**Structural Equation Modeling and Meta-Analysis**

PSYC 892-005

Spring 2020

Tuesdays and Thursdays, 1:30-2:45

Krug Hall, Rm 253



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Office Hours: Tuesdays, 11:15-1:15 or by appt.



**COURSE OVERVIEW AND COURSE OBJECTIVES**

This class covers two different methodological/statistical topics - meta-analysis and structural equation modeling (SEM). We will spend the first part of the semester going over meta-analysis and then will cover SEM.

Over about the past 30 years, both of these “methodologies” have become increasingly common and important in psychological research (as in many other areas in the social sciences and beyond). Gaining a thorough understanding of these topics will benefit you as a researcher and a consumer of research.

This class is meant to provide you with practical knowledge with regard to conducting, interpreting, and applying (findings) for these methodologies. As such, we will focus mostly on the “how to” instead of concentrating on the underlying mathematics. That said, having some understanding of the conceptual and mathematical underpinnings of the methodologies also is essential in conducting and interpreting (results from) them appropriately. Thus, we also will cover some of this more conceptual material.



**COURSE FORMAT AND PHILOSOPHY**

The class meets twice a week. For the most part, the meetings will consist of a mix of lecturing, discussion, and hands-on activities/exercises. The specific format of each meeting will vary, depending on the topic we are covering. My expectation is that students will attend every class meeting and will be actively engaged during class sessions (e.g., not texting, on Facebook, etc.) Also, please read the corresponding material before it is discussed in class as such will maximize learning.



**PROJECTS AND COURSE EVALUATION**

Over the course of the semester, you will be required to complete several projects. The largest project will be a comprehensive meta-analysis in an area of your choosing. It will be due on the date of the final exam (May 12th) and will be worth 40% of your course grade. This project may be done alone or with one classmate, although I would strongly recommend pairing up with someone in order to share the workload.

The remainder of your grade will be based on smaller projects, each worth 10% of your grade. Five of these six projects are SEM-related; one is meta-analysis related. Thus, as a set, these projects will constitute 60% of your class grade. You are free to work with one other classmate on each of these as well.

I will determine final course grades using the scale below

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| --- | --- | --- | --- |
| A+ 98-100 | A 93-97 | A- 90-92 | B+ 87-89 |
| B 83-86 | B- 80-82 | C+ 77-79 | C 73-76 |
| C- 70-72 | D+ 67-69 | D 63-66 | D- 60-62 |



**ADMINISTRATIVE STUFF**

**Texts:**

Borenstein, M. Hedges, L.V., Higgins, J.P.T., & Rothstein, H.R. (2009).

*Introduction to meta-analysis*. Chichester, England: Wiley.

Kline, R.B. (2016). *Principles and practice of structural equation modeling*,

4th ed. New York: The Guilford Press.

Companion website: https://www.guilford.com/companion-site/Principles-and-Practice-of- Structural-Equation-Modeling-Fourth-Edition/9781462523344

Byrne, B.M. (2012). *Structural equation modeling with Mplus: Basic concepts,*

*applications, and programming*. New York: Routledge.

Datasets: http://www.routledge.com/books/details/9781848728394/

**Software:**

I will be showing you a few programs for meta-analysis. We primarily will be using Mplus for SEM. Please download the demo version: <http://www.statmodel.com/demo.shtml>. I also will show you other programs for SEM. You are free to use the program with which you are most comfortable. We will discuss the details in class.

**Attendance and Participation**: My expectation is that students will attend every class meeting and will be actively engaged during class sessions. *You will need to complete an additional assignment for each class you miss beyond a first missed class (e.g., if you miss three classes, you would have to complete two additional assignments). All make-up assignments are due on May 12th. Failure to adequately complete make-up assignments will result in failing the course.*

**Honor Code Statement:** All aspects of this course are bound by the George Mason University Honor Code which states that, “Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.” Any student who engages in scholastic dishonesty, inadvertently or not, will be reported directly to the Honor Committee.

**Students with Disabilities:** If you are student with disability and you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 703-993-2474. All academic accommodations must be arranged through that office.

**Official Communications via GMU Email:** Mason uses electronic mail to provide official information to students. Examples include communications from course instructors, notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their mason email account, and are required to activate that account and check it regularly.

**Class Cancellation Policy:** If a class needs to be cancelled, you will receive notification from the University (and/or I will e-mail to inform you). If no makeup class is scheduled (in the case that the University cancels the class), I will make a video lecture covering the missed material.

**Changes to Syllabus:** The instructor reserves the right to make necessary changes to the syllabus with reasonable advance notice.

**Important Dates:** Last day to add the course is Tuesday, January 28th. Last day to drop the course is Monday, February 24th.



COURSE SCHEDULE

I will try to adhere to this schedule. But, please recognize that we may need to deviate from it to some degree. If I need to make changes, I will do so on an electronic version of this syllabus here:

https://docs.google.com/document/d/1P7QL9eJMBigmd78yqzKQtoH4SALjy5jr6KGHws1cpJA/edit?usp=sharing

I obviously will let you know of any changes I need to make in class as well.

|  |  |
| --- | --- |
| **DATE** | **Topic/Event/Assignment/Readings** |
| 1/21 | **Overview of Class and Introduction to/ Overview of Meta-Analysis** |
|  | **Before next class, read Preface and Chapters 1 and 2 in Borenstein et al**  *\*\*Additional Readings on Meta-Analysis (Overviews, Future Direction)\*\**  Grant, M. J., & Booth, A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies: A typology of reviews, *Maria J. Grant & Andrew Booth*. *Health Information & Libraries Journal*, *26*(2), 91–108. https://doi.org/10.1111/j.1471-1842.2009.00848.x  Ioannidis, J. (2017). Next-generation systematic reviews: Prospective meta-analysis, individual-level data, networks and umbrella reviews. *British Journal of Sports Medicine*, *51*(20), 1456–1458. https://doi.org/10.1136/bjsports-2017-097621  Upreti, B. R., Asatiani, A., & Malo, P. (2016). To Reach the Clouds: Application of Topic Models to the Meta-Review on Cloud Computing Literature. *2016 49th Hawaii International Conference on System Sciences (HICSS)*, 3979–3988. https://doi.org/10.1109/HICSS.2016.493 |
| 1/23 | **Overview of Meta-Analysis (cont)/ Finding and Coding Articles** |
| By 1/27 @ 9 pm | **Complete Meta-Analysis Assignment 1** |
| 1/28 | **Finding and Coding Articles** |
|  | *\*\*Additional Readings on the Logistics of Conducting Meta-Analyses\*\**  Aguinis, H., Dalton, D. R., Bosco, F. A., Pierce, C. A., & Dalton, C. M.  (2011). Meta-Analytic choices and judgment calls: Implications for theory  building and testing, obtained effect Sizes, and scholarly Impact. *Journal*  *of Management*, *37*(1), 5–38.<https://doi.org/10.1177/0149206310377113>  Aytug, Z. G., Rothstein, H. R., Zhou, W., & Kern, M. C. (2012). Revealed or concealed? Transparency of procedures, decisions, and judgment calls in meta-analyses. *Organizational Research Methods*, *15*(1), 103–133. <https://doi.org/10.1177/1094428111403495>  \*Bosco, F. A., Uggerslev, K. L., & Steel, P. (2017). metaBUS as a vehicle for facilitating meta-analysis. Human Resource Management Review, 27, 237-254.  Levac, D., Colquhoun, H., & O’Brien, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*, *5*(1), 69. <https://doi.org/10.1186/1748-5908-5-69>  Marshall, I. J., Noel‐Storr, A., Kuiper, J., Thomas, J., & Wallace, B. C. (2018). Machine learning for identifying Randomized Controlled Trials: An evaluation and practitioner’s guide. *Research Synthesis Methods*, *9*(4), 602–614. <https://doi.org/10.1002/jrsm.1287>  Ones, D., Viswesvaran, C., & Schmidt, F. L. (2017). Realizing the full potential of psychometric meta-analysis for a cumulative science and practice of human resource management. *Human Resource Management Review*.  Page, M. J., & Moher, D. (2017). Evaluations of the uptake and impact of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Statement and extensions: A scoping review. *Systematic Reviews*, *6*(1), 263. https://doi.org/10.1186/s13643-017-0663-8  http://www.prisma-statement.org/  Quintana, S. M., & Minami, T. (2006). Guidelines for meta-analyses of counseling psychology research. *The Counseling Psychologist*, *34*(6), 839–877. <https://doi.org/10.1177/0011000006286991>  Silberzahn, R., Uhlmann, E. L., Martin, D. P., Anselmi, P., Aust, F., Awtrey, E., Bahník, Š., Bai, F., Bannard, C., Bonnier, E., Carlsson, R., Cheung, F., Christensen, G., Clay, R., Craig, M. A., Dalla Rosa, A., Dam, L., Evans, M. H., Flores Cervantes, I., … Nosek, B. A. (2018). Many Analysts, One Data Set: Making Transparent How Variations in Analytic Choices Affect Results. *Advances in Methods and Practices in Psychological Science*, *1*(3), 337–356. <https://doi.org/10.1177/2515245917747646>  Wanous, J.P., Sullivan, S.E., & Malinak, J. (1989). The role of judgment calls in meta-analysis. *Journal of Applied Psychology, 74,* 259-264. |
|  | **Before next class, read Chapters 3-8 in Borenstein et al.** There is a lot of information here. You do not need to know all the formulae. Focus on the different types of effect sizes and converting among them. Please also read  Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense*. Advances in Methods and Practices in Psychological Science, 2,* 156-168. https://doi.org/10.1177/2515245919847202\  *\*\*Additional Readings on Effect Sizes and Computations\*\**  <https://www.campbellcollaboration.org/research-resources/effect-size-calculator.html>  https://bookdown.org/MathiasHarrer/Doing\_Meta\_Analysis\_in\_R/  https://mason.gmu.edu/~dwilsonb/ma.html  Carter, E. C., & McCullough, M. E. (2018). A simple, principled approach to combining evidence from meta-analysis and high-quality peplications. *Advances in Methods and Practices in Psychological Science*, *1*(2), 174–185. https://doi.org/10.1177/2515245918756858  Dahlke, J. A., & Wiernik, B. M. (2018). psychmeta: An R Package for psychometric meta-analysis. *Applied Psychological Measurement*, 0146621618795933. https://doi.org/10.1177/0146621618795933  Henson, R. K. (2006). Effect-Size Measures and Meta-Analytic Thinking in Counseling Psychology Research. *The Counseling Psychologist*, *34*(5), 601–629. <https://doi.org/10.1177/0011000005283558>  Morris, S.B., & DeShon, R.P. (2002). Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychological Methods, 7,* 105-125.  Viechtbauer , W. (2010). Conducting Meta-Analyses in R with the metafor Package. *Journal of Statistical Software, 36(3), 1-48* |
| 1/30 | **Computing Effect Sizes** |
| 2/4 | **Computing Effect Sizes** |
|  | **Before we begin talking about heterogeneity, read Chapters 10-17 in Borenstein et al.**  **Before we begin talking about study artifacts, please read the following (I will let you know when that is before we get to the topic in class)**  Chapter 38 inBorenstein et al.  Schmidt, F.L. & Hunter, J.E. (1977). Development of a general solution to  the problem of validity generalization*. Journal of Applied Psychology, 62,* 529-540.  Stanley, T. D., Carter, E. C., & Doucouliagos, H. (2018). What meta-analyses reveal about the replicability of psychological research. *Psychological Bulletin*, *144*(12), 1325–1346. https://doi.org/10.1037/bul0000169  *\*\*Additional Readings on Heterogeneity of Effect Sizes and Study Artifacts\*\**  Glance at Chapters 3 and 4 in Hunter and Schmidt (2015)  Erp, S. van, Verhagen, J., Grasman, R. P. P. P., & Wagenmakers, E.-J. (2017). Estimates of between-study heterogeneity for 705 meta-analyses reported in *Psychological Bulletin* From 1990–2013. *Journal of Open Psychology Data*, *5*(1), 4. <https://doi.org/10.5334/jopd.33>  Kenny, D. A., & Judd, C. M. (2019). The unappreciated heterogeneity of effect sizes: Implications for power, precision, planning of research, and replication. *Psychological Methods*, *24*(5), 578–589. <https://doi.org/10.1037/met0000209>  Klein, R. A., Vianello, M., Hasselman, F., Adams, B. G., Reginald B. Adams, J., Alper, S., Aveyard, M., Axt, J. R., Babalola, M. T., Bahník, Š., Batra, R., Berkics, M., Bernstein, M. J., Berry, D. R., Bialobrzeska, O., Binan, E. D., Bocian, K., Brandt, M. J., Busching, R., … Nosek, B. A. (2018). Many Labs 2: Investigating Variation in Replicability Across Samples and Settings: *Advances in Methods and Practices in Psychological Science*. <https://doi.org/10.1177/2515245918810225>  Paterson, T. A., Harms, P., Steel, P., & Credé, M. (2016). An assessment of the magnitude of effect sizes evidence from 30 years of meta-analysis in management. *Journal of Leadership & Organizational Studies, 23,* 66-81. |
| 2/6 | **Heterogeneity and Study Artifacts (and Psychometric Meta-Analysis)** |
| 2/11 | **Heterogeneity and Study Artifacts (and Psychometric Meta-Analysis)** |
| 2/13 | **Heterogeneity and Study Artifacts (and Psychometric Meta-Analysis)** |
|  | **Before we begin talking about moderators, read Chapters 19-21 in Borenstein et al.**  *\*\*Additional Readings on Meta-Analytic Moderators\*\**  Aguinis, H., Gottfredson, R.K., & Wright, T.A. (2011). Best-practice recommendations for estimating inter-action effects using meta-analysis. *Journal of Organizational Behavior, 32,* 1033–1043.  Aguinis, H., Sturman, M.C., & Pierce, C.A. (2008). Comparison of three meta-analytic procedures for estimating moderating effects of categorical variables. *Organizational Research Methods, 11,* 9-34.  Cortina, J.M. (2003). Apples and oranges (and pears, Oh My!): The search for moderators in meta-analysis. *Organizational Research Methods, 6,* 415-439. |
| 2/18 | **Meta-Analytic Moderators** |
|  | **Before we begin talking about “Other Issues”, read Chapter 30 in Borenstein et al. and**  Aguinis, H., Pierce, C. A., Bosco, F. A, Dalton, D. R., & Dalton, C. M. (2011). Debunking myths and urban legends about meta-analysis. *Organizational Research Methods, 14*, 306-331.  \*\*Additional Readings on Other Issues\*\*  Cheung, M. W.-L., & Chan, W. (2005). Meta-analytic structural equation modeling: A two-stage approach. *Psychological Methods*, *10*(1), 40–64. <https://doi.org/10.1037/1082-989X.10.1.40>  Duyx, B., Urlings, M. J. E., Swaen, G. M. H., Bouter, L. M., & Zeegers, M. P. (2017). Scientific citations favor positive results: A systematic review and meta-analysis. *Journal of Clinical Epidemiology*, *88*, 92–101. https://doi.org/10.1016/j.jclinepi.2017.06.002  Kepes, S., & McDaniel, M. A. (2014). *Publication bias: Causes, detection, and remediation*. <https://doi.org/10.13140/2.1.3617.4727>  Landis, R. S. (2013). Successfully combining meta-analysis and structural equation modeling: Recommendations and strategies. *Journal of Business and Psychology*, *28*(3), 251–261. https://doi.org/10.1007/s10869-013-9285-x  Sheng, Z., Kong, W., Cortina, J. M., & Hou, S. (2016). Analyzing matrices of meta-analytic correlations: Current practices and recommendations. *Research Synthesis Methods*, *7*(2), 187–208. https://doi.org/10.1002/jrsm.1206  Cheung M. W. (2015). metaSEM: an R package for meta-analysis using structural equation modeling. *Frontiers in Psychology, 5,* 1521. doi:10.3389/fpsyg.2014.01521  Viswesvaran C., Ones D. S. (1995). Theory testing: combining psychometric meta-analysis and structural equations modeling. Pers. Psychol. 48, 865–885 10.1111/j.1744-6570.1995.tb01784.x  Viechtbauer, W., & Cheung, M.W.-L. (2010). Outlier and influence diagnostics for meta-analysis. *Research Synthesis Methods,1,* 112-125. |
| 2/20 | **Meta-Analytic Moderators and Other Issues in Meta-Analysis (e.g., Publication Bias, Outliers, Multiple Effects from the same study, Meta-SEM)** |
| 2/25 | **Other Issues in Meta-Analysis (cont.)** |
|  | **Before next class, read Kline (2016), Chapters 1-4 (much of this material is review), and Chapter 6** |
| 2/27 | **Introduction to/Overview of SEM** |
|  | **Before next class, read Kline (2016), Chapter 7 and Chapter 11** |
| 3/3 | **Introduction to/Overview of SEM (cont)/ Initial Considerations in SEM** |
| 3/5 | **Initial Considerations in SEM (cont)** |
| 3/10 & 3/12 | **Spring Recess – No Class** |
|  | **Before next class, read**  Kline (2016), Chapter 9 and Chapter 13  Byrne (2012), Chapter 3,4, & 5 (you can just skim the parts describing the examples)  Credé, M., & Harms, P. D. (2015). 25 Years of higher-order confirmatory factor analysis in the organizational sciences: A critical review and development of reporting recommendations. *Journal of Organizational Behavior, 36,* 845–872. |
| 3/17 | **CFA/Measurement Models** |
| 3/24 | **SEM Assignment 1 Due** |
| 3/24 | **CFA/Measurement Models (cont)** |
|  | **Before the next class, read**  Kline (2016), Chapter 10 and Chapter 14  Byrne (2012), Chapter 6 (you can just skim the parts describing the example) |
| 3/26 | **Full SEM Models** |
| 4/2 | **SEM Assignment 2 Due** |
| 4/2 | **Full SEM Models** **(cont)** |
|  | **Before the next class, read**  Kline (2016), Chapter 16  Byrne (2012), Chapter 7 (you can just skim the parts describing the example) |
| 4/7 | **Multiple-group SEM/Invariance Testing** |
| 4/9 | **SEM Assignment 3 Due** |
| 4/9 | **Multiple-group SEM/Invariance Testing (cont)** |
|  | **Before the next class, read**  Kline (2016), Chapter 15 and Chapter 17  Byrne (2012), Chapter 11 (you can just skim the parts describing the example) |
| 4/14 | **Advanced Topics in SEM** |
| 4/16 | **SEM Assignment 4 Due** |
| 4/16 | **Advanced Topics in SEM (cont)** |
| 4/21 | **Advanced Topics in SEM (cont) or Catch-up Day** |
| 4/23 | **No Class – Many of us will be away at a conference** |
| 4/28 | **Meta-Analysis Presentations** |
| 4/30 | **Meta-Analysis Presentations** |
| 4/30 | **SEM Assignment 5 Due** |
| 5/12 | **Meta-Analysis Project Due by 1:30** |