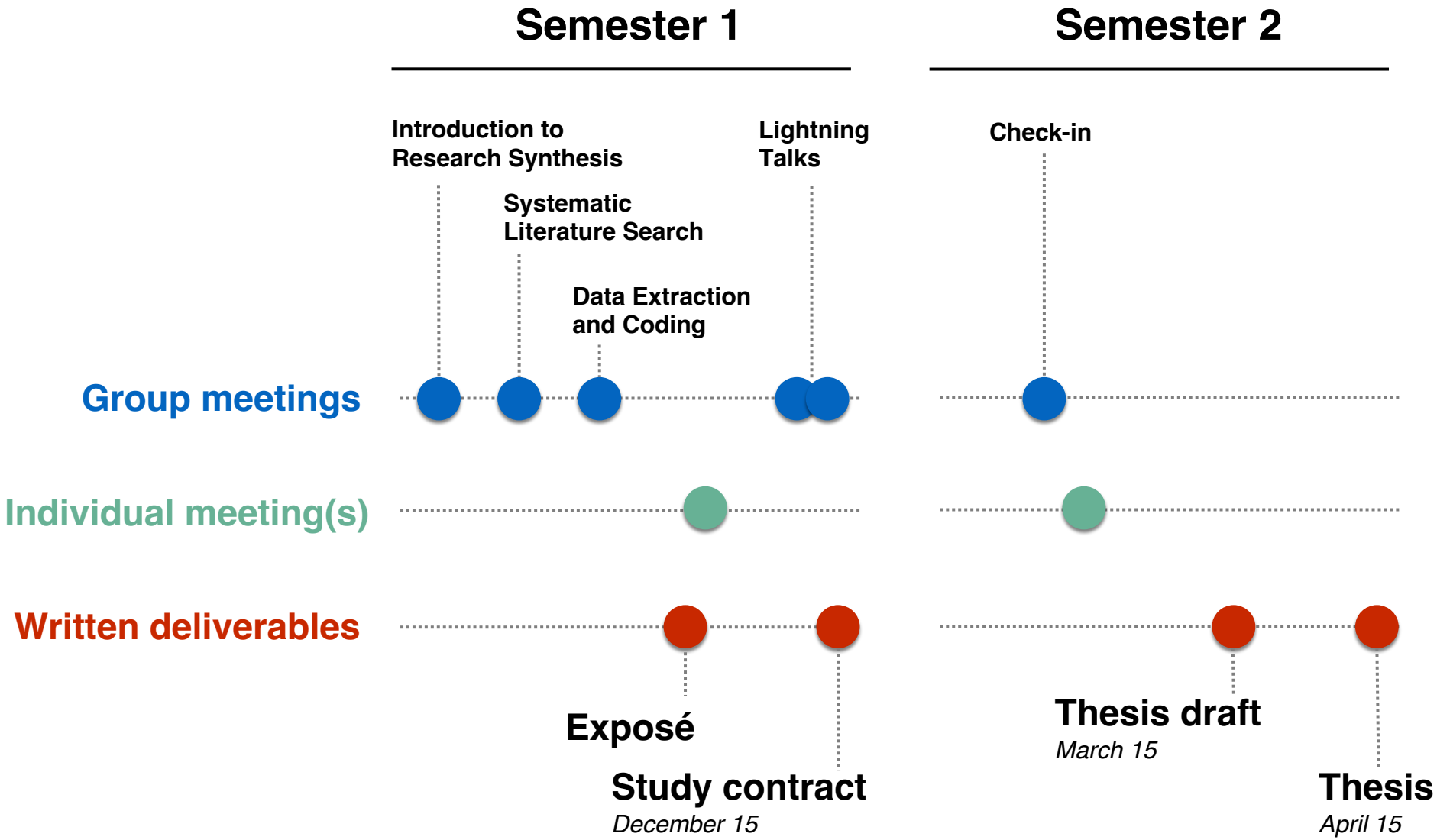
# Introduction to Research Synthesis

Loreen Tisdall, Maximilian Theisen, Rui Mata

October 8th 2024

# Timeline


Semester 1
Semester 2
Introduction to Research Synthesis
Lightning Talks
Check-in
Systematic Literature Search
Data Extraction and Coding
Group meetings
Individual meeting(s)
Written deliverables
Exposé
Study contract
December 15
Thesis draft
March 15
Thesis
April 15

# Agenda

1. Welcome (10 min)
2. What is a BSc thesis? (10 min)
3. Research synthesis (15 min)
4. Developing a research question (55 min)
5. Wrap-up (5 min)

# What is a BSc thesis?

## Thesis ≅ scientific product/publication

abstract, intro, methods, results, discussion, references, figures/tables

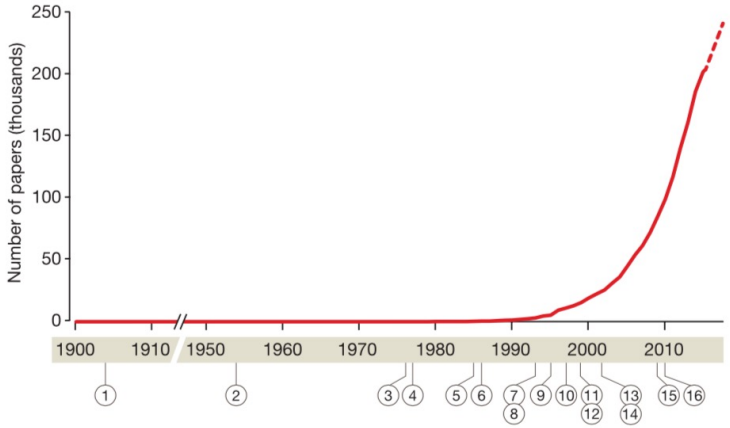
**Research synthesis**

systematic literature search + qualitative or quantitative summary of past results

Your thesis should demonstrate your ability to advance scientific knowledge while adopting appropriate guidelines and ethical principles of scientific conduct. Specific steps typically include:

– summarising extant research and identify research gap
– providing a rationale for the synthesis
– conducting a systematic literature search
– collating and analysing data (extraction and coding)
– reporting procedures and results appropriately (i.e., APA, PRISMA)

# Research synthesis: History




1. **1904** First (medical) meta-analysis published (effect of innoculation against typhoid) (ref. 83)
2. **1954** First meta-analytic methods formalized (fixed- and random-effects models) (ref. 86)
3. **1976** Term 'meta-analysis' coined (ref. 95)
4. **1977** First social science meta-analysis published (efficacy of psychotherapy) (ref. 87)
5. **1985** Statistics textbook dedicated to meta-analytic methods released (ref. 16)
6. **1986** Method for calculating between-study variance developed (ref. 96)
7. **1993** Review of 302 social science meta-analyses on treatment efficacy published (ref. 97)
8. **1993** Cochrane Collaboration established
9. **1995** Term 'systematic review' introduced (ref. 98)
10. **1997** Methods for assessing publication bias introduced (funnel plot and Egger's test) (ref. 19)
11. **1999** QUOROM (Quality of Reporting of Meta-analyses) standards developed (ref. 99)
12. **1999** Campbell Collaboration established
13. **2002** Heterogeneity index $I^2$ proposed (ref. 100)
14. **2002** Term 'network meta-analysis' coined (ref. 74)
15. **2009** PRISMA guidelines established (ref. 12)
16. **2010** *metafor* (free and comprehensive R package for meta-analysis) released (ref. 17)

Gurevitch, J., Koricheva, J., Nakagawa, S., & Stewart, G. (2018). Meta-analysis and the science of research synthesis. *Nature, 555*, 175. http://doi.org/10.1038/nature25753

# Research synthesis: Systematic Reviews and Meta-analysis

**Table 2 PRISMA-P terminology**

| Term | Definition |
|---|---|
| Systematic review | A systematic review attempts to collate all relevant evidences that fits pre-specified eligibility criteria to answer a specific research question. It uses explicit, systematic methods to minimize bias in the identification, selection, synthesis, and summary of studies. When done well, this provides reliable findings from which conclusions can be drawn and decisions made [25,26]. The key characteristics of a systematic review are (a) a clearly stated set of objectives with an explicit, reproducible methodology; (b) a systematic search that attempts to identify all studies that would meet the eligibility criteria; (c) an assessment of the validity of the findings of the included studies (e.g., assessment of risk of bias and confidence in cumulative estimates); and (d) systematic presentation, and synthesis, of the characteristics and findings of the included studies |
| Meta-analysis | Meta-analysis is the use of statistical techniques to combine and summarize the results of multiple studies; they may or may be contained within a systematic review. By combining data from several studies, meta-analyses can provide more precise estimates of the effects of health care than those derived from the individual studies |
| Protocol | In the context of systematic reviews and meta-analyses, a protocol is a document that presents an explicit plan for a systematic review. The protocol details the rationale and *a priori* methodological and analytical approach of the review |

PRISMA-P Group, Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., et al. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Systematic Reviews, 4(1), e1000326–9. http://doi.org/10.1186/2046-4053-4-1

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. P. A., et al. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. Bmj, 339(jul21 1), b2700–b2700. http://doi.org/10.1136/bmj.b2700

# Research synthesis: Charts & plots

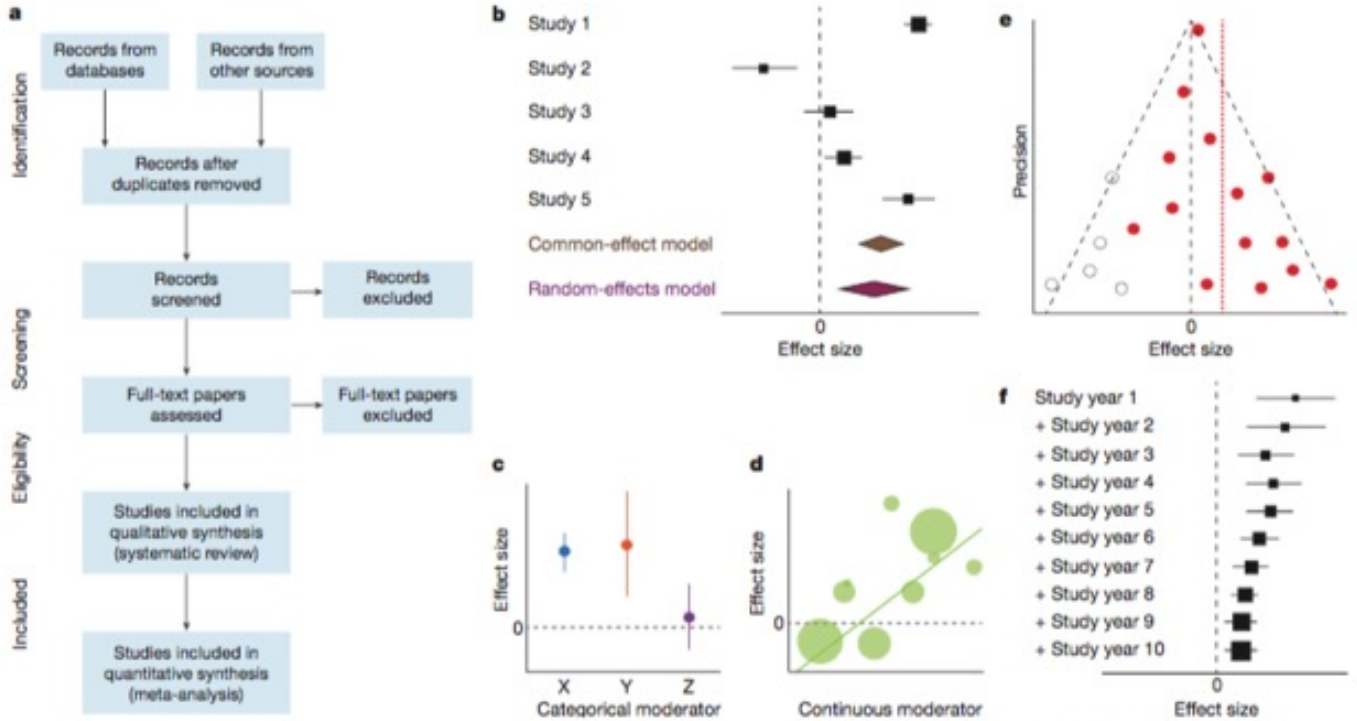



**Figure 1 | Various charts and plots common to meta-analysis.** **a**, A PRISMA flow diagram[12], which describes information flow (the number of relevant publications) at the four stages of the systematic review process ('identification', 'screening', 'eligibility' and 'included'). **b**, A 'forest' plot of the various means (symbol centres), confidence limits (95% confidence intervals; whiskers) and precision (indicated by the size or 'weight' of the symbols, with larger symbols indicating greater precision) of the effect-size determined from individual studies (black), and the overall means (symbol centres) and 95% confidence intervals (symbol widths) determined using meta-analysis with a common-effect (or fixed-effect) model (brown) and a random-effects model (purple). This type of plot is used to represent effect sizes and their confidence intervals graphically. **c**, A summary 'forest' plot of the mean effect sizes and 95% confidence intervals for different groups of studies. This type of plot may be used to assess categorical moderators (denoted X, Y and Z here) and are common in EEC and some social sciences. **d**, A 'bubble' plot showing a line predicted from a meta-regression analysis; the sizes of the bubbles reflect the sample sizes of the individual studies. This type of plot may be used to assess continuous predictors (such as publication year or length of a treatment). **e**, A 'funnel' plot displays the effect size against the precision with which it is estimated, which relates to its weight. Here we illustrate data (red points, with the dotted red line indicating an overall effect) that display 'funnel asymmetry', which could indicate publication bias, along with data (open circles) obtained after applying the trim-and-fill method, a sensitivity analysis that corrects for a potential publication bias. **f**, A 'forest' plot of a cumulative meta-analysis in which outcomes are added into the analysis in chronological order, demonstrating an increase in precision and a convergence of effect sizes as studies are added, and a temporal trend across studies. The dashed black lines in **b**–**f** indicate 'no effect' of an intervention on the outcome.

Gurevitch, J., Koricheva, J., Nakagawa, S., & Stewart, G. (2018). Meta-analysis and the science of research synthesis. Nature, 555, 175. http://doi.org/10.1038/nature25753

# Research synthesis: Rapid and Scoping reviews

Rapid reviews are a form of knowledge synthesis in which components of the systematic review process are simplified or omitted to produce information in a timely manner.

Tricco, A. C., Antony, J., Zarin, W., Strifler, L., Ghassemi, M., Ivory, J., et al. (2015). A scoping review of rapid review methods. *BMC Medicine*, *13*(1), 224. http://doi.org/10.1186/s12916-015-0465-6

Scoping reviews can be conducted to meet various objectives. They may examine the extent (that is, size), range (variety), and nature (characteristics) of the evidence on a topic or question; determine the value of undertaking a systematic review; summarize findings from a body of knowledge that is heterogeneous in methods or discipline; or identify gaps in the literature to aid the planning and commissioning of future research. (…) Systematic reviews are useful for answering clearly defined questions (for example, “Does this intervention improve specified outcomes when compared with a given comparator in this population?”), whereas scoping reviews are useful for answering much broader questions (such as “What is the nature of the evidence for this intervention?” or “What is known about this concept?”).

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467–473. http://doi.org/10.7326/M18-0850

# Research synthesis: Umbrella reviews

**Umbrella reviews** are reviews of previously published systematic reviews or meta-analyses, and consist in the repetition of the meta-analyses following a uniform approach for all factors to allow their comparison.

Fusar-Poli, P., & Radua, J. (2018). Ten simple rules for conducting umbrella reviews. *Evidence Based Mental Health*, *21*(3), 95–100. http://doi.org/10.1136/ebmental-2018-300014

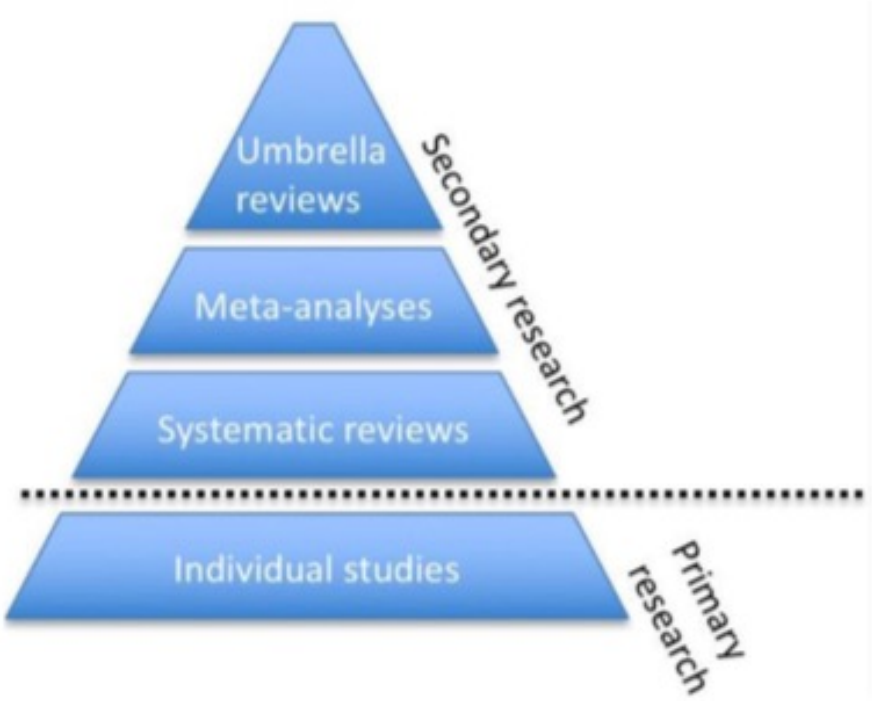



**Figure 1** Hierarchy of evidence synthesis methods.

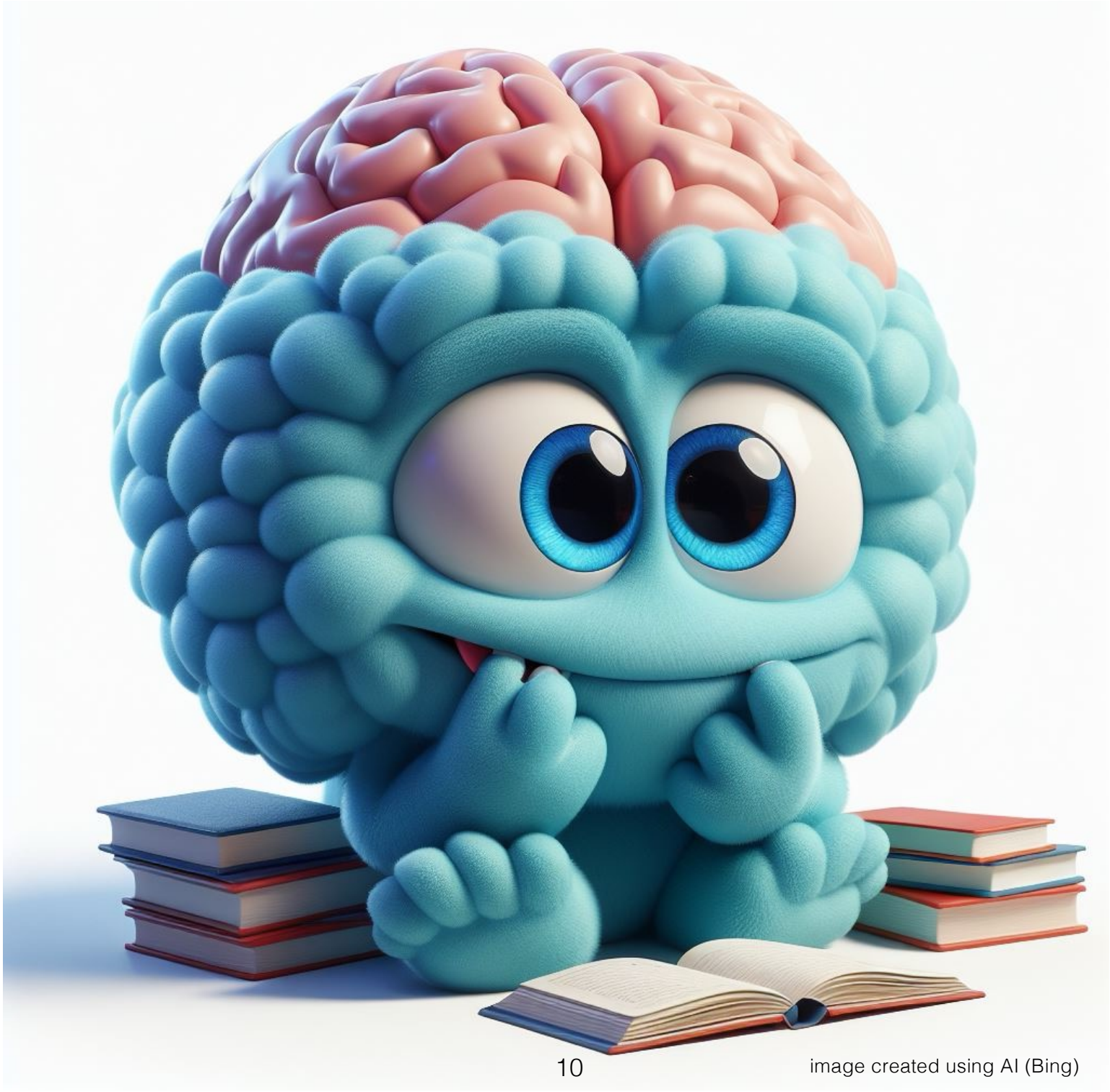




image created using AI (Bing)

# How do I develop my very own research question?

## Be specific

*General*: Does risk taking vary across the life span?

*Specific*: Do young and older adults differ in reckless driving?

*General*: Are there gender differences in social interaction?

*Specific*: How do women and men negotiate salary?

## Be innovative

Create a new topic by overlapping existing topics (age differences in risk taking & public safety) or applying an existing theory to a new area (health psychology models applied to sustainable behavior)

## Be patient

This process typically takes several rounds – be patient and kind to yourself - good ideas take time…

## Exercise (5 min)

- Tell your partner about your interests and potential topic(s) for your BSc thesis and research synthesis approach to address it. Discuss potential challenges you can already anticipate
- Please bring back to the plenum:
  - A short title describing a possible topic
  - A description of the approach
  - Any pressing questions

## My BSc thesis…

- Title…
- Approach…
- Open issues…

# To do list (until October 15th)

- ☐ Check out examples of an Exposé, theses, and evaluation criteria

  ADAM: https://adam.unibas.ch/goto_adam_crs_1027835.html

  PASSWORD: cdsrules!

- ☐ Familiarize yourself with the PRISMA guidelines (e.g., checklist, flow diagram; http://www.prisma-statement.org)

- ☐ Read Atkinson & Cipriani (2018) and conduct a preliminary literature search based on a potential research question