

How to Write a Research Paper

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This procedure outlines in detail the steps and best practices to perform research and produce a manuscript for an academic journal article. Not all steps are necessary for every project, so you may want to ask your Research Advisor for suggestions. Conference papers and informal articles are often less rigorous, but this can still serve as a useful reference for such.

PROCEDURE

1. Create a control document to record decisions made during the research project. This acts as a reference for future decisionmaking (like defining your research question based on a chosen framework). [Find our template here.](#)
2. Form a research topic.
 - a. Determine the need.
 - i. Ask around: colleagues, experts, institutions, etc.
 - ii. Review existing literature.
 - b. Determine the scope of research.
 - i. Develop a manageable scope based on your expected timeline, resources, etc.
 - ii. Define your research question using frameworks like CIMO, PICO, or SPICE.
 - c. Create the tentative title for your project/paper.
3. Form a research project group and decide the following:
 - a. How will you each contribute? How much time? What resources?
 - b. Verify alignment and reduce risk by signing a Co-authorship and Collaborative Research Agreement. ISERG can supply a template Agreement upon request.
4. Create an outline for the project.
 - a. Activity categories vary per project, but usually at least include: preparation, literature review, experimentation, synthesis, manuscript, and publication.

- b. A Gantt chart is a great tool to track tasks and timeline. [Find our template here.](#)
- 5. Prepare for research.
 - a. Register the research plan, hypotheses, and analytical methods on an open registry like [OSF](#) to deter confirmation bias and selective reporting during the project.
 - b. Request an ethical and regulatory compliance check from your research advisor or a review board.
 - c. Establish a stewardship plan to ensure data and assets are archived according to FAIR (findable, accessible, interoperable, reusable) principles.
- 6. Perform a literature review.
 - a. Choose a literature review type (see Appendix A).
 - b. Set the search scope:
 - i. Publication date range
 - ii. Source types (journals, conference proceedings, patents, standards, trade reports, physical collections, etc.)
 - iii. Language and geography (English-language, regional, international, etc.)
 - iv. Methodology (empirical testing, physical prototyping, field surveys, theoretical modeling, etc.)
 - c. Perform the literature discovery.
 - i. Perform a manual search.
 - 1. Best practice is to search at least one broad database (e.g. Web of Science, Google Scholar, Semantic Scholar) and at least two domain-specific databases (e.g. PubMed, PsycINFO, USPTO).
 - 2. Use Boolean operators (AND, OR, NOT) with keywords to refine the search results. Syntax and conventions vary by database.
 - 3. Common practice is to use 5-15 unique search strings, with concept keyword phrases separated by “AND” and synonyms within a concept separated by “OR”. This may vary depending on your research topic.
 - 4. Save your search results into a BibTex file or similar for later screening and processing.
 - ii. After your manual search, use 3-5 high-quality “seed papers” for “citation snowballing”, searching backward and forward in the citation networks of the papers to discover relevant literature.

- iii. Literature discovery may be deemed complete when you have reached “conceptual saturation”, which is the point where continued searches yield no new relevant literature.
 - iv. Record data from all searches, including source name, date of search, exact search string, applied filters, initial result count, retained count, search results (this can be done easily in some databases via a file export), and notes (e.g. exclusion rationale).
 - v. Screen the search results for relevant literature.
 - 1. Referring to the [PRISMA flow chart](#) is recommended.
 - 2. Use the framework (e.g. CIMO) you used to define the research question to inform the inclusion criteria.
 - 3. Read titles and abstracts for initial screening, using two reviewers (“inter-raters”) if possible to reduce selection bias.
 - vi. There are AI-driven workflows for literature discovery, but they must be vetted for accuracy and comprehensiveness (see Appendix C).
 - d. Read the screened literature.
 - i. For relevant data, create a data-extraction matrix (columns for interested data types, rows for literature).
 - ii. Record relevant information.
 - 1. LLM tools like Gemini Notebook can be used to extract and organize data from literature, but these should only be used as a preliminary scoping exercise, and all results must be verified.
 - iii. Actively evaluate the literature for quality (you may have columns attached to the extraction matrix for qualifiers like “methodological rigor”).
 - e. Analyze and synthesize relevant information.
 - i. Use relevant tools for storage, representation, and analysis.
- 7. Perform the study or experiment.
 - a. Methodology will be dependent on your research question, team, timeline, and resources. Consult your Research Advisor for support.
 - b. Rigorous documentation of all experiment design, set-up, performance, and results should be recorded in a persistent lab notebook or equivalently rigorous software (e.g. SciNote, Benchling, Evernote, or Google Docs/Sheets, depending on your needs).
- 8. Draft the manuscript or other research assets or deliverables.
 - a. Create and insert graphics as needed from research and experiment data.

- b. LLMs like Gemini can review drafts for logical consistency, spelling and style, error spotting, and more, but a final review should be performed by the Research Advisor.
- 9. Publish the manuscript on an open pre-print server (e.g. Zenodo) if the publisher allows and/or if required by the Fundamental Research Exclusion (FRE) of the U.S. Export Administration Regulations (EAR).
- 10. Submit the assets for publication.
- 11. Celebrate!

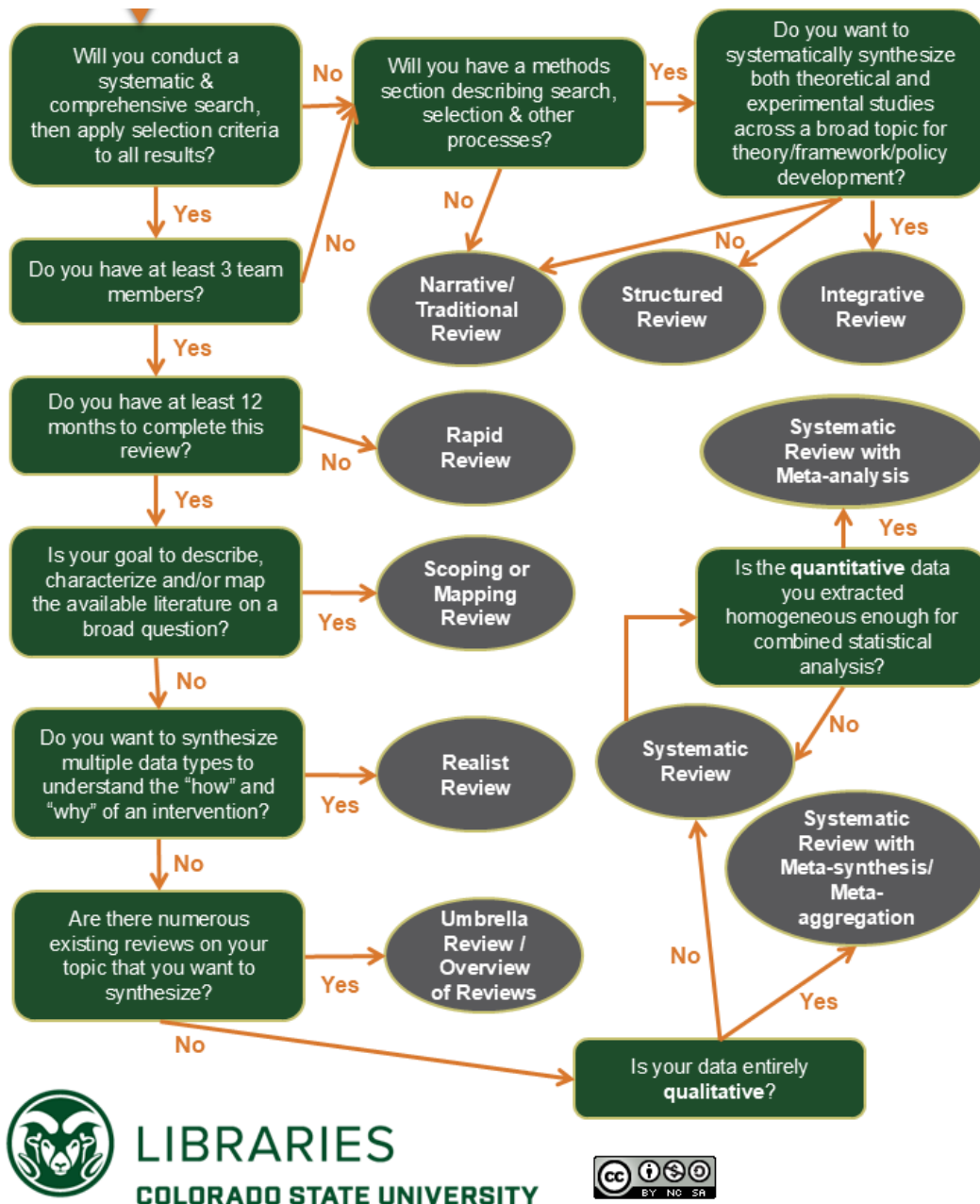
APPENDIX A – Choosing a Type of Literature Review

It is important to choose the most appropriate type of literature review for your project for efficiency and comprehensiveness. Use any of the following resources to help you make a confident choice.

[Review comparison chart by University of Melbourne](#)

[Right Review \(interactive survey tool\)](#)

Flowchart selector:



Methodology of the integrative review

If performing a systematic literature review, follow [PRISMA 2020](#) (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

- Follow the [PRISMA flow chart](#) to ensure comprehensive review and documentation.

APPENDIX B – Free Digital Tools

These are some powerful free tools to assist the production of academic literature.

Overleaf: <https://www.overleaf.com>

- A collaborative online LaTeX document editor. There are limitations to the free version, but it is a powerful way to create manuscripts and format them to publishers' templates.

Publish or Perish: <https://harzing.com/resources/publish-or-perish>

- Useful for bulk-downloading search results (DOIs, bibliographies, metadata, etc.) from popular databases.

Reference Extractor: <https://rintze.zelle.me/ref-extractor/>

- Useful for generating a bibliography file or selecting items in Zotero based on a manuscript's bibliography made via the Zotero plugin for Microsoft Word.

Spreadsheet to BibTeX Converter: https://nuwanjanaka.info/tools/csv_to_bibtex/

- Converts CSV or Excel files to BibTeX bibliography files (e.g. to import into Zotero).

Zotero: <https://www.zotero.org>

- All-around useful document manager. It can store, gather, display, and generate metadata, bibliographies, and citations for literature and other files. It has many extra features and has a plugin for Microsoft Word to assist with citation and bibliography generation. There is also a browser extension that allows for quick download of literature from the web.

APPENDIX C – AI Tools

AI tools must be used cautiously and not be relied on for accuracy or comprehensiveness – all results of such tools should be fully verified by a human researcher. Various AI tools to assist academic literature are below.

Conversational Assistants (Gemini, Claude, ChatGPT, etc.)

- AI tools that can speed up initial outlining, scoping, brainstorming, and editing. They should not be used for comprehensive literature discovery, analysis, synthesis, or for producing final literature or other research assets.

Gemini Notebook (formerly Notebook LM): <https://notebooklm.google.com>

- An AI analysis tool that can analyze and synthesize information from a targeted set of literature or other resources. This reduces “hallucinations” and improves relevance of results since web-sourced information can be excluded; however, hallucinations are still possible.

Research Rabbit: <https://app.researchrabbit.ai>

- An AI tool to assist with literature discovery and “citation snowballing”.