CPSE 790 and IP&T 789 Advanced Seminar: Meta-analysis
Brigham Young University – Spring, 2020

Tim Smith, PhD

Office: 237-C MCKB   Class Time: 1:00 - 3:30PM, Monday & Wednesday

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Course Description

Systematic reviews and meta-analyses provide an essential foundation for evidence-based practice and policy. This advanced doctoral seminar provides information and skills necessary to evaluate and conduct systematic reviews of research and meta-analyses. Students will learn meta-analytic methods and statistics. They will apply their learning by executing components of their own meta-analysis (or a related project) and by analyzing the quality of existing meta-analyses.

Prerequisites

Students should already be familiar with basic statistics and statistical concepts including measures of central tendency, characterizations of data distributions, correlation coefficients, analysis of variance, regression, confidence intervals, p-values, and power. Optimally, students will be able to conduct analyses using statistical software (SPSS or STATA).

Textbook   Card, N. A. (2012). *Applied meta-analysis for social science research.*
New York: Guilford   *Available for free at* lib.byu.edu
https://ebookcentral.proquest.com/lib/byu/detail.action?docID=759913

Learning Objectives

Upon completion of this course students should be able to:
- Convey the assumptions, limitations, benefits, and procedures of systematic reviews and meta-analyses;
- Conduct an exhaustive literature search using multiple methods to retrieve studies that meet pre-defined criteria;
- Convert information from research studies to data by using appropriate coding strategies;
- Define, calculate, and, where appropriate, adjust/aggregate the following statistics: Cohen's d, Hedges g, risk ratio, odds ratio, hazard ratio, correlation coefficient, Fisher's z, Q, I-squared, forest plot, funnel plot, and fail-safe N;
- Assess heterogeneity across studies and evaluate systematic sources of that heterogeneity by using such methods as meta-regression;
- Assess risk of bias and possible publication bias and, if necessary, correct for bias(es); and
- Evaluate existing meta-analyses using professional guidelines and publication standards.

Indicators of Student Learning

Class Preparation & Participation (35%)

Students should come to class on time having studied the assigned readings – and bring at least two questions to ask during class. Students should actively participate in class discussions and contribute to in-class simulations/exercises.

Students should bring a computer to class to conduct literature searches, to compute effect sizes, etc., and they should use the internet only for course purposes.

- Completing readings before class and bringing $\geq$ 2 question(s) to class = 15% of course grade
- Active class participation, without distraction = 20% of course grade

Five Small Applied Learning Projects (28%; three projects, 4% each; two projects, 8% each)

Students will apply concepts learned in class through completing five small projects:

#1 Identify/share a research study or meta-analysis that demonstrates a point made in the readings (4%)

It is useful to see how concepts in the readings relate to actual research in the field. Students will identify a concept from the readings and find an example of that concept in a specific research article, and then they will share that concept and corresponding example article with the class. For instance, a student reading about publication bias could share a manuscript that had very few participants, questionable methodology, and a large effect size (such that the article was likely published because of the "strong" finding despite its poor quality). Or a student reading about effect size heterogeneity could bring in a systematic review that used multiple methods appropriately to ascertain sources of that variability -- or one that completely ignored heterogeneity and interpreted only the averages. The instructor will distribute a sign-up sheet so that at least one student has the opportunity to share an example each class session.

#2 Develop a comprehensive search string (4%)

Students will select a specific research topic (optimally relevant to their final project) and will develop a comprehensive collection of search terms and synonyms. They will combine those words/phrases using Boolean terms to generate a viable search string to locate relevant literature. (This project can be completed as a small group).

#3 Compute effect sizes, variances, standard errors, and confidence intervals from studies (4%)

Students will compute effect sizes (r and d) using data provided by the instructor. This project will be conducted individually, and student responses will be compared to known values.

#4 Quantifying omnibus meta-analytic data, including heterogeneity and data plots (8%)

Students will be provided with a dataset, and they will calculate (a) the omnibus effect size using appropriate weighting methods, (b) estimates of heterogeneity, and (c) a graphical representation, such as a forest plot. Student responses will be compared to known values. Students may work independently or as small groups (and the entire group will receive the same score).
To complete this assignment, students will use SPSS, STATA, or a downloaded trial version of Comprehensive Meta-Analysis software.

#5 Evaluate three meta-analyses based on published standards (8%)

Students will receive a coding sheet regarding descriptive information and aspects of PRISMA standards, and they will use that coding sheet to evaluate three meta-analyses. Students may select their own meta-analyses for evaluation - or the instructor will provide students with them). Students work individually, and the instructor will evaluate the ratings.

Course Research Project (37%)

Over several weeks, students will apply their learning by conducting a research project that has the potential for submission for publication in a professional journal or newsletter. Students will design and carry out this project as small groups. Students may select among these options:

> *Option 1: Replicate a meta-analysis.* Students will identify a published meta-analysis and, following instructor approval, replicate aspects of the meta-analysis. Students will (a) collect the studies used in the meta-analysis, (b) create an effect size dataset by extracting all relevant information and calculating the effect sizes, (c) conduct the meta-analysis and include heterogeneity statistics and forest plot, (d) assess publication bias, including a funnel plot, and (e) provide a write up of the methods and results.

> *Option 2: Conduct a meta-analysis (or reliability generalization analysis).* Students will complete a meta-analysis of at least 10 studies that meet inclusion criteria (after obtaining instructor approval for the topic, criteria, and coding sheet). Students are required to (a) create an effect size dataset by extracting all relevant information and calculating the effect sizes, (b) conduct the meta-analysis and include heterogeneity statistics and forest plot, (c) assess publication bias, including a funnel plot, and (d) provide a write up of the methods and results. Students opting to conduct a reliability generalization analysis will follow the same procedures but use reliability coefficients obtained from studies using a previously published measure.

> *Option 3: Conduct a review of meta-analytic reviews.* Students will conduct a review of meta-analytic reviews after obtaining instructor approval for the topic and methods of the review. Students are required to (a) identify at least 10 meta-analyses of the same topic, (b) create a database by extracting all relevant information and effect sizes, (c)

evaluate meta-analyses based on published standards, and (d) provide a write up of the methods and results, including a table listing the characteristics of all meta-analyses.

Option 4 (only for students already familiar with survey methods): Conduct a survey of a targeted population regarding a topic pertinent to meta-analysis. Students will select a target sample and obtain survey data from at least 100 individuals (optimally randomly selected). Example survey topics could include: (1) Awareness of the findings of influential meta-analyses in teacher education among teacher educators, (2) Understanding of effect size metrics and their (accurate) interpretation among scholars publishing outcome research, etc. Students are required to select an appropriate sample, follow best practices for survey design and administration, analyze data, and provide a write up of the methods and results.

Option 5 (only for students already familiar with social network analysis): Conduct a social network analysis among authors/co-authors in a published meta-analysis. Students will select a highly influential meta-analysis in a particular sub-discipline, and after instructor approval, they will (a) create a database of mutual citations over time using a coding system that includes attributes such as publication year, (b) generate statistics of centrality, betweenness, etc. using social network analysis software and run analyses of those variables with study attributes (effect size, year of publication, etc.), (c) present a graphical representation of the network changing over time, and (d) provide a write up of the methods and results.

Each group will give a 20-minute presentation in class that describes key principles they learned, recommendations, and findings.

Course Grades

Final course grades will be accounted for as follows:

Learning Component	
5 Learning Projects 3 at 4% each and 2 at 8% each	28%
Course Research Project and Presentation	37%
Class Preparation	15%
Class Participation	20%

Class Schedule

Wednesday, Apr 29
1. An Introduction to Meta-Analysis
    The Need for Research Synthesis in the Social Sciences
    Basic Terminology
    A Brief History of Meta-Analysis
    The Scientific Process of Research Synthesis
    Some Highly Influential Meta-analyses
    Some Good Examples (Psychological Bulletin) and some bad examples

Monday, May 4
2. Answering Questions through Meta-Analysis
    Identifying Goals and Research Questions for Meta-Analysis
    The Limits of Primary Research and the Limits of Meta-Analytic Synthesis
    Critiques of Meta-Analysis: When Are They Valid and When Are They Not?
    Planning and Conducting a Meta-Analysis

Wednesday, May 6
3. Searching the Literature
    Developing and Articulating a Sampling Frame
    Inclusion and Exclusion Criteria
    Finding Relevant Literature, Boolean terms, filters
    Meta-Analytic Databases
    Flow Diagrams
    Fugitive Literature and Contacting Scholars
    Literature Databases and Reference Management (Covidence, Rayyan, etc.)

Monday, May 11   **Project #2 due**
4. Coding Study Characteristics
    Identifying Interesting Moderators
    Coding Study "Quality" and Risk of Bias
    Evaluating Coding Decisions
    Creating an Organized Protocol for Coding

Wednesday, May 13
5. Basic of Effect Size Computation
    The Common Metrics: Correlation, Standardized Mean Difference, and Odds Ratio
    Using Effect Size Calculators and Meta-Analysis Programs

Monday, May 18   **Project #3 due**
6. Corrections to Effect Sizes
    Controversy of Corrections
    Artifact Corrections to Consider
    Conceptual, Methodological, and Disciplinary Considerations

Wednesday, May 20
8. Computing Mean Effect Size and Heterogeneity around the Mean
      The Logic of Weighting
      Measures of Central Tendency in Effect Sizes
      Inferential Testing and Confidence Intervals of Average Effect Sizes
      Evaluating Heterogeneity among Effect Sizes
      Nonindependence among Effect Sizes

Wednesday, May 27
9. Explaining Heterogeneity among Effect Sizes: Moderator Analyses
      Categorical Moderators
      Continuous Moderators
      A General Multiple Regression Framework for Moderation

Monday, June 1   **Project #4 due**
10. Fixed-, Random-, and Mixed-Effects Models
      Differences among Models
      Analyses of Random-Effects Models
      Mixed-Effects Models
      Presenting Meta-analytic Data (Forest Plots, Summary Tables)

Wednesday, June 3
11. Publication Bias
      The Problem of Publication Bias
      Managing Publication Bias (Funnel Graphs, Trim & Fill, etc.)
      What Impact Do Sampling Biases Have on Meta-Analytic Conclusions?
      Putting all of the pieces together: Evaluating Meta-Analyses Using PRISMA,
      MOOSE, AMSTAR checklists and similar professional standards

Monday, June 8
13. Writing Meta-Analytic Results   **Project #5 due**
      Dimensions of Literature Reviews, Revisited
      What to Report and Where to Report It
      Using Figures and Tables in Reporting Meta-Analyses
      Avoiding Common Problems in Reporting Results of Meta-Analyses

Wednesday, June 10   Research Project Presentations

Saturday, June 20   Research Projects due by 10PM, submitted via email

Supplemental Resources and Readings

Hanbook of Research Synthesis and Meta-analysis 3rd Ed.
https://ebooksold.com/product/the-handbook-of-research-synthesis-and-meta-analysis-3rd-edition-ebook-pdf

Cochrane library https://www.cochranelibrary.com/

UK NICE (National Institute for Health and Clinical Excellence) http://www.nice.org.uk/

PRISMA statement http://www.prisma-statement.org/

MOOSE guidelines: Stroup DF, et al, Meta-analysis of observational studies in epidemiology (MOOSE) consensus statement, *JAMA* 2000, 283:2008-2012.

http://supp.apa.org/psycarticles/supplemental/bul0000053/Document_1.pdf

https://osf.io/gxsbj/download

AMSTAR 2 Tool   https://www.nccmt.ca/knowledge-repositories/search/307

List of resources:

http://utas.libguides.com/SystematicReviews/Resources

https://guides.lib.unc.edu/systematic-reviews/tools-resources

https://libguides.cmich.edu/cmed/ebm/systemicreviewsresources

Schwandt, T. A. (2000). Meta-analysis and everyday life: The good, the bad, and the ugly. American Journal of Evaluation, 21(2), 213---219.

University Policies

Respect for Others and for the University Honor Code
All BYU students are expected to treat their peers, professors, personnel, clients, etc. with respect, especially when opinions by differ. Class discussions should demonstrate respect for all individuals involved. Respect and other principles for maintaining a healthy campus environment are found in BYU's Honor Code, https://policy.byu.edu/view/index.php?p=26

Responding to and Reporting Sexual Harassment and Related Misconduct:
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, you have several options of how to report or voice your concerns. You could talk with your professor; contact BYU's Equal Opportunity Manager at 801-422-5895 or email sue_demartini@byu.edu. Refer to this website for additional information about sexual misconduct: https://policy.byu.edu/view/index.php?p=155 Other options include calling or visiting with Tiffany Turley, who serves as the university's Title IX coordinator. Office 1085 WSC; 801-422-7256; tiffany_turley@byu.edu You may also call or visit with Lisa Leavitt, BYU's full-time advocate for survivors of sexual assault. If you wish to speak with someone confidentially about an incident of sexual assault or abuse, contact Lisa Leavitt: lisa_leavitt@byu.edu; advocate@byu.edu; or call 801-422-9071. Lisa's office is located in 1500 WSC on the BYU campus.

Understanding Services for Students with Disabilities:
Brigham Young University and I are committed to providing a working/ 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 me at the beginning of the semester, as early as possible, to ensure adequate prevention and intervention efforts to provide a positive learning experience. You may also contact the University Accessibility Center (UAC; 801-422-2767). See their Internet site [https://uac.byu.edu/]. Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. Services are coordinated with the student and instructor by the UAC 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. You may contact the Equal Employment Office in the ASB. They can be reached by phone at 801-422-6878 or 801-422-5895.

Laptop Computer/Electronics Use
Electronics and internet access can enhance student learning if they are used for that purpose. Full and effective participation in discussions and experiential activities is essential for learning and success. Students are expected to use phones, computers, and all other electronic devices to enhance learning and to refrain from distracting themselves or others during class.