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

Go to menti.com and enter 2334 8585, or:

Resources

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

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…

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

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

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

Eight Steps to Open Science

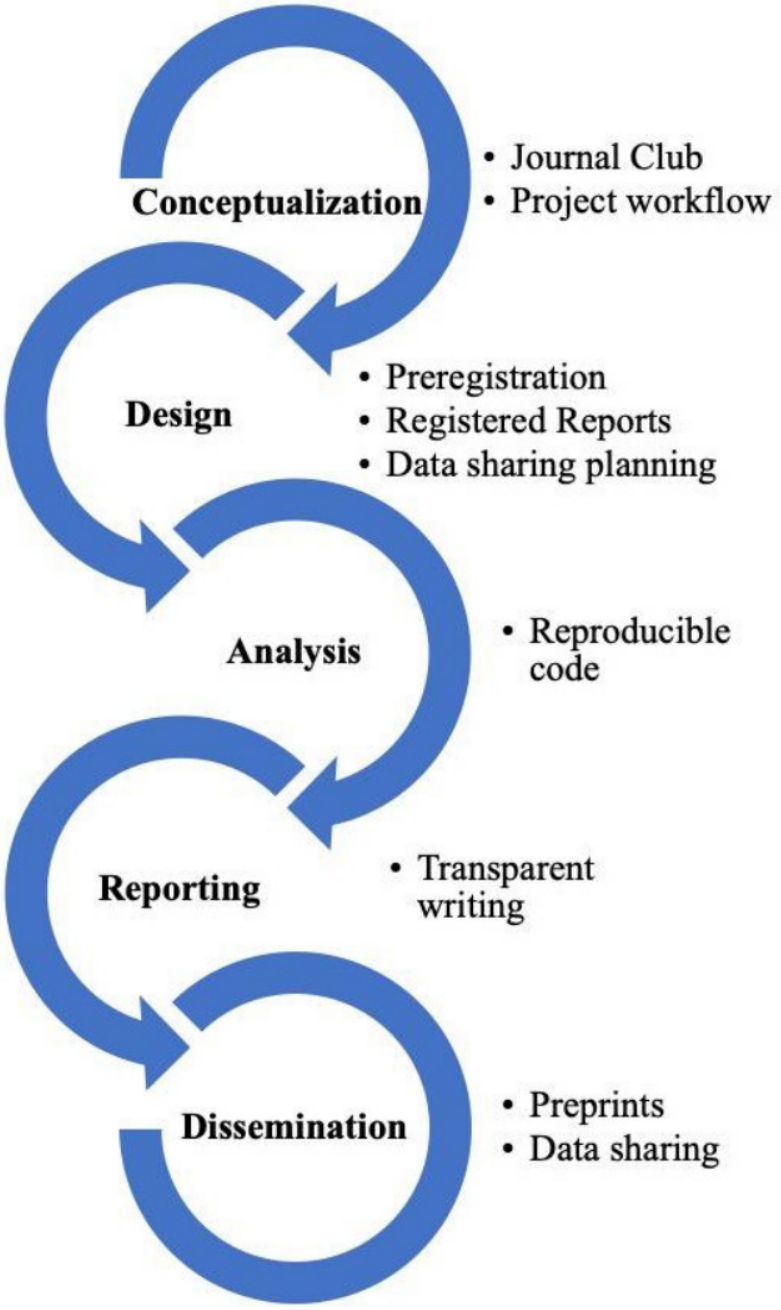

Figure 1. Open Science research practices across the research cycle

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

Journal Club

- level: Easy
- e.g., ReproducibiliTea Berlin
  - discuss topics and share knowledge on Open Science Practices

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

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

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 propreitary software (paid licences, e.g., SPSS, Matlab)
  - use open software (e.g., R, Python)
  - use a programming language and include useful comments

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

Transparent writing

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

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

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

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

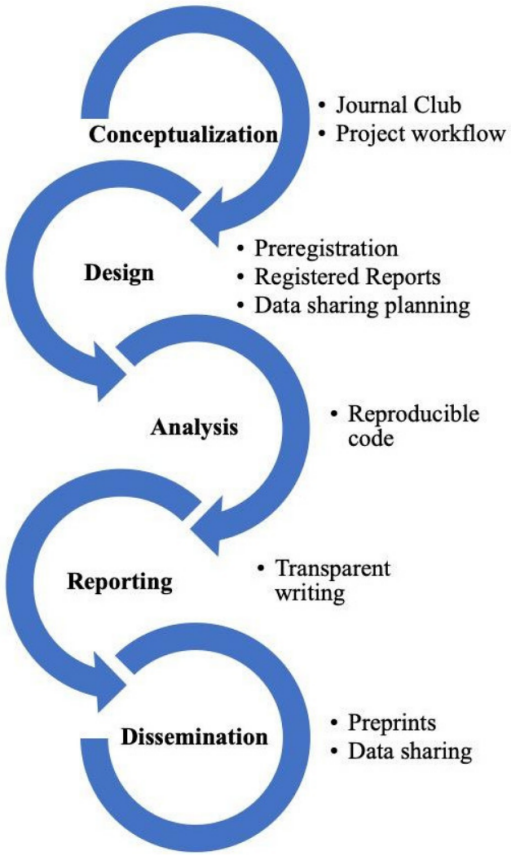

Figure 1. Open Science research practices across the research cycle

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

Further resources

- Open Science Framework (OSF)
- OSF Project page for Kathawalla et al. (2021)

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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