

Open Science

What it is and how to do it

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Learning Objectives

Today we will learn...

- what Open Science Practices are
- why they're important

- which practices you can implement

Mentimeter

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Resources

- this lecture covers Kathawalla et al. (2021)
- suggests 8 open science practices graduate students can adopt
 - with three levels: easy, medium, and hard

1 What is Open Science?

“Open science” is an umbrella term used to refer to the concepts of openness, transparency, rigor, reproducibility, replicability, and accumulation of knowledge, which are considered fundamental features of science”

— Crüwell et al. (2019), p.3

- a movement developed to respond to crisis in scientific research
 - lack of accessibility, transparency, reproducibility, and replicability of previous research
- transparency is key to all facets of Open Science
 - it allows for full evaluation of all stages of science
- Open Access, software, data, code, materials...

1.1 Systemic problem in science

- the combination of
 - publication bias
 - * journals favour novel, significant findings
 - publish or perish
 - * researchers’ careers depend on publications
- can/does/did lead to:
 - HARKing
 - * Hypothesising After Results are Known
 - p-hacking
 - * (re-)running analyses until a significant effect is found
 - replication crisis
 - * pervasive failure to replicate previous research

2 Why do Open Science?

- open science is good science
- it encourages organisation and planning
 - helpful for future you
- increases *transparency*
 - without transparency we cannot inspect evidence ourselves
 - or ensure the claims match the evidence
- makes our work more robust
 - so future work stands on solid ground

3 How to do Open Science?

- not all-or-nothing
- there are things I consider the bare minimum
 - detailed experiment plan, ideally public
 - openly available materials (e.g., stimuli)
 - share code and data
- the important thing is to do what you can

4 Eight Steps to Open Science

4.1 Journal Club

- level: Easy
- e.g., [ReproducibiliTea Berlin](#)
 - discuss topics and share knowledge on Open Science Practices



Figure 1. Open Science research practices across the research cycle

Figure 1: Image source: Kathawalla et al. (2021) (all rights reserved)

4.2 Project Workflow

- level: Easy
- folder structure
 - how to sensibly set up your folders
- contained environments
 - using RProjects and the **here** package
- data management
 - establishing some data storage convention
- version control
 - e.g., git, GitHub/GitLab, OSF

4.3 Preprints

- level: Easy
- manuscript version publicly available
 - prior to peer review
 - during peer review
 - after publication
- allows for a wider audience
 - earlier feedback
 - actually *increases* citation count
- typically found on (psy)arXiv, OSF

4.4 Reproducible Code

- level: Medium
- with open source software (R, RStudio, packages)
- literate programming
- dynamic reports with Quarto/Rmarkdown
- reproducibility goes hand-in-hand with project workflow and data management
- ideally:
 - avoid GUI (Graphic User Interface with point-and-click, e.g., SPSS)
 - avoid proprietary software (paid licences, e.g., SPSS, Matlab)
 - use open software (e.g., R, Python)
 - use a programming language and include useful comments

4.5 Data sharing

- level: Medium
- publicly sharing your data
 - including raw data (if possible)
- allows for reproduction of analyses
- takes forethought and experience
- documentation and naming conventions are important
 - e.g., data dictionaries/codebooks

4.6 Transparent writing

- level: Medium
- transparency regarding
 - methods/procedure
 - hypotheses (confirmatory vs. exploratory)
 - data analyses
- an experiment plan or lab notebook are key!

4.7 Preregistration

- level: Medium
- a timestamped and (often) public plan of:
 - research questions
 - hypotheses
 - method
 - analyses
- clearly state intentions and predictions for *confirmatory* analyses
 - everything else is exploratory
- templates available on [AsPredicted](#) and the [OSF](#)

4.8 Registered Report

- level: Difficult
- submitting the introduction, methods, analysis plan to a journal before data collection
 - if accepted: publication regardless of the result
- a more detailed pre-registration, often with fully written sections
- much more time consuming before data collection can begin
 - journal acceptance can take months

5 What we'll cover

- Conceptualisation
 - Project Workflow
- Design
 - Data sharing
 - Pre-registration
- Analyses
 - Reproducible Code
- Reporting

- Transparent writing
- Dissemination
 - Data sharing
- all in the RStudio environment

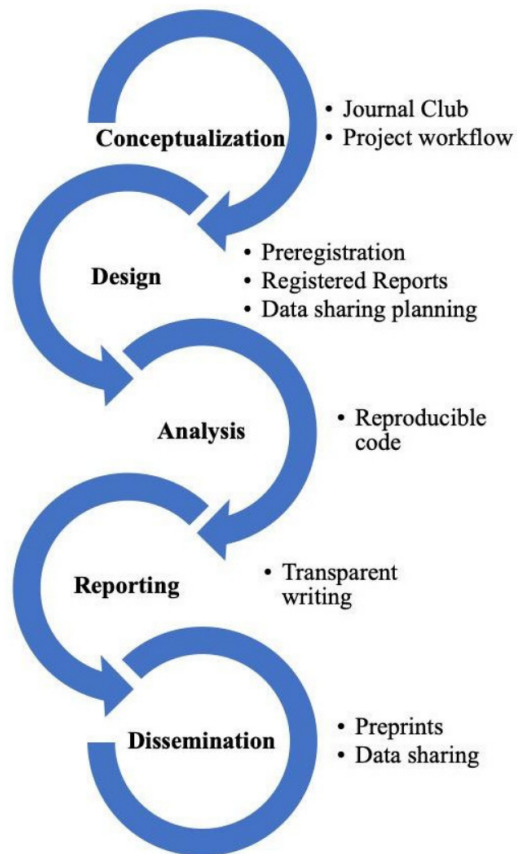


Figure 1. Open Science research practices across the research cycle

Figure 2: Image source: Kathawalla et al. (2021) (all rights reserved)

6 Further resources

- [Open Science Framework \(OSF\)](#)
- [OSF Project page for Kathawalla et al. \(2021\)](#)

Learning objectives

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References

- Crüwell, S., Van Doorn, J., Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., Orben, A., Parsons, S., & Schulte-Mecklenbeck, M. (2019). Seven Easy Steps to Open Science: An Annotated Reading List. *Zeitschrift für Psychologie*, 227(4), 237–248. <https://doi.org/10.1027/2151-2604/a000387>
- Kathawalla, U.-K., Silverstein, P., & Syed, M. (2021). Easing Into Open Science: A Guide for Graduate Students and Their Advisors. *Collabra: Psychology*, 7(1), 18684. <https://doi.org/10.1525/collabra.18684>