# Intermediate statistics in SPSS and/or R

## Department of Psychology and Behavioural Sciences,

## Aarhus University

**Venue:** Aarhus University

**Course coordinator:** Karolina Ścigała (KS; karolina.scigala@psy.au.dk)

**Lecturers:** Bobby Zachariae (BZ; bzach@psy.au.dk); Laila Nockur (LN; laila.nockur@psy.au.dk); Mia Skytte O'Toole (MSO; mia@psy.au.dk); Karolina Ścigała (KS; karolina.scigala@psy.au.dk)

**Dates:**

- **Block 1: 03-04/03/2027: Fundamentals** (SPSS; KS)
- **Block 2: 05-07/04/2027: Linear and logistic regression** (SPSS; LN, KS)
- **Block 3: 03/05/2027: Psychometrics 101** – Developing and evaluating self-report instruments (SPSS; BZ)
- **Block 4: 20-21/05/2027: Multilevel modeling** (SPSS; MSO)
- **Block 5: 31/05-01/06/2027: Systematic review and meta-analysis** (SPSS; BZ)
- **Block 6: 15-16/06/2027: Introduction to R for beginners:** R environment, data cleaning, and basic statistical analyses (R; KS)

It is not obligatory to attend each block. Participants can sign up to any number of blocks.

**It is strongly recommended that students who are not very familiar with fundamentals and regression — or who have not reviewed them in a long time — attend Blocks 1–2 before participating in Blocks 3–6.**

**ECTS:**

Blocks 1 (fundamentals), 4 (multilevel modelling), 5 (systematic review and meta-analysis), and 6 (statistics in R) amount to 3 ECTS per block.

Block 2 (regression) amounts to 4 ECTS.

Block 3 (psychometrics) amounts to 1 ECTS.

## Course description

### Learning outcomes

- Across blocks 1 (fundamentals), 2 (regression), 4 (multilevel modelling), and 5 (systematic review and meta-analysis) participants will gain a theoretical understanding of basic and some advanced statistical analyses relevant to social sciences, particularly psychological research, as well as perform both basic and some advanced statistical analyses using IBM SPSS Statistics.
- By the end of block 3 (psychometrics), participants will understand the basic principles of psychological and health measurement, construct and evaluate individual questionnaire items, understand the concepts of reliability and validity, conduct and interpret common psychometrics, critically evaluate published questionnaires, understand the basics of Classical Test Theory (CTT), and be acquainted with Item Response Theory (IRT).
- In block 6 (statistics in R), participants will conduct basic statistical analyses using R, and learn to navigate R effectively for more advanced analyses, including exploring relevant packages, vignettes, tutorials, and other resources to support ongoing independent learning.

**Content**

- Blocks 1 (fundamentals), 2 (regression), 4 (multilevel modelling), and 5 (systematic review and meta-analysis) will provide students with a theoretical understanding of statistical methods and practical skills in conducting these methods using IBM SPSS Statistics.
- Block 3 (psychometrics) will provide participants with a basic conceptual framework to critically evaluate questionnaires, scales, tests, and patient-reported outcome measures (PROMs).
- Block 6 (Statistics in R) will introduce students to conducting basic statistical analyses in R, focusing on technical and practical skills, rather than theory. This block is suitable for students who have completed Blocks 1 and 2 and want to apply those analyses (e.g., correlations, t-tests, linear and logistic regression) in R, or for those already familiar with the theory behind these statistical methods. Participants will also learn to navigate R for more advanced analyses using various resources.

This course assumes prior undergraduate knowledge of introductory statistics. If you need a refresher, it is strongly recommended to attend the first block and review topics you do not feel confident in using the literature provided.

**Format and Evaluation**

The course includes a combination of lectures and practical instruction using SPSS and R. Focus will be on giving participants hands-on experience with each type of analysis. Practical exercises will be assigned for each session; some of these exercises will be done collectively during the teaching day and others must be completed independently. The course consists of six blocks in total.

In order to receive a certificate of completion and ECTS points for a block, participants must receive approval of the corresponding assignment.

The specific number of ECTS points awarded is determined as follows:

- Block 1 (fundamentals): 1 assignment + 2 days of attendance (with preparation) = 3 ECTS. Block 1 concludes with a written assignment: Students run the analyses covered in the block on a provided dataset and submit the analysis output together with a short written summary of the results (summary max. 5 pages, individual work).
- Block 2 (regression): 2 assignments + 3 days of attendance (with preparation) = 4 ECTS. Block 2 concludes with two individual written assignments: one covering days 1–2 and one covering day 3. For each assignment, students apply the analyses taught in the block to a provided dataset and submit (a) the analysis output and (b) a short written summary of the results (max. 5 pages per assignment).
- Block 3 (psychometrics): 1 day of attendance (with a preparatory assignment) = 1 ECTS. Prior to the course, the participants are required to write an overview (max 2 pages) of all measurements/instruments to be used in their PhD project and describe what is known about their reliability and validity, and, if relevant, how they have been translated/adapted and the reliability and validity of the adapted/translated versions. If the instruments are constructed ad hoc for the project, the ensuing validation process should be described.
- Block 4 (multilevel modelling): 1 assignment + 2 days of attendance (with preparation) = 3 ECTS. Block 4 concludes with a written assignment: Students run the analyses covered in the block on a provided dataset and submit the analysis output together with a short written summary of the results (summary max. 5 pages, individual work).

- Block 5 (systematic review and meta-analysis): 1 assignment + 2 days of attendance (with preparation) = 3 ECTS. Before Day 1 of the Systematic Review and Meta-Analysis course, participants are required to download and study an introductory text on systematic review and meta-analysis (127 pages). Between Day 1 and 2, the participants are required to prepare for the exercise on Day 2 by downloading and familiarizing themselves with the course materials, which include a) two texts on conducting meta-analysis with SPSS (45 pages), b) exercise instructions, c) 9 published studies from which data are to be extracted, and d) an Excel-tool for calculating and converting effect sizes.
- Block 6 (statistics in R): 1 assignment + 2 days of attendance (with preparation) = 3 ECTS. Block 6 concludes with a written assignment: Students run the analyses covered in the block on a provided dataset and submit the analysis output together with a short written summary of the results (summary max. 5 pages, individual work).

Priority will be given to students who can attend all of the course, but it is possible to attend specific blocks if space is available.

Notice that certification for a block is only awarded if the corresponding assignment is approved, and that certificates are not sent out, until the whole course is finished.

**Expected workload**

100-150 pages per course day as well as homework assignments. The due dates for the homework assignments will be 2–3 weeks after each block (except Blocks 3 and 5, where the assignment is preparation done before or during the block).

**Readings and Resources:** The core reading materials:

Field, A. (2024). Discovering Statistics Using SPSS.

Field, A. (2026). Discovering Statistics Using R.

Lakens, D. (2023). Improving Your Statistical Inferences: https://lakens.github.io/statistical_inferences/

An 'Additional reading' list is also outlined below. Participants will be expected to read from the list to expand their understanding of the course content.

A Brightspace page will be made for the course where we will upload PowerPoint slides, answers for the assignments, links to additional materials, etc. Announcements will be sent via e-mail.

**Getting in contact with us**

Open dialogue and cooperation are important to us. If you have questions about the class, special needs, or require clarification regarding the course requirements, please ask! Similarly, if you are having difficulty understanding something, please let us know.

**Detailed overview of the course**

| Teacher | Day | Times | ECTS | Content | Software |
|---|---|---|---|---|---|
| **Block 1: Fundamentals** | | | | | |
| KS | 03/03/2027 | 10:00-15:30 | 3 ECTS | Fundamentals 1: Introduction to SPSS; statistical assumptions, t-tests, effect sizes, confidence intervals | SPSS |
| KS | 04/03/2027 | 09:00-15:30 | | Fundamentals 2: Missing data, sample size and power analysis, introduction to Bayesian statistics, equivalence testing | SPSS |
| **Block 2: Regression** | | | | | |
| LN | 05/04/2027 | 10:00-15:30 | 4 ECTS | Linear regression 1: Simple and multiple regression | SPSS |
| LN | 06/04/2027 | 09:00-15:30 | | Linear regression 2: Mediation and moderation in regression | SPSS |
| KS | 07/04/2027 | 10:00-15:30 | | Logistic regression and chi square; ANOVA as regression | SPSS |
| **Block 3: Psychometrics** | | | | | |
| BZ | 03/05/2027 | 09:00-15:30 | 1 ECTS | Developing and evaluating self-report instruments | SPSS |
| **Block 4: Multilevel modeling** | | | | | |
| MSO | 20/05/2027 | 10:00-15:30 | 3 ECTS | Multi-level modeling 1 | SPSS |
| MSO | 21/05/2027 | 09:00-15:30 | | Multi-level modeling 2 | SPSS |

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|---|---|---|---|---|---|
| **Block 5: Meta-analysis** | | | | | |
| BZ | 31/05/2027 | 10:00-15:30 | 3 ECTS | Systematic Review and Meta-analyses 1 | SPSS |
| BZ | 01/06/2027 | 09:00-15:30 | | Systematic Review and Meta-analyses 2 | SPSS |
| **Block 6: Statistics in R: A quick introduction for beginners** | | | | | |
| KS | 15/06/2027 | 10:00-15:30 | 3 ECTS | R environment, data cleaning, t tests and correlations, linear regression | R |
| KS | 16/06/2027 | 09:00-15:30 | | Logistic regression, data visualizations, power analyses and simulations | R |

**Block 6 is meant for:**

1. Students who have completed blocks 1 and 2 and would like to conduct the analyses they learnt about in these blocks using R, or
2. Students who have not completed blocks 1 and 2 but are familiar with: correlations, t-tests, linear and logistic regression in other software and want to learn to conduct these analyses in R

**Additional readings**

American Psychological Association. (2009). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: American Psychological Association.

Baguley, T. (2012). *Serious stats: A guide to advanced statistics for the behavioural sciences*. New York, NY: Palgrave MacMillan.

Bandalos, D. L., & Finney, S. J. (2010). Factor analysis: Exploratory and confirmatory. In G. R. Hancock & R. O. Mueller (Eds.), *The reviewer's guide to quantitative methods in the social sciences* (pp. 93-114). New York, NY: Routledge.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York, NY: Guilford.

Byrne, B. (2016). *Structural equation modeling with Amos: Basic concepts, applications, and programming* (3rd ed.). New York, NY: Routledge.

Camerer, C. F., Dreber, A., Holzmeister, F., Ho, T.-H., Huber, J., Johannesson, M., et al. (2018). Evaluating the replicability of social science experiments in *Nature* and *Science* between 2010 and 2015. *Nature: Human Behaviour, 2*, 637-644.

Cummings, G. (2014). The new statistics: Why and how? *Psychological Science, 25*, 7-29.

Cummings, G., & Calin-Jageman, R. (2017). *Introduction to the new statistics: Estimation, open science, and beyond*. New York, NY: Routledge.

Field, A., & Hole, G. (2003). *How to report and design experiments*. London, England: Sage.

Gamst, G., Meyers, L. S., & Guarino, A. J. (2008). *Analysis of variance designs*. Cambridge, England: Cambridge University Press.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Publications.

Heck, R. H., Thomas, S. L., & Tabata, L. N. (2014). *Multilevel and longitudinal modeling with IBM SPSS* (2nd ed.). New York, NY: Routledge.

Hoekstra, R., Kiers, H. A. L., & Johnson, A. (2012). Are assumptions of well-known statistical techniques checked, and why (not)? *Frontiers in Psychology, 3*, 1-9.

Kline, R. B. (2011). *Principles and practices of structural equation modeling* (3rd ed.). New York, NY: The Guilford Press.

Lance, C. E., & Vandenberg, R. L. (2010). *Statistical and methodological myths and urban legends*. New York, NY: Routledge.

Mueller, R. O., & Hancock, G. R. (2010). Structural equation modeling. In G. R. Hancock & R. O. Mueller (Eds.), *The reviewer's guide to quantitative methods in the social sciences* (pp. 371-384). New York, NY: Routledge.

Navarro, D. (2024). *Learning Statistics with R.* https://learningstatisticswithr.com/

Pallant, J. (2010). *SPSS survival manual* (4th ed.). Maidenhead, England: McGraw Hill.

Palij, M. (2012). Review of Cummings – Understanding the new statistics: Effect sizes, confidence intervals, and meta-analysis. *PsycCRITIQUES, 57*(24).

Simonsohn, U., Nelson, L. D., & Simmons, J. P. (2014). P-curve: A key to the file-drawer. *Journal of Experimental Psychology: General, 143*, 534-547.

Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.

Wagenmakers, E.-J. (2007). A practical solution to the pervasive problem of p values. *Psychological Bulletin & Review, 14*, 779-804.