

Open Science in Teaching

Dr. Johanna Gereke (MZES)

21 September 2021

Open Science Day 2021, University of Mannheim

Roadmap of today's lecture

1. Why teach open science?
2. How to incorporate open science in higher education teaching?
3. Example: Replication Seminar

Why teach open science?

Growing awareness of the 'Replication or Credibility Crisis'

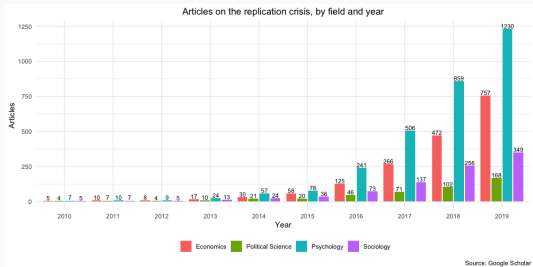


Figure 1: own calculation

Teaching as a Component of the Credibility Revolution

- ✓ effective tool to teach ...
 - students awareness of the 'reproducibility crisis'
 - how to conduct methodologically sound and ethical empirical research
- ✓ fosters transparency and develops norms of transparency among the next generation of scientists
- ✓ promotes open and transparent scientific knowledge production
- ✓ improves the self-correcting process of science

Some of the benefits for students & instructors

For students:

- ✓ hands-on learning for students
- ✓ jumping to the research frontier instead of reading old textbook examples

For instructors:

- ✓ creates high levels of student engagement
- ✓ helps to keep up with the latest scholarship by assigning new publications
- ✓ helps to improve on own research practices
- ✓ possibly publication of joint article
- ✓ demonstrates commitment to open science principles to hiring committees (e.g. LMU psychology department, esp. for young academics)

How to incorporate open science in higher education teaching?

Two approaches to teaching open science

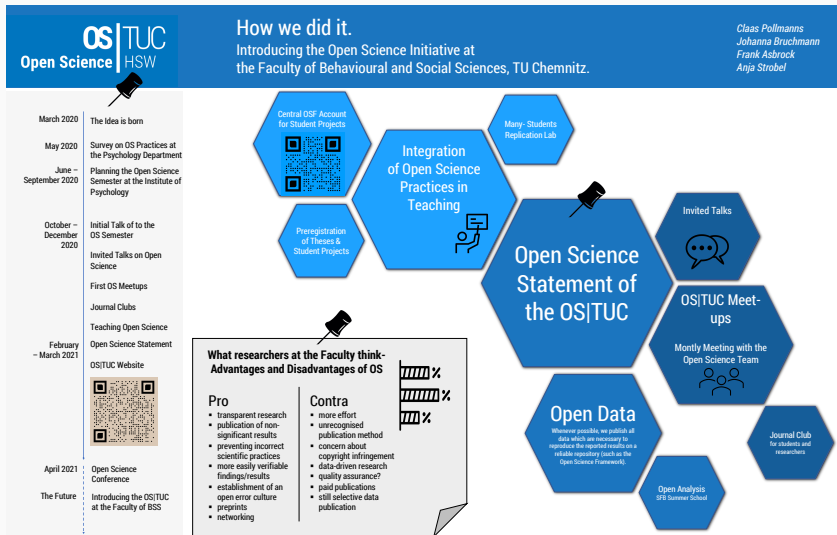
- Teaching about open science as a **subject**
 - Terminology, principles, philosophy of science, etc.
- Teaching open science practices as a **process**
 - Using open educational resources

Open Science Teaching can happen in...

- ✓ methodology classes
- ✓ applied research classes
- ✓ theses as replications

at all levels: BA, MA and PhD

Example TU Chemnitz, Behavioral and Social Sciences



Example, Master of Science in Epidemiology, Johannes Gutenberg University Mainz

- Curriculum integration → no isolated replication course, rather make replication pop up in different relevant contexts
- Study protocol, statistical analysis plan, practical data analysis, scientific writing to connect separate topics

Daniel Wollschläger, University Medical Center Mainz, IMBEI, see OSF Replication Workshop Page <https://osf.io/8a597/>

TEACHING OPEN SCIENCE @ TU DRESDEN

Anne Gärtner, Alexander Strobel, OSIP Members
Faculty of Psychology, Technische Universität Dresden

Bachelor

Module Methods of Psychology

- Training in general open science aspects
- Replicability crisis
- Credibility
- Statistical methods

Module Empirical Studies

- Preregistration of research projects
- OSF and AsPredicted templates
- Open data and documentation

Bachelor Thesis (in progress)

- Open Science part of the guidelines for (1) conducting and (2) supervising Bachelor theses
- Engagement in Open Science practices part of the thesis evaluation protocol



Master

Dedicated course elements in various modules on

- Open Science
- Good Scientific Practice
- Replicability crisis
- Preregistration

Module Applied Statistics in Clinical Research

- Good Scientific Practice
- Questionable research practices (p-hacking, harking)
- Replicability crisis
- Preregistration

Module Neurobiology of Individual Differences

- Introduction to open data, open code, open material
- Preregistration of own research project with AsPredicted template

Module Research and Intervention

- Lectures/tutorials on how to preregister project ideas



Postgraduate Training

Collaborative Research Centre 940: MGK Open Science Module

- E-learning material complemented by three workshops (1–2 days)
- 1) Good Scientific Practice: basic scientific values, scientific misconduct, clearing processes in case of conflict
- 2) Research Data Management: facilitate scientific workflows, routines to assess, analyze, store and share data
- 3) Open Science Practices: principles and practices including preregistration, open access, data, materials, code and reproducible research
- Optional visits of OSIP meetings and open science lectures
- Module is currently in pilot phase, will be evaluated, revised and finalized during 2021



Guiding Principles

- Communicate rules for good scientific practice
- Raise awareness for questionable research practices

Lay foundations for enhancing credibility and transparency and efficiently doing open research and managing data
Offer workshops on good scientific practice, research data management and research transparency from early on

Providing teaching materials open access



Teaching Open Science



<https://rimamrahal.wordpress.com>

New Teaching Formats – Things to consider

01	Reuse	<ul style="list-style-type: none">• Use in different ways
02	Revise	<ul style="list-style-type: none">• Adapt, modify, update and otherwise change
03	Remix	<ul style="list-style-type: none">• Combine with other resources
04	Redistribute	<ul style="list-style-type: none">• Share with others
05	Retain	<ul style="list-style-type: none">• Keep access to the materials

David Wiley: <https://opencontent.org/blog/archives/3221>

Rima-Maria Rahal | Teaching Open Science | MZES

Example: Replication Seminar

Learning outcomes

- Why is teaching reproducibility important?

Students can learn to...

- ✓ Understand what decisions and difficulties authors of published work have typically faced
 - ✓ Do cutting-edge empirical research in the social sciences
 - ✓ Add value to an existing study
-
- Examples:
 - University of Amsterdam: Replication for sociology (MA) ¹
 - Ludwig-Maximilians-Universität München: Replication of sociological research (BA)
 - UC San Diego: Social Science Replication (PhD, political science with external guest lectures)

¹Stojmenovska, D., Bol, T., & Leopold, T. (2019). Teaching Replication to Graduate Students. *Teaching Sociology*, 47(4), 303-313.

Course Manual Replication

Course Catalogue Number
7325A0029Credits
6 ECTS

Entry requirements

The student is:

- enrolled in the RMSS (BA track)
- enrolled in the RMSS (MSc track)
- has completed the course Advanced Multivariate Modelling (9 EC) offered in the first year of the Research Master Social Sciences.

Instruction language

The instruction language is English; assignments must be written in English.

Time Period(s)

Academic year 2017-2018 Semester 1, Block 2

Mondays 15:00-17:00

Location

Schedules can be found at <http://www.uva.nl/>.

REG- H1.01

Lecturers

Thijs Beel

E-mail: thijs.beel@uva.nl

Office: REG- C.6/9

Personal website: www.thijsbeel.com

Thomas Loepold

E-mail: loepold@uva.nl

Office: REG- C.6/9

Personal website: www.thomaskloepold.nl

Course Objectives

Students who complete this course will be able to:

1. critically evaluate the publication process and the role of replication in the social sciences,
2. understand what decisions and difficulties authors of published work have typically faced,
3. conduct a replication study according to standard replications of replicability,
4. perform, and add value to, a replication study.

Regarding the overall curriculum of the RMSS program, replication builds upon the knowledge acquired during the course Advanced Multivariate Modelling. Furthermore, it prepares students interested in applying quantitative methods for their final thesis.

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Christof Wolf

Christof.Wolf@hhs.org

Seminar for MA Sociology and Elective for GESS/CDS, HS 2018

Friday, 10:15 to 11:30

Dates: September 7, 21, October 5, 18, November 2, 16, 30.

Room: 309, 86, 30-32

Learning social research through replication

Description

In addition to a thorough understanding of the substantive field you are studying you need firm methodological and statistical knowledge in order to successfully conduct quantitative social research. This seminar will give you the opportunity to apply and expand your knowledge of social research by replicating published research findings.

The research that we are going to replicate was conducted with data from publicly available survey data like the European Social Survey (ESS), the International Social Survey Programme (ISSP) or the European Values Study (EVS). Data from surveys like these have several advantages: the surveys follow a repeated cross-section design, a research design particularly well suited to study social changes; they are comparative allowing you to compare data cross-nationally on a broad range of topics; the surveys follow rigorous methodological standards and, finally, data are available at no cost and can be downloaded from the web.

Replicating published research has the advantage that you are able to check your results against existing results. By trying to replicate previous research you learn where the original researcher has made tacit decisions not documented in the paper (e.g. defining the analysis sample, coding of variables, treatment of missing values). Replicating social research also trains you to judge the validity of research results.

In addition to these primarily pedagogical aspects replicating research is important from an epistemological point of view as well. Through replication of research by independent research groups biases in previous work can be discovered and findings can be validated (see Hendrick 1993, King 1995).

Assignment

Participants should choose a published paper and try to replicate the findings reported in it using the same data. The results to be replicated either will be given in a table containing the outcome of a multivariate model. Please document each step in your attempt to replicate the findings, report and explain the decisions you had to make during data preparation and data analysis. If you fail to replicate the result please indicate possible explanations. Your paper should not exceed 10,000 words; please add your documented report in the Appendix.

Papers should be delivered in electronic form no later than January 20, 2018.

POLI 229: Social Science Replication

Gareth Nellis

Winter 2019

E-mail: gnelis@uva.nl

Office Hours: By appointment

Office: SSB 130

Web: garethnellis.github.io

Class Hours: Th 09:00-11:50

Class Room: SSB 104

Course description

The purpose of this class is to learn how to do cutting-edge empirical research in the social sciences by replicating others' work. For each class, we will have a non-UCSD faculty member visit campus. A week before their visit, they will circulate a working paper—typically one drawing on an experimental or quasi-experimental design—along with the data and code needed to reproduce the results. Small teams of graduate students will analyze the data, and prepare further substantive tests and extensions. A presentation and group discussion of these findings, with input from the paper's author, will last about two hours. Classes will start with short (30 minute) lectures covering various topics in experimental design and analysis. This is an opportunity for graduate students to engage with scholars from leading departments, take a deep dive into work in progress, and to pick up new tools and best practices.

Prerequisites

The class is aimed at students in the second, third, and fourth years of the PhD program in political science. A strong understanding of probability, regression, and causal inference is required. Prior knowledge of R is highly recommended.

Course requirements and grading policy

1. Full replication (6), as part of a pair (8%). This is the principal assignment and you should work on it very carefully. Here are some pointers:
 - You should produce three outputs:
 - a. Replication plan. Once you've read the visitor's working paper, write a replication plan outlining in words the additional tests you'd like to do. Finalize this document before you do the tests themselves, and don't make changes after you start analyzing. Given time constraints, I would limit this to 2-3 pages. It's more important to spend time with the data.

Forschungspraktikum quantitative Methoden
„Replikation sozialwissenschaftlicher Studien“Dipl.-Soz. Felix Bader (felix.bader@lmu.de)Dr. Marc Krauchinger (krauchinger@lmu.de)

Wintersemester 2014/2015

Dienstag 14-18 Uhr, Konradstr. 6, CIP Raum

Kurzhinhat

Eine Grundvorlesung von Wissenschaft ist, dass sie replizierbar ist. In den Sozialwissenschaften gilt es jedoch kaum Replikationen. Dies ist problematisch. Erstens, weil die Aufbereitung und Analyse von Daten nicht Fehler gemacht werden können (insbesondere bei komplexen Power- und Ereignisdaten). Zweitens, weil unsere Gefahr von Stichprobenbedingten droht. Drittens, weil manchmal auch falsch wird. Replikationen sind daher auch in den Sozialwissenschaften notwendig, um einen Bestand an wissenschaftlichen Ergebnissen zu gewährleisten. Um diesem Ziel näher zu kommen, werden Teilnehmer des Forschungspraktikums nach einer Wiederholung fortgeschrittener statistischer Verfahren anhand des Programms Stata lernen, wissenschaftliche Ergebnisse Studien selbst replizieren. Dabei werden fortgeschrittene Verfahren der Kausalanalyse zur Anwendung kommen, dazu zählen insbesondere Fixed-Effects-Regressionen oder Instrumentenvariablen-Schätzung.

Leistungsanforderungen und Benotung

Das Forschungspraktikum richtet sich an Masterstudierende der Soziologie. Die Teilnehmerinnen und Teilnehmer sollen in Zweiergruppen eine zentrale empirische Arbeit replizieren. Grundsätzlich bildet die Studie eine zentrale Grundlage für die eigene Masterarbeit, so dass im Forschungspraktikum die Masterarbeit schon vorbereitet wird. Voraussetzungen sind ein Interesse an quantitativer Sozialforschung, gute statistische Kenntnisse sowie eine gewisse Vertrautheit mit Stata.

Präsenzzeiten

Der Erwerb eines Scheins erfordert die zweifache Präsenzzeiten des eigenen Replikationsprojekts. Zu Beginn des Semesters wird das Replikationsarchiv vorgestellt, gegen Ende des Semesters werden die eigenen Resultate präsentiert.

Hausarbeit

Bis zum Semesterende ist von jeder Projektgruppe eine Hausarbeit zu der durchgeführten Replikation zu entwerfen. Die Hausarbeit einer Zweiergruppe hat einen Umfang von ca. 20 Seiten (ca. 60.000 Zeichen) und ist bis zum 09.10.2015 einzureichen. Die Hausarbeit wird als Word- oder PDF-Datei (inklusive von beiden unterschriebener und eigengezeichneter Eigenständigkeitserklärung) zu senden an: felix.bader@lmu.de und krauchinger@lmu.de.

Anwesenheit

Als weitere Sicherungsfaktor wird vollständige Inmax. 2 Fehltage ohne Abteil und aktive Teilnahme erwartet.

Benotung

Benotet wird ausschließlich die Hausarbeit. Um zur Hausarbeit zugelassen zu werden, müssen beide Präsentationen sowie die assoziierte Übung „Kausalanalyse“ als bestanden benotet werden.

What do we mean by replication?

Table 1: Types of "Replications" in the Behavioral, Social, and Cognitive Sciences

	...Using the same data	...By collecting new data
Same materials, methods, code (i.e., no deviation)	Reproducibility Analysis	Direct/"Exact" Replication
Different materials, methods, code etc.	Robustness Analysis	Generalizability Analysis (Extension; "Conceptual" Replication)

Figure 2: Types of replications²

²Gollwitzer, M. (2020). DFG Priority Program SPP 2317 Proposal: A meta-scientific program to analyze and optimize replicability in the behavioral, social, and cognitive sciences (META-REP). PsychArchives.

<https://doi.org/10.23668/PSYCHARCHIVES.3010>

Duplication vs. Replication

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- **Duplication:** Verification of research results
 - > same results expected

Duplication vs. Replication

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- **Replication:** Robustness test of research results
 - > diverging results unsurprising

My course design on experimental methods (1)

- **Course Title:** Replication & Reproduction in the Social Sciences
 - Junior-Fellowship der Baden-Württemberg Stiftung / Stifterverband (2019-2021) [15.000 EUR, [More info](#)]
 - For advanced Master and PhD students in Sociology, Political Science & Psychology
- **Aim:** students get to know scientific work processes and are involved in the creation and further development of sustainable knowledge
- **Scope:** Replication and reproduction of an experimental study published in a high-impact journal (e.g. ASR)
- **Goal:** achieving the concept of “research-based learning” (i.e. teaching **process** as well as **subject**)

My course design on experimental methods (2)

- Procedure
 1. First duplicate (using the same data and methods as the original study)
 2. Replicate with a new extension, i.e. collect new data with the same methods but new context
- Focus on recent experimental study on ethnic boundaries³
 - Extension: translating findings on ethnic boundaries in the U.S. to national boundaries in Germany

³Abascal, M. (2020). Contraction as a Response to Group Threat: Demographic Decline and Whites' Classification of People Who Are Ambiguously White. *American Sociological Review*, 85(2), 298–322. <https://doi.org/10.1177/0003122420905127>

My course design on experimental methods (3)

- During the course, students will gain hands-on experience:
 - Developing research (extension) ideas
 - Reviewing & critiquing scholarly work
 - Writing and posting pre-registration and analysis plan
 - Learning how to apply for ethical approval
 - Programming survey software
 - Completing a pilot test
 - Conducting data analysis
 - Writing a publication-ready paper
 - Completing a learning portfolio

How to best teach replications in the social sciences?

- ✓ sharing best practices
- ✓ practical steps (selection of papers, supervision, grading, communication with original authors & journals)
- Videos, Resources, Contacts [OSF Workshop page](#)
- Publication forthcoming: Teacher's Companion: How to teach constructive replications in the social sciences

Take-aways

1. Teaching students about open science is a crucial component of the credibility revolution to make science transparent & self-correcting
 - Open science has the potential to improve learning & teaching in higher education
 - Teaching open science as a **subject** and a **process** helps to train the next generation of scientists & fosters norms of this research culture
2. Sharing teaching resources reduces barriers to spreading open science knowledge throughout the field
3. Institutional efforts and comprehensive curriculum development should ensure students learn about and how to do open science
(E.g.: Open Science semester, Chemnitz University; Open Science Module at TU Dresden (Psychology) e-learning plus 3 workshops for postgraduate training: Good Scientific Practice, Open Science Practices, Research Data Management)

Other resources

- Nate Breznau's Zotero bibliography on open science for teaching
- Project Tier (Teaching Integrity in Empirical Research) promotes the integration of principles and practices related to transparency and replicability in the research training of social scientists.



- The Berkeley Initiative for Transparency in the Social Sciences works to improve the credibility of science by advancing transparency, reproducibility, rigor, and ethics in research.



Questions?

- Stojmenovska, D., Bol, T., Leopold, T. (2019). Teaching Replication to Graduate Students. *Teaching Sociology*, 47(4), 303-313.
- My course design on Experimental Methods: Replication
Reproduction in the Social Sciences
 - Link: Johanna Gereke, Stifterverband