster, V. (2011). Explained variance in multilevel models (pp.219-230). In J.J. Hox & J.K. Roberts (Eds.), *Handbook of Advanced Multilevel Analysis*. New York: Routledge.

### 4/25,4/30 Full Multilevel Regression Models, Part II: Cross-level Interactions & Centering

- S & B, Chapter 5, Section 5.2 only (cross-level interactions)

- Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interaction effects in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics*, 31, 437-448. (*Optional section:* Interactions in LCA)

- S & B, Chapter 4, Section 4.6 only, Chapter 5, Section 5.3.1 only (centering)

- Enders, C.K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods*, 12, 121-138.

- *Example Article:* Morrison, E. W., Wheeler-Smith, S. L., & Kamdar, D. (2011). Speaking up in groups: a cross-level study of group voice climate and voice. *Journal of Applied Psychology*, 96, 183.

### 5/2 Homework 1 Due

### 5/2,5/7 Estimation Methods, Assumptions & Diagnostics

- S & B, Chapter 4, Sections 4.7 – 4.8 only (estimation).

- S & B, Chapter 10 (assumptions & diagnostics).

- Raudenbush & Bryk, pp. 266-280 (assumptions, diagnostics, remedies)

- S & B, Chapter 12, Sections 12.1 – 12.2 only (remedies).
- Bauer, D.J., & Cai, L. (2009). Consequences of unmodeled nonlinear effects in multilevel models. *Journal of Educational and Behavioral Statistics*, 34, 97–114.

#### **5/9,5/14 Growth Curve Models, Part I: Linear Growth**

- Singer & Willett, Chapter 2 & 3.
- Hox, Chapter 5, pp. 79-99
- *Example Article*: Stoddard, S.A., Zimmerman, M.A., Bauermeister, J.A. (2011). Thinking About the Future as a Way to Succeed in the Present: A Longitudinal Study of Future Orientation and Violent Behaviors Among African American Youth. *American Journal of Community Psychology*, 48, 238–246.

#### **5/16,5/21 Growth Curve Models, Part II: Extensions of Growth Curve Models**

- S&B Chapter 15
- Singer & Willett, Chapter 6.
- *Example Article*: Hindman, A.H., Cromley, J.G., Skibbe, L.E., and Miller, A.L (2011). Conventional and Piecewise Growth Modeling Techniques: Applications and Implications for Investigating Head Start Children's Early Literacy Learning. *Evaluation Review*, 35, 204 - 239.

#### **5/23 Homework 2 Due**

#### **5/23,5/28 Binary and Noncontinuous Outcomes**

- S&B Chapter 17
- Hox, Chapters 6 & 7.
- Example: Bradshaw, C. P., Mitchell, M. M., O'brennan, L. M., & Leaf, P. J. (2010). Multilevel exploration of factors contributing to the overrepresentation of black students in office disciplinary referrals. *Journal of Educational Psychology*, 102, 508.
- *Optional*: Hedeker, D. (2005). Generalized linear mixed models. In B. Everitt & D. Howell (Eds.), *Encyclopedia of Statistics in Behavioral Science*, New York: Wiley.

#### **5/30,6/4,6/6 Missing Data, Sample Size Issues & Power**

- S&B, Chapter 9 (missing data)
- Hox, Chapter 12 (sample size & power)
- S&B Chapter 11 (sample size & power)
- *Optional*: Scherbaum, C.A. & Ferreter, J.M. (2009). Estimating statistical power and required sample sizes for organizational research using multilevel modeling. *Organizational Research Methods*, 12, 347-367.

#### **6/11 Homework 3 Due 5 PM (No class—finals week)**