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

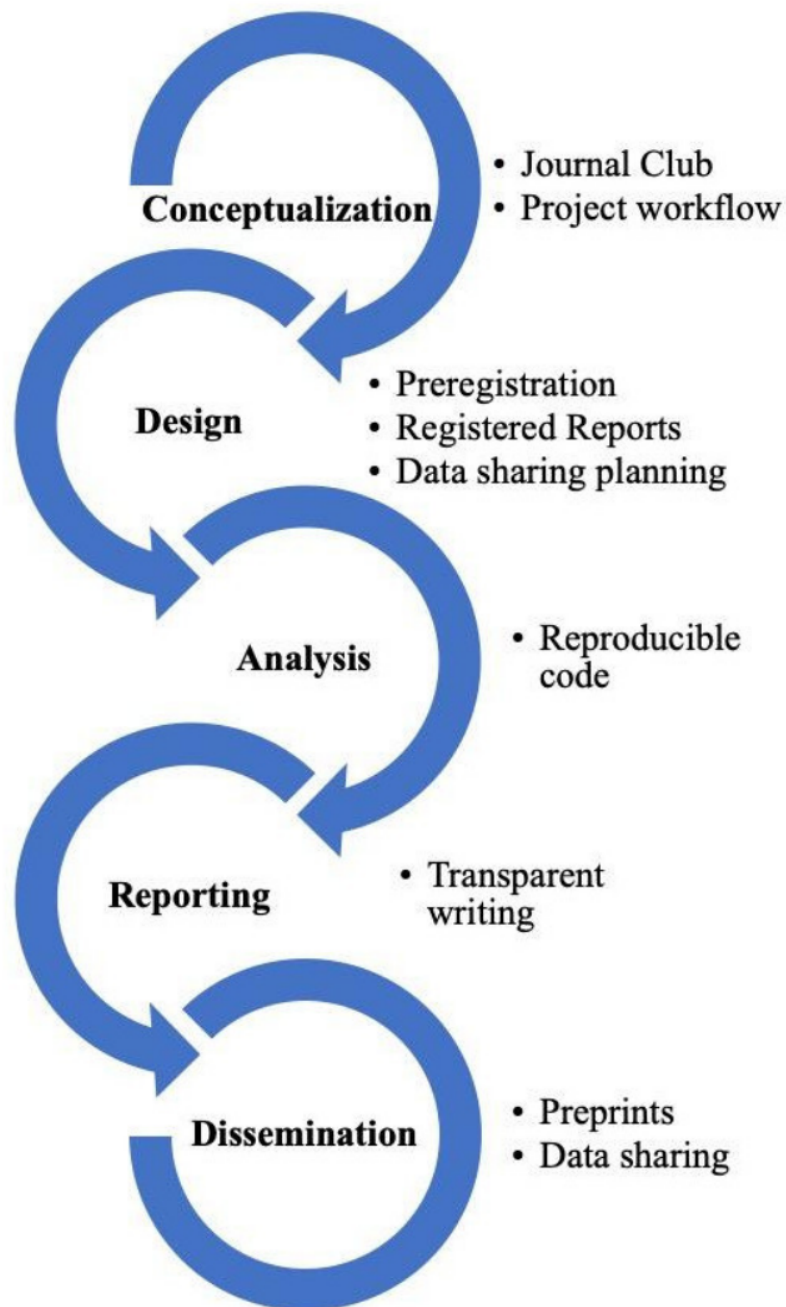- the important thing is to do what you can

Eight Steps to Open Science

Figure 1. Open Science research practices across the research cycle

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
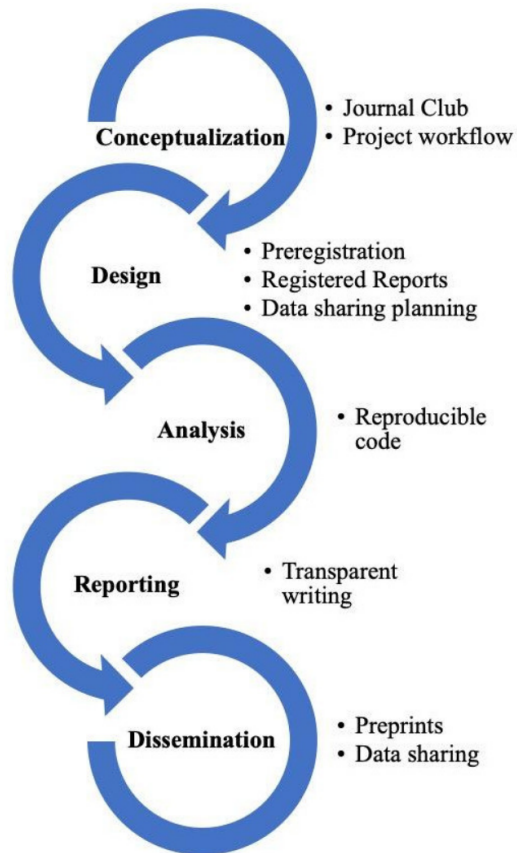- all in the RStudio environment

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)

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