ORLA 6641 – Advanced Topics in Research Methods and Design
Teachers College, Columbia University
Spring 2020
Mondays 5:10-6:50pm, Location: TBA

Instructor: Alex J. Bowers, Ph.D., Associate Professor of Education Leadership
Office: 303i Zankel, (212) 678-7466
Email: Primary: By Canvas course page. Alternate: Bowers@tc.edu
Faculty Webpage: http://www.tc.columbia.edu/faculty/ab3764/
Office Hours: Mondays 3-5pm or by appointment.

Course Catalog Description:
This course provides students the opportunity to explore advanced topics in research design and analytic methods, especially as they relate to studies of educational contexts and policies.

Academic Prerequisites:
Students should have completed at least one intermediate graduate level applied statistics or data analysis course, such as HUDM 5122 or EDPA 5002, along with some experience working with SPSS or similar statistical software. **Credits:** Variable 1-4 points.

Course Purpose & Overview:
The purpose of this course is to provide instruction in the application of analytic research design and methods to problems of research, policy and practice in organizational leadership to help support students who are working on research projects, either for possible publication, in collaboration with faculty, for thesis or dissertation research. This course is designed to help students take analytic methods learned in previous courses and build on that knowledge to answer substantive questions in organizational leadership and policy.

The goal of the course is for students to pursue a research project over the course of a semester, culminating in the creation of a research presentation and supporting manuscript for possible presentation at a national or international education research conference and possible submission for publication, incorporation into a policy brief or report, or inclusion within a thesis or dissertation.

Students are not required to begin the class with a pre-formulated research project, although for students who do enter the class with a research project in mind, the course is structured to help them analyze their dataset, complete the project and format and present the results for publication. Students will be provided with instruction around large public-access datasets in education appropriate for publication-level research if they do not enter the class with a dataset in-hand. These datasets include the types of data collected by the National Center for Education Statistics (NCES) http://nces.ed.gov/surveys/

The course considers the research design and methodological issues in studying the following:

1) Examining longitudinal risk of event occurrence (estimating hazards)
2) Assessing organizational effects on individuals (teachers/principals/schools/districts)
3) Determining what is associated with longitudinal trajectories & change-over-time
4) Asking if there is one group or multiple subgroups (a typology) in your data.

Required Texts: *Note: These texts are on course reserve in the TC library*

1) Heck, R. H., Thomas, S. L., & Tabata, L. N. (2013). *Multilevel and Longitudinal Modeling with IBM SPSS* (2nd ed.). New York, NY: Routledge. 978-0415817110

2) Mertler & Vannatta Reinhart (2017) *Advanced and Multivariate Statistical Methods*, **Sixth Edition**, Routledge, ISBN: 978-1138289734.

3) Huff, D. (1954) *How to Lie with Statistics*. New York, NY: W.W. Norton & Company. (Note: Many reprints since 1954 are available, including 1993)

4) Tufte, Edward R. (2006) *The Cognitive Style of PowerPoint: Pitching Out Corrupts Within*, **2nd Edition.** Graphics Press, Cheshire, CT.

5) Tufte, Edward R. (2001) *The Visual Display of Quantitative Information*, **2nd Edition**. Graphics Press, Cheshire, CT.

Optional Course Texts:
Note: These texts are on course reserve in the TC library:

- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press
- Hox, J., Moerbeek, M., & Van de Schoot, R. (2018). *Multilevel Analysis: Techniques and Applications* (3rd ed.): Routledge.
- Collins, L. M., & Lanza, S. T. (2010). *Latent Class and Latent Transition Analysis: With Applications in the Social, Behavioral, and Health Sciences*. Hoboken, NJ: Wiley.
- Heck, R. H., Thomas, S. L., (2015) *An Introduction to Multilevel Modeling Techniques: MLM and SEM Approaches Using Mplus*. 3rd Edition, Routledge. ISBN: 978-1848725522
- Tabachnick & Fidell (2012) *Using Multivariate Statistics* (6th Edition). Pearson. ISBN: 978-0205849574
- Hancock & Mueller (2010) *The Reviewer's Guide to Quantitative Methods in the Social Sciences*. Routledge. ISBN-10: 041596508X
- Stevens, James P (2009) Applied Multivariate Statistics for the Social Sciences. Fifth Edition. Routledge. ISBN 978-0-8058-5903-4

Beyond these texts, a considerable amount of material will be available via the Online Canvas course page. This will include Word, Excel and PDF files. You will need to be able to access these files readily. If you need software updates, please acquire them.

Online Course Administration:
Much of the material, management and information for this course will be located online within Canvas. All course information will be located online, including additional readings and the updated course syllabus. Please check online regularly for messages. Canvas can be accessed from the myTC link on the main Teachers College website or at: http://my.tc.columbia.edu/. Click on the courses tab near the top and select Canvas, then this course number.

Grading:

Graded Sections:	*%*	*Tentative Due dates*
Exercises x 5	25%	Weekly (see schedule)
Mid-Term	25%	Week 9
Research Presentation	20%	Week 14 & Week 15
Final	30%	Week 15
Total	100%	

Grades are defined as follows, according to the Teachers College Policy:

A+	Rare performance. Reserved for highly exceptional, rare achievement.
A	Excellent. Outstanding achievement.
A-	Excellent work but not quite outstanding.
B+	Very good. Solid achievement expected of most graduate students.
B	Good. Acceptable achievement.
B-	Acceptable achievement but below what is generally expected.
C+	Fair achievement, above minimally acceptable level.
C	Fair achievement but only minimally acceptable.
C-	Very low performance.

Writing Details:
All writing for this course is to be double spaced, in a 12-point font (Times New Roman) with 1-inch margins, using APA format for all citations, and submitted electronically through Canvas in Microsoft Word format on the due date.

Accommodation:
The College will make reasonable accommodations for persons with documented disabilities. Students are encouraged to contact the Office of Access and Services for Individuals with Disabilities for information about registration. Services are available only to students who are registered and submit appropriate documentation. As your instructor, I am happy to discuss specific needs with you as well.

Incompletes:
The grade of Incomplete will be assigned only when the course attendance requirement has been met but, for reasons satisfactory to the instructor, the granting of a final grade has been postponed because certain course assignments are outstanding. If the outstanding assignments are

completed within one calendar year from the date of the close of term in which the grade of Incomplete was received and a final grade submitted, the final grade will be recorded on the permanent transcript, replacing the grade of Incomplete, with a transcript notation indicating the date that the grade of Incomplete was replaced by a final grade. If the outstanding work is not completed within one calendar year from the date of the close of term in which the grade of Incomplete was received, the grade will remain as a permanent Incomplete on the transcript. In such instances, if the course is a required course or part of an approved program of study, students will be required to re-enroll in the course including repayment of all tuition and fee charges for the new registration and satisfactorily complete all course requirements. If the required course is not offered in subsequent terms, the student should speak with the faculty advisor or Program Coordinator about their options for fulfilling the degree requirement. Doctoral students with six or more credits with grades of Incomplete included on their program of study will not be allowed to sit for the certification exam.

TC Email:
Teachers College students have the responsibility for activating the Columbia University Network ID (UNI) and a free TC Gmail account. As official communications from the College – e.g., information on graduation, announcements of closing due to severe storm, flu epidemic, transportation disruption, etc. -- will be sent to the student's TC Gmail account, students are responsible for either reading email there, or, for utilizing the mail forwarding option to forward mail from their account to an email address which they will monitor.

Religious Holidays:
It is the policy of Teachers College to respect its members' observance of their major religious holidays. Students should notify instructors at the beginning of the semester about their wishes to observe holidays on days when class sessions are scheduled. Where academic scheduling conflicts prove unavoidable, no student will be penalized for absence due to religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and the instructor, students and instructors should consult the appropriate department chair or director. If an additional appeal is needed, it may be taken to the Provost.

Structure of the Course:
After the first few weeks that are devoted to introducing the course, the structure of the course will follow a two-week pattern in which topics are discussed in two week blocks. For any one subject block, the first week we will read and discuss peer reviewed research articles which have asked the same type of research question that we will be discussing; examining how the authors addressed the topic, brought an interesting set of questions and data to the topic, and how they went about analyzing the data, reporting the results and interpreting the outcomes. For the second week of a subject block, we will read about how to conduct the analysis and will practice the analysis using datasets that accompany the assigned readings. Exercises are then due the following week in which students will work through the analysis presented in the text using the dataset provided.

Additionally, for the final presentation and paper, students will select an "analysis focus area" from the range of topics listed in the schedule below. Students will be expected to apply this focus area

in their final paper to either the dataset and research questions they brought into the class, or to an NCES dataset. During the second week of any subject block, students who have selected that block as an analysis focus area will be expected to start the class with a 45-60 minute overview of the method (either individually or in a group) and how it applies to your research area. Students are strongly encouraged to begin the background reading for their focus area as soon as possible.

Variable Credit:
This course is offered for variable credit, for 1-4 credits. Students who enroll for one credit will be required to attend all courses and submit all exercises. Students who enroll for two credits will also be required to complete the mid-term and participate in a focus area presentation. Students who enroll for three credits will also be required to complete the final exam and presentation. Students who enroll for four credits will also be required to turn in additional submissions as they work to submit their final exam to a conference for presentation, please talk to Bowers before enrolling for four credits to create a plan for the additional assignments. Most students traditionally enroll for either one or three credits.

Statistical Software:
Familiarity and access to IBM SPSS is required for this course. In addition, we will discuss the application of multiple analysis techniques within other statistical software packages, such as MPlus. Note TC and Columbia computer labs supply both software packages (and many more!) in the computer labs.

Note that SPSS is freely available to all TC students for home use. Please see the link under myTC for more information on how to obtain SPSS for free through the TC site license. If you have problems accessing the TC version of SPSS, please contact the service desk servicedesk@tc.columbia.edu.

****** Please see the course schedule below for specific readings and due dates ******

Tentative Course Schedule of Weekly Readings:

Week 1 **Introduction**

Please come prepared to discuss possible research topics and analysis focus areas. We will focus our discussion on data analysis questions in education research and student focus topic areas.

Readings:

- Review the Syllabus
- Review the Canvas Course Page

Please make sure to have reviewed the Canvas course page and posted information prior to the first class, and please make sure to participate in any of the online course forum discussions. Please feel free to post about your possible research topics in response to online course discussions.

Week 2 **An Introduction to NCES National Level Data**

The purpose of this course is to help you address problems of research, practice and policy through developing your skills learned in your statistics courses to interesting quantitative research questions. Theory testing, however, requires data. The National Center for Education Statistics (NCES) provides many different datasets for public use that are extensive and most are nationally generalizable, so that with the proper statistical weights applied, you can generalize to all students, schools, principals, or teachers in the U.S. These datasets include surveys and standardized assessments of thousands of students every 10 years, surveys of tens of thousands of teachers, librarians, parents and counselors, as well as inventories of school facilities, libraries, crime rates, and financial records, just to name a few. The data are extensive! If you have a research question related in some way to education, there's a very good chance that NCES has a dataset that will help you test that question. This week we build on our discussions of student's research questions from the prior week, and begin to examine the variety of data available to help answer those questions. The reading from Strayhorn provides an excellent introduction to the main issues with using NCES data. Additionally, the data are publically available online, so students are encouraged to take a tour through the datasets prior to class to familiarize yourself with the webtools and the sheer variety of topics available to you.

Urick, A. (2018). Large-scale data with large-scale implications. In C. R. Lochmiller (Ed.), *Complementary Research Methods for Educational Leadership and Policy Studies* (pp. 143-172): Palgrave-MacMillan.

Chudgar, A., & Luschei, T. F. (2016). The untapped promise of secondary data sets in international and comparative education policy research. *Education Policy Analysis Archives*, 24(113), 1-16. http://epaa.asu.edu/ojs/article/view/2563

Familiarize yourself with the NCES datasets at: http://datainventory.ed.gov/ and the list of databases https://datainventory.ed.gov/InventoryList

Optional (if you are interested in using public state-level longitudinal data)
Levesque, K., Fitzgerald, R., & Pfeiffer, J. (2015). A guide to using state longitudinal data for applied research (NCEE 2015–4013). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Analytic Technical Assistance and Development. https://ies.ed.gov/ncee/pubs/20154013/pdf/20154013.pdf

Week 3 **Review & Refresher of statistical concepts**

While this course focuses on addressing substantive research questions in school organizations, some familiarity with the foundational concepts and techniques in sociological quantitative methods is required so that we are all starting on similar grounds and at least somewhat familiar territory. Thus, this week will focus on a refresher of the basics of inferential statistics with examples shown using NCES data, including examining and cleaning data, descriptive statistics, ANOVA, and multiple regression in SPSS.

Reading:

Merlter & Vannatta Reinhart (2017) *Advanced and Multivariate Statistical Methods: Practical Application and Interpretation*. Chapters 1, 2, 3 & 7.

Week 4 **Asking Questions about Time-Varying Risks -** *Survival Analysis & Discrete Time Hazard Modeling*

In education research, there are many questions that concern not only the risks of an event happening, but that the hazard of the event taking place can vary over time. The education process is one that unfolds over time, so examining events over time appropriately is an important issue. For instance, examining the risk of a student dropping out of school is inherently a time-varying issue. First, there are the multiple years in which a student may drop out of high school, with the year that they turn the legal age to drop out in their state being the most hazardous year of dropout. Second, as students drop out of a cohort within a school system there are fewer students who are left to drop out, thus the calculation of one's risk of dropping out is conditional on the proportion of students who dropped out the previous years since that influences how many students are left. This inherent conditional dependency violates one of the central assumptions in inferential statistics, yet assessing student risk is a central concern to many researchers, practitioners and policymakers. This is true for many longitudinal and time-varying issues in education research. Fortunately, there are multiple useful and interesting ways to examine research questions around such conditional hazard questions, such as survival analysis and discrete time hazard modeling. This week's readings address example research questions around a) the longitudinal risk of a student dropping out of school, and b) the longitudinal risk of an educator becoming a superintendent in Texas. Questions that we'll address this week center around examining which years are the most hazardous for the event, and examining what variables predict the outcome, using a modified logistic regression framework proposed by Singer & Willet (2003).

Reading:

Bowers, A. J. (2010). Grades and Graduation: A Longitudinal Risk Perspective to Identify Student Dropouts. *Journal of Educational Research*, 103(3), 191-207. doi: 10.1080/00220670903382970. Pre-print: https://doi.org/10.7916/D8H13C5Z

Davis, B. W., & Bowers, A. J. (2019). Examining the Career Pathways of Educators with Superintendent Certification. *Educational Administration Quarterly*, 55(1), 3-41. http://doi.org/10.1177/0013161x18785872

Merlter & Vannatta Reinhart (2017) *Advanced and Multivariate Statistical Methods: Practical Application and Interpretation*. Chapter 11 (p.289-308).

Optional:
Bowers, A.J., Chen, J.(2015) Ask and Ye Shall Receive? Automated Text Mining of Michigan Capital Facility Finance Bond Election Proposals to Identify which Topics are Associated with Bond Passage and Voter Turnout. *Journal of Education Finance*, 41(2), p.164-196.
Pre-print: http://dx.doi.org/10.7916/D8FJ2GDH

DUE: Exercise 1

Week 5 **Continuing discussion from week 4**

This week we continue our discussion of research design around issues of time and longitudinal risk, focusing on the methodological considerations, assumptions, and modeling fitting procedures.

Reading:

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press. Chapters 9, 10 & 11, p.305-402.

Week 6 **Is there an Organizational Effect on Individual Outcomes? -** *Hierarchical Linear Modeling*

The majority of organizations that we interact with in society have a hierarchical structure. As an example, students and teachers are nested within schools and districts. Which school a student goes to influences that student's achievement, not only through the instruction provided but also through the student's interaction with peers, school services offered, and the variety of different local context effects. However, that means that one student's scores will be related to other students' scores in their same classrooms and schools – student's data will be dependent, violating the assumption of independence in inferential statistics. Through the 1980's and into the early 1990's, Hierarchical Linear Modeling (HLM) came out of a tradition in education research of asking about how to not only appropriately nest students within schools to better model reality, but also to ask substantive questions about the independent effect of organizational actors, processes and contexts on individual outcomes. This type of question could be something like "is there an effect of principal leadership on students dropping out?" or "does the racial composition of a high school have an effect on student college expectations?" These are the types of questions we'll be considering addressing this week with HLM.

Reading:
Bowers, A.J., Berland, M. (2013) Does Recreational Computer Use Affect High School Achievement? *Educational Technology Research & Development*, 61(1), 51-69. http://doi.org/10.1007/s11423-012-9274-1

Bowers, A.J., Urick, A. (2011) Does High School Facility Quality Affect Student Achievement? A 2-Level Hierarchical Linear Model. *Journal of Education Finance*, 37(1), 72-94. http://muse.jhu.edu/journals/journal_of_education_finance/v037/37.1.bowers.html

Xia, J., Izumi, M., Gao, X. (2015) School Process and Teacher Job Satisfaction at Alternative Schools: A Multilevel Study Using SASS 2007–08 Data. *Leadership and Policy in Schools*, 14(2), p.167-203. http://doi.org/10.1080/15700763.2014.997935

Heck, R. H., Thomas, S. L., & Tabata, L. N. (2013). *Multilevel and Longitudinal Modeling with IBM SPSS* (2nd ed.). New York, NY: Routledge. Chapters 1, p.1-34.

Optional:
Roschelle, J., Feng, M., Murphy, R. F., & Mason, C. A. (2016). Online Mathematics Homework Increases Student Achievement. AERA Open, 2(4). doi: 10.1177/2332858416673968 http://journals.sagepub.com/doi/abs/10.1177/2332858416673968

DUE Exercise 2

Week 7 **Continuing Discussion from Week 6**

This week we continue our discussion of research design around issues of estimating organizational-level effects on individual outcomes, focusing on the methodological considerations, assumptions, and modeling fitting procedures.

Reading:

Heck, R. H., Thomas, S. L., & Tabata, L. N. (2013). *Multilevel and Longitudinal Modeling with IBM SPSS* (2nd ed.). New York, NY: Routledge. Chapters 2-3, p.35-130.

O'Dwyer, L. M., & Parker, C. E. (2014). A primer for analyzing nested data: Multilevel modeling in SPSS using an example from a REL study. Washington, DC: U.S.Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northeast & Islands.
http://ies.ed.gov/ncee/edlabs/regions/northeast/pdf/REL_2015046.pdf

Optional:
Hox, J., Moerbeek, M., & Van de Schoot, R. (2018). *Multilevel Analysis: Techniques and Applications* (3rd ed.): Routledge. Chapters 1-4 (pages 1-70).

Spring Break Week *** Spring Break ***

Week 8 **Honestly Reporting Statistical Research Results to the Public**
This week we pause to reflect and consider on how best to report and discuss our research results to a public who is interested but may not be trained in the methods around research design, as well as exactly what is a sound research design when we have so many options. We'll pick this discussion up again at the end of the semester, but this week we start out with one of the best books to outline the classic problems with reporting statistics – How to Lie with Statistics *by Darrell Huff. In a way, quantitative methods are a language, and as with any language, one can lie using that language. But a lie told in statistics seems to be more pernicious than say a lie told in English or Spanish. Thus, Huff wrote his book to help us all spot the usual lies (unintended or otherwise) so that not only can we avoid making the same mistakes ourselves, but that we can train others to spot statistical lies and help everyone "tell the truth" in their research. The Gelman & Loken (2013) and Wicherts et al. (2016) readings take on the specifics of modern statistics, and the idea of "p-hacking" "fishing" and "researcher degrees of freedom". Wicherts et al. (2016) have a fabulous table of all of the different ways that one should watch out for in avoiding p-hacking. Please come to class ready to discuss these and what they look like in practice. Gelman & Loken (2013) then take on the idea of "the garden of forking paths" and make the claim that even when one is trying to be honest, it can all still go badly wrong.*

Readings:
Huff, D. (1954) *How to Lie with Statistics*. New York, NY: W.W. Norton & Company.

Wicherts, J. M., Veldkamp, C. L. S., Augusteijn, H. E. M., Bakker, M., van Aert, R. C. M., & van Assen, M. A. L. M. (2016). Degrees of Freedom in Planning, Running, Analyzing, and Reporting Psychological Studies: A Checklist to Avoid p-Hacking. *Frontiers in Psychology*, 7, 1832.
http://doi.org/10.3389/fpsyg.2016.01832

Gelman, A., & Loken, E. (2013). The garden of forking paths: Why multiple comparisons can be a problem, even when there is no "fishing expedition" or "p-hacking" and the research hypothesis was posited ahead of time. http://www.stat.columbia.edu/~gelman/research/unpublished/p_hacking.pdf

DUE Exercise 3

Week 9 **Examining Change Over Time**

Many research designs in education focus on understanding how individuals (students, teachers, schools, communities) change over time. Given some selected outcome of interest, are the participants in the study growing over time, declining, or holding steady? Understanding longitudinal trajectories around repeated measures is thus an important research issue in education. But, if say we assess students in a school every year for four years, those student's scores are highly correlated year-to-year, so they violate the assumption of independence. How do we account for this? Our discussion of HLM from Week 6 helps us out. Using a HLM framework, hierarchical linear growth models provide an analysis strategy where we can appropriately model growth trajectories. Additionally, we can ask what accounts for the variance in trajectories through time, and control for those factors. As an example, we may know that student socio-economic status contributes to the rate of change over time, but we may be interested in controlling for this effect to compare student growth rates from multiple backgrounds. Also, as we'll discuss, organizational processes can be assessed for their effect not just on a single year of data, but on change over time, such as which school a student attends (charter or not) or how much a student participates in extracurricular activities influences changes in student self-esteem. This type of modeling framework gives us a much richer picture into organizational effects by examining the effect of time appropriately.

Reading:

Kort-Butler, L., & Hagewen, K. (2011). School-Based Extracurricular Activity Involvement and Adolescent Self-Esteem: A Growth-Curve Analysis. *Journal of Youth and Adolescence*, 40(5), 568-581. http://doi.org/10.1007/s10964-010-9551-4

Bowers, A. J. (2015). Site Selection in School District Research: A Measure of Effectiveness Using Hierarchical Longitudinal Growth Models of Performance. *School Leadership & Management*, 35(1), 39-61. doi: 10.1080/13632434.2014.962500. Pre-print: http://dx.doi.org/10.7916/D8P84B2J

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press. Chapters 1-3, p.3-74.

DUE Midterm

Week 10 **Continuing discussion on questions of change over time**

This week we continue our discussion of research designs around issues of estimating change over time effects, focusing on the methodological considerations, assumptions, and modeling fitting procedures.

Reading:
Heck, R. H., Thomas, S. L., & Tabata, L. N. (2013). *Multilevel and Longitudinal Modeling with IBM SPSS* (2nd ed.). New York, NY: Routledge. Chapter 5, p.167-238.

Optional:
Hox, J., Moerbeek, M., & Van de Schoot, R. (2018). *Multilevel Analysis: Techniques and Applications* (3rd ed.): Routledge. Chapter 5 (pages 71-102).

Week 11 **Typology Research Questions – Is there one group or multiple groups in your data?**

In education research, policymakers will often lump all students into one group. Examples of this are college-goers, high school dropouts, teachers who leave the profession, principal forms of leadership, and students pursuing STEM careers, to name just a few. However, are these participants actually one group, or are there multiple subgroups within the larger group (a typology) that helps to explain heterogeneity across the data and outcomes? Mixture modeling and specifically, Latent Class Analysis (LCA) can help address these types of questions, by allowing us to look at the data and empirically assess if there is one or more than one homogenous subgroup within the data. More specifically, LCA addresses the question of if there is a single mode across the hyper-dimensional survey responses across a dataset, or if there are multiple modes, and if there are multiple modes, then we can run a hypothesis test on if those distributions are statistically significantly different. If so, then we can state that there are two (or more) significantly different groups, and then examine the data to understand the differences between the subgroups. In many ways, while much of inferential statistics is concerned with grouping variables, LCA groups people, and thus helps us to understand more about how different empirically defined subgroups of people within our dataset are responding in different ways, and how those groups help to predict outcomes and possible interventions.

Readings:

Lanza, S. T., & Rhoades, B. L. (2013). Latent Class Analysis: An Alternative Perspective on Subgroup Analysis in Prevention and Treatment. *Prevention Science*, 14(2), 157-168. http://doi.org/10.1007/s11121-011-0201-1

Vaval, L., Bowers, A.J., Snodgrass Rangel, V. (2019) Identifying a Typology of High Schools Based on Their Orientation Toward STEM: A Latent Class Analysis of HSLS:09. *Science Education*, 103(5) p. 1151-1175. http://doi.org/10.1002/sce.21534

Graves, K.E., Bowers, A.J. (2018) Toward a Typology of Technology-Using Teachers in the "New Digital Divide": A Latent Class Analysis (LCA) of the NCES Teachers' Use of Educational Technology in U.S. Public Schools, 2009 (FRSS 95). *Teachers College Record*, 120(8). http://www.tcrecord.org/library/abstract.asp?contentid=22277 (Preprint available)

Optional:

Boyce, J., & Bowers, A. J. (2016). Principal Turnover: Are there Different Types of Principals Who Move From or Leave Their Schools? A Latent Class Analysis of the 2007-08 Schools and Staffing Survey and the 2008-09 Principal Follow-up Survey. *Leadership & Policy in Schools*, 15(3), 237-272. http://dx.doi.org/10.1080/15700763.2015.1047033 Preprint: http://dx.doi.org/10.7916/D8F76CQQ (Mplus code is in the appendix in the pre-print)

Bowers, A. J., & Sprott, R. (2012). Why tenth graders fail to finish high school: A dropout typology latent class analysis. *Journal of Education for Students Placed at Risk*, 17(3), 129-148. doi: 10.1080/10824669.2012.692071. Pre-print: https://doi.org/10.7916/D8BG3003

DUE: Exercise 4

Week 12 **Continuing Discussion of Typology Subgroup Analysis**

This week we continue our discussion of research designs around issues of estimating the extent that there are statistically different subgroups in your data, focusing on the methodological considerations, assumptions, and modeling fitting procedures.

Reading:

Nylund-Gibson, K., & Choi, A. Y. (2018). Ten frequently asked questions about latent class analysis. *Translational Issues in Psychological Science*, 4(4), 440-461. http://doi.org/10.1037/tps0000176

Optional:
Collins, L. M., & Lanza, S. T. (2010). *Latent Class and Latent Transition Analysis: With Applications in the Social, Behavioral, and Health Sciences*. Hoboken, NJ: Wiley. Chapters 1-4 (pages 1-112).

Week 13 **The Visual Display and Presentation of Quantitative Data**

Presenting your research in an honest, understandable and concise way is hard work. This is especially hard work given the prevalence of highly problematic graphic design and "data vis" found across modern media outlets and slideware programs such as PowerPoint. This week we explore the arguments made by Edward Tufte that the study of how to visually display quantitative information is just as important as generating that information, since if people can't understand your point, why make it? However, as Tufte so well points out, modern slideware programs serve to obfuscate, confuse and bore, more than they do to help convey meaning and aid in decision making. While Tufte is by no means the arbiter of what "good" data presentations should look like, he makes some very salient points, and provides many interesting and useful examples that help us think more deeply about exactly how to visually display our results so that they are honest and accurate yet visually appealing, helpful and ultimately instructive as we work to teach our audience why they should spend their limited time attempting to not only understand our results, but make decisions based on them.

Reading:

Tufte, Edward R. (2006) *The Cognitive Style of PowerPoint: Pitching Out Corrupts Within*, **2nd Edition.** Graphics Press, Cheshire, CT.

Tufte, Edward R. (2001) *The Visual Display of Quantitative Information*, **2nd Edition**. Graphics Press, Cheshire, CT.

DUE: Exercise 5

Week 14 **Final Student Presentations**

Student final research presentations

Week 15 **Final Student Presentations Continued**

Student final research presentations continued

DUE: Final paper due