

**Description:** Experimental Designs and Statistical Methods for Quantitative Research in Management (3 credits). Basic concepts for data collection planning; appropriate statistical analyses of these data and interpretation of results. Advantages and disadvantages of the various experimental designs.

This course has four main objectives:

1. to present the major experimental designs used for research in management and in the behavioral sciences;
2. to familiarize students with the statistical methods and a software to analyze experimental data (e.g., SPSS);
3. to interpret and present results from the statistical analyses and discuss the validity and limits of the results;
4. to understand and to critic the methodology and statistical results of published articles in the research fields of the students.

In addition to these, listed on the university calendar description, I intend to focus on the following:

1. being able to undertake reproducible analyses;
2. recognizing and avoiding statistical fallacies.

**Instructor:** Léo Belzile (leo.belzile@hec.ca).

**Lectures:** Friday, 8:30–11:30 in class (Côte-Sainte-Catherine building, Béton Grilli room) + on Zoom.

**Course content:**

1. R programming language
2. Planning of experiments
3. Review of basic statistical concepts and experimental designs
4. One-way analysis of variance: inference for contrasts and treatment means, model assumptions, power calculations, *post-hoc* tests and multiple comparisons
5. Multi-way analysis of variance and interactions
6. Complete and incomplete block designs, confounding
7. Repeated measurements, random effects and variance components
8. Introduction to causal inference
9. Mediation analysis
10. The reproducibility crisis and pre-registration
11. Guidelines for reporting statistical analysis

**Target audience:** The course is part of the PhD program in Administration offered by HEC Montréal jointly with McGill, Concordia and Université du Québec à Montréal (UQÀM).

**Prerequisite:** No programming background is assumed, but students should have some background in introductory statistics at the level of Diez et al. (2019) (including basic notions such as descriptive statistics, hypothesis testing, simple linear regression).

**Grading scheme:** your final grade will be based on

- Weekly check-in, worth 5%
- Problem sets, worth 40%.
- Methodological review of a paper, worth 15%
- Final examination, worth 40%. The exam will take place on Monday, December 13th, 2021, from 9:00–12:00.

Team work counts toward your final grade only if you obtain more than 50% on the individual evaluations. Otherwise, the final grade is calculated on a pro rata basis using only individual evaluations.

**References:** The course notes and slides are available online on the course website. Additional textbook references include Dean et al. (2017), Cox (1958) and Keppel & Wickens (2004),

## References

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- Berger, P. D., Maurer, R. E., & Celli, G. B. (2018). *Experimental Design With Applications in Management, Engineering, and the Sciences*. Springer, 2 edition.
- Box, G. E. P., Hunter, W. G., & Hunter, J. S. (1978). *Statistics for experimenters : an introduction to design, data analysis, and model building*. Wiley.
- Campion, M. A. (1993). Article review checklist: a criterion checklist for reviewing research articles in applied psychology. *Personnel Psychology*, 46(3), 705–718.
- Cox, D. R. (1958). *Planning of Experiments*. Wiley.
- Dean, A., Voss, D., & Draguljić, D. (2017). *Design and Analysis of Experiments*. Springer.
- Diez, D., Çetinkaya Rundel, M., & Barr, C. D. (2019). *OpenIntro Statistics*. OpenIntro, 4 edition.
- Kelley, K. & Preacher, K. (2012). On effect size. *Psychological Methods*, 17(2), 137–152.
- Keppel, G. & Wickens, T. (2004). *Design and Analysis: A Researcher's Handbook*. Pearson Prentice Hall.
- Pearl, J. (2014). Interpretation and identification of causal mediation. *Psychological Methods*, 19(4), 459–481.
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- Wilkinson, L. (1999). Statistical methods in psychology journals: guidelines and explanations. *American Psychologist*, 54, 594–604.
- Zhao, X., Lynch, John G., J., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*, 37(2), 197–206.