Meta-Analysis:

Know-How and Beyond

Any general questions for the Winter School support team? Contact graduatewinterschool@vu.nl

Course Details

Title	Meta-Analysis: Know-How and Beyond
Coordinator(s)	Dr. Jacek Buczny
Study credits	3 ECTS
Form(s) of tuition	Interactive online seminar (using Zoom), individual assignments
Approximate contact hours	30
Approximate self-study hours	40

Teaching Staff

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Course Description

"Systematic reviews and meta-analyses are essential tools for summarizing evidence accurately and reliably (...)" (Liberati et al., 2009, p. 1). Currently, meta-analysis is a widely applied technique for a multitude of reasons. For instance, to test and advance theories. It is also applicable to many of today's issues, tackling extensive scientific research, for example, to test the robustness of the relationship between variables across cultures. It can be used not only to conclude general effect size related to the studied relationships, but it is also essential for finding and estimating publication bias. Moreover, it can be applied in an a priori power analysis for the purpose of designing a sample size.

Within this course, students will learn how to formulate a problem and analyze it by conducting a meta-analysis in JASP/R, a valuable **open-science** software. Also, students will have the opportunity to practice wide-and-far literature searches and will learn how to report their findings following the PRISMA standards with professional assistance. Students will learn the basics on how to prepare and describe a meta-analytical study in a separate article as well. Moreover, students will be able to apply this technique to summarize studies described in a manuscript in order to improve argumentation and "publishability", furthering academic and professional careers while building a solid skill set and portfolio.

The course is organized as an interactive seminar where students will perform four individual assignments, one at the end of each unit. After submitting each assignment, professional feedback will be provided.

The following major topics will be discussed:

- Two types of systematic reviews
- Pros and cons of meta-analysis
- Publication bias and quality of publications
- Effect size and how to calculate it
- Literature search, exclusion, inclusion, and coding
- Available software, including JASP/RStudio
- Fixed- and random-effects model
- Heterogeneity and its consequences
- Estimating overall effect size
- Analysis of moderators
- Estimating publication bias (trim and fill, p-uniform*, PET-PEESE)
- Gentle introduction to R, meta-analysis in R (briefly)
- Additional topics: meta-analysis of indirect effects, meta-CART, meta-plot, and Bayesian meta-analysis
- Additionally, students will be familiarized with examples of published research to better understand the standard expectations and means of professionalism

Learning Objectives

At the end of this course, the students will be able to:

- Formulate a research question to conduct a meta-analysis
- Carry out an expansive literature search
- Systematically review relevant literature
- Code studies fitting inclusion criteria
- Meta-analyze the coded effects using JASP software
- Interpret and report the meta-analytic results
- Apply PRISMA standards into a report

Software

Each participant must install the following software: JASP (https://jasp-stats.org/download/), jamovi (https://www.jamovi.org/download.html), R (https://cran.r-project.org), and RStudio (https://posit.co/download/rstudio-desktop/#download). After installation, check if the software runs on your computer without problems. If possible, seek

tutorials to learn how to use each piece of software. In this course, some basic analyses will be performed in RStudio.

Recommended Readings

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. New York: Wiley. LINK (the link will open an e-book, available if you have access to the VU Amsterdam Library)

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, *372*. http://doi.org/10.1136/bmj.n71

Moreau, D., & Gamble, B. (2022). Conducting a meta-analysis in the age of open science: Tools, tips, and practical recommendations. *Psychological Methods*, *27*(3), 426–432. https://doi.org/10.1037/met0000351

Recommended additional sources:
- Literature provided on the Canvas course
- Meta-Analysis in JASP (https://jasp-stats.org/2017/11/15/meta- analysis-jasp/)
- Meta-Research (https://metaresearch.nl/publications)
- PRISMA (https://www.prisma-statement.org)

Course Organization and Schedule

Before starting the course: (1) read the suggested literature, and (2) watch the first lecture that will be shared via or Canvas. It will take approximately 26 hours of preparation.

The format of this course combines prerecorded online lectures, working on assignments, and online live sessions (later shared as recordings). The course utilizes a hands-on approach and consists of approximately 10 hours of lectures, maximum of 30 hours of sessions (Q&A, tutorial, and feedback). The primary purpose of the live sessions is to discuss topics presented in the lectures and the assignments. After an assignment is submitted, you will receive individualized feedback. Finishing all the assignments will require approximately 24 hours of work.

The online prerecorded lectures will present the major aspects relevant to this course. Selected advanced topics, for instance, the use of R (RStudio) or mini meta-analysis of own studies, and several specific problems, for example, coding published and unpublished studies, will be discussed in the live online session.

Finishing this course requires at least six hours of work per day after the course starts on January 6, plus the time needed to watch lectures, reading the recommended literature, incorporating feedback, and finishing the final assignment. In total, you will need to spend at least 80 hours to benefit from the course. Below, you may find the Amsterdam time schedule.

Unit and Date	Time	Platform
1 Monday, January 6	13:30-16:30	Zoom
1 Tuesday, January 7	13:30-16:30	Zoom
2 Thursday, January 9	10:30-16:30	Zoom
3 Tuesday, January 14	10:30-16:30	Zoom
4 Thursday, January 16	10:30-16:30	Zoom
5 Friday, January 17	10:30-16:30	Zoom

Please note that the schedule covers all possible activities, namely, summaries of the prerecorded lectures, Q&A sessions, exercises in JASP and RStudio, discussions, and individual consultations. Participation in each session from the beginning until the end is not a must but is encouraged. Everyone will have an opportunity to adequately plan their time spent in the course.

Online meetings (summary sessions, Q&A, and feedback sessions) will be organized through Zoom application (https://zoom.us). To join online meetings, use the following information:
- Link: online sessions (https://vu-live.zoom.us/j/98637211634?pwd=TWszVGpvbDFpNGx1UEwyTFkyN0U1Zz09)
- Meeting ID: 986 3721 1634
- Passcode: 502299

Before you start using Zoom, set up an account using this link. Due to the Zoom security policy, all students must create an account to participate in the course. All students are expected to comply with an etiquette shared at the beginning of the course.

Each session will follow **this structure**:
- Summarizing a prerecorded lecture
- After Unit 1, providing general comments regarding submitted assignments
- Answering questions
- Discussing advanced topic(s) related to a unit
- From Unit 2, JASP/RStudio tutorial. If requested, the tutorials can be recorded and then shared via Canvas
- Answering questions and clarifications regarding the use of JASP/RStudio
- Preparing for an assignment submission

Unit 1: Introduction

Watch the prerecorded lecture posted online **before the first online session**.

The goal of the unit is to present and discuss the definition and the use of meta-analysis in the current research practices. You will learn how to identify a good meta-analysis and prepare a meta-analysis to study a problem in your field. Contents:
- What meta-analysis is
- Two types of systematic reviews
- Open science and meta-analysis: multisite replications
- Pros and cons of meta-analysis
- Longitudinal studies meta-analyzed
- Publication bias and the quality of publications
- Replication and advancing research practices
- Effect size and how to calculate it
- Study design and its meaning for a meta-analysis
- Variables to be included into a meta-analysis
- Submission of Assignment 1 (see the detail below)

Unit 2: Literature Search and Coding

Watch the prerecorded lecture posted online before the second meeting.

This unit aims to showcase how to prepare and perform a good literature search. I will emphasize the importance of including unpublished findings. I will help you to learn good practices in coding literature and keeping track of it. We will analyze a few examples of how to code studies to enable effective analysis. Contents:
- Literature search
- Additional sources of studies
- PRISMA standards
- Exclusion and inclusion of studies
- Coding characteristics: sources, participants, study variables, moderators
- Problems in coding statistics
- Protocol and coding form
- Coding of published vs. unpublished studies
- Available software to perform literature search and arrange coding
- Submission of Assignment 2

Unit 3: Simple Analysis

Watch the prerecorded lecture posted online.

The goal of this unit is to prepare you for analyzing your coded studies. You will mainly learn JASP interface applied to perform a meta-analysis. Contents:
- Estimating overall effect size
- Fixed and random-effects model
- Heterogeneity and its consequences
- Analysis of moderators
- JASP vs. jamovi
- R and available packages
- Analysis of examples
- Limitations of the software
- Coding effect sizes
- Submission of Assignment 3

Unit 4: Advanced Analysis

Watch the prerecorded lecture posted online.

The goal of this unit is to help you in learning methods applied to illustrate publication bias.
- Sensitivity analysis
- Estimating publication bias: trim-and-fill method, p-uniform*, p-curve, PET-PEESE, published vs. unpublished studies
- Replicability Index (https://replicationindex.com/)
- How to reduce publication bias: A discussion
- Function of a priori power analysis in research
- Preparation of Assignment 4

Unit 5: Reporting a Meta-Analysis and Advanced Aspects

Watch the prerecorded lecture posted online.

This unit aims to perform a meta-analysis of your data and help you learn how to report it. Additionally, I will present methods that can help you to improve your future reports.
- Critical analysis of selected publications
- Publication standards
- Meta-CART
- Meta-plot

- Bayesian meta-analysis
- Meta-analysis of indirect effects
- MetaForest and small sample meta-analyzes
- Mini meta-analysis of your own studies and when it should be avoided
- Model selection analysis (briefly)
- Meta-analysis and theory development
- Submission of assignment 4 (see our Canvas for the deadline)

Assignments

Four assignments are planned. All the assignments should be delivered in writing and uploaded onto our Canvas, as indicated in the online course. All the deadlines are provided within the Canvas course, each per assignment.

- Assignment 1. Create an idea for your meta-analysis and prepare a working title of your project. The topic should match your expertise. See and use the form for this assignment that is available on Canvas. Briefly describe the goal of your meta-analysis, use not more than 400 words. This assignment is worth 10% of the final grade.
- Assignment 2. Perform a literature search. Create and note an adequate set of keywords for the literature search. Ensure that you identified at least 8 suitable empirical articles which can be coded into your database. For recording your literature search use materials "2 A Meta-analysis of Improving Self-control with Practice: 1 PRISMA strategy" to be found in materials for "Workshop: 4 Workshop: Reporting a Meta-Analysis and Advanced Aspects", namely, PRISMA flow chart. Prepare a search for unpublished studies. This assignment is worth 20% of the final grade.
- Assignment 3. Create a brief protocol and a coding form. Code at least eight studies into an Excel sheet. Code all effects/information available, if necessary, consider aggregation of the effect sizes. Upload all (three) files as an archive (e.g., .zip). See an example of a coding form uploaded onto Canvas and materials "2 A Meta-analysis of Improving Self-control with Practice: 2 Methods and Procedures". This assignment is worth 30% of the final grade.
- Assignment 4. Prepare a report. Save your Excel sheet as a .csv file, and use the dataset in JASP. Include a final version of the PRISMA flow diagram. Analyze the effects by applying both fixed and random effects models. Interpret the results related to the overall effect size and other statistics. Analyze the effects of at least one categorical (e.g., dichotomous) and one continuous moderator. Create a forest plot and a funnel plot, then interpret the results. Perform a sensitivity analysis

(publication bias) and interpret it, then add brief conclusions to your report. This assignment is worth 40% of the final grade.

Feedback regarding the assignments will be delivered via our Canvas course.

Grading

To pass the course, the participants must actively attend online meetings, submit all the assignments, and obtain at least 60% of points for each. The grade for this course is based on the performance in the assignments. The standard Dutch grading scale will be used (1-10; 5.5 is sufficient). See the assignment description to learn the weight of each assignment.