

Literature synthesis/review for regular research papers

- All research papers should review existing literatures/papers to synthesize the current state of understanding on the particular subject that the paper intends to address.
- Literature reviews helps frame the problem, put and the research into a proper context.
- It can motivate the manuscript by showing the historical and scholarly context of the problem and justify the manuscript by showing that good research is needed to solve existing problems.
- The literature synthesis can demonstrate that an author's manuscript is a meaningful contribution to a meaningful problem.
- Literature synthesis is often part of the Introduction section, although when it is relatively long it can be organized into a subsection of Introduction or has its own section after Introduction.
- Ph.D. dissertations often have a separate section on literature review.

What should a literature review in a research be like?

- The best literature syntheses contain critical evaluations of previous literature, dead-end research directions, forgotten gems from the literature, unpublished conference preprints, and questions still to be addressed, pointing toward potential avenues for further investigation.
- Synthesizing the previous literature also holds you up to the scrutiny of all the previous authors who you cite — authors who are depending on you to understand and accurately cite their literature.
- Scholarly literature syntheses can become the equivalent of textbooks for students and scientists who are surveying the field. Thus, every effort should be made to be complete, accurate, and fair.
- Authors should synthesize and critique the past literature, showing explicitly how their manuscript compares and contrasts to previously published work.
- The literature synthesis for a review article might be most of the manuscript. In other manuscripts, a literature synthesis that is long enough might be its own section. Alternatively, the previous literature may be discussed only as part of the introduction.
- Discussions of cited literature do not have to be all in the Introduction or Literature synthesis section, they can be weaved throughout the paper, e.g., when comparing the author's results to that of the previous literature in the results or discussion section.

To measure the quality of a literature review, Boote and Beile (2005) constructed a rubric consisting of twelve criteria grouped into five categories (Table 4.5). These criteria reveal four common weaknesses in literature syntheses that are often identified by reviewers.

Table 4.5 Rubric for determining the quality of a literature synthesis (excerpted from Table 1 in Boote and Beile 2005)

| Category | Criterion |
|-----------------|--|
| Coverage | Justified criteria for inclusion and exclusion from review |
| Synthesis | Distinguished what has been done in the field from what needs to be done Placed the topic or problem in the broader scholarly literature Placed the research in the historical context of the field Acquired and enhanced the subject vocabulary Articulated important variables and phenomena relevant to the topic Synthesized and gained a new perspective on the literature |
| Methodology | Identified the main methodologies and research techniques that have been used in the field, and their advantages and disadvantages Related ideas and theories in the field to research methodologies |
| Significance | Rationalized the practical significance of the research problem Rationalized the scholarly significance of the research problem |
| Rhetoric | Was written with a coherent, clear structure that supported the review |

Common weaknesses in literature syntheses

1. Coverage not well defined—Too little or too much.

The literature synthesis should be clearly focused on a specific theme. The scope of synthesis should be bounded, clearly defined, and stated at the beginning. Key terms should be defined first.

The coverage may be too little and too much.

Too little.

- Some authors may only cite a few articles that they deem most important or relevant.
- They may only list those articles that they or their close colleagues have coauthored.
- Some literature syntheses, especially those from early career scientists, may have the tendency to cite only papers published within the last ten years.
- The authors may fail to balance their review by picking only those references that support their argument.
- Discuss papers that you don't agree with, say the reasons that you disagree, then present the evidence that supports your argument versus the evidence that does not support it.

Too much.

- The literature synthesis section should not list every single paper that has influenced, inspired, or infuriated the author.
- The synthesis will then be lengthy and dominate the early part of the manuscript, lacking focus. It can cause the reader to become exhausted going through the previous literature instead of being energized by reading about the present work.

2. No synthesis or discussion of methodologies—“Just the facts.”

- To be effective, the previous literature must tell a story that is relevant to the audience.
- Do not simply provide a list of references with little explanation or interpretation.
- This approach of delivering “just the facts” robs the reader of any context for why the information is being presented. The review does not provide ‘added value’ – the readers will have to read the original papers.
- Unnecessary references should be removed, leaving only those that contribute to understanding the manuscript, the remaining references should be integrated into a cohesive narrative.
- Remember to describe the topic, not the papers themselves.
- The organization for such narratives could be thematic or chronologic.
- Show that you truly understand the matters being reviewed.
- Use your own words to describe other people’s work.

3. Significance not discussed.

- Should tell the readers the practical or scholarly significance of various research referenced.

4. Poor structure — The grocery list.

- It's like "Dunn (1983) showed this. Carpenter (1993) did that. Onton et al. (2001) demonstrated the following."
- Such listing of articles is devoid of context and often organization.
- Perhaps authors assume the audience knows why they were cited or believe that such a list is sufficient to convey insight. It suggests that The authors may not even have read them.
- Grocery lists are often "just the facts" reviews, too.
- Avoid sentences lacking quantifiables or specificity. An example is "Very little research has investigated bow echoes in Europe." In contrast, the following statement is more easily defended: "Compared to the United States, less research on the climatology of bow echoes has been done in Europe in the last 50 years."
- The literature synthesis, even if in a specific section of the manuscript, should not be isolated from the rest of the manuscript. For instance, connections are often made between the discussion section and the literature.

Writing review papers

- Reviews or review papers are articles, focused on a specific topic, that synthesize previous research accomplishments, summarize the state of the science, and suggest avenues for future research.
- Many Reviews are as valuable as textbooks, but often more current than textbooks, and can contain issues/theories still under debate.
- A good Review often requires more time and effort to research and write than does a regular research article.
- In a Review, the overarching theme should be clear. Boundaries of what will and will not be discussed should be stated explicitly early in the paper.
- Authors of Reviews should not be afraid to address the failures and limitations of research previously published, although fairness is imperative.
- Controversy is healthy in science, and all authors should dare to address these issues.
- The best Reviews can resolve outstanding controversies in the literature, especially if the authors involved with the controversy did not cleanly resolve them within their own published works.
- Synthesizing the previous literature can be quite demanding as the author faces the scrutiny of all the previous authors cited.

Based on: Schultz, D. M., 2008: The past, present, and future of Monthly Weather Review. *Mon. Wea. Rev.*, **136**, 3-6, 10.1175/2007MWR9047.

Meteorological Monographs Volume 59 (2018): “A Century of Progress in Atmospheric and Related Sciences: Celebrating the American Meteorological Society Centennial” has 27 chapters that review the progresses over the last 100 years in different subject area.

Houze, R. A., 2018: 100 Years of Research on Mesoscale Convective Systems. *Meteorological Monographs*, 59, 17.11-17.54, 10.1175/AMSMONOGRAPHS-D-18-0001.1.

Emanuel, K., 2018: 100 Years of Progress in Tropical Cyclone Research. *Meteorological Monographs*, 59, 15.11-15.68, 10.1175/AMSMONOGRAPHS-D-18-0016.1.

Brooks, H. E., and Coauthors, 2019: A Century of Progress in Severe Convective Storm Research and Forecasting. *Meteorological Monographs*, 59, 18.11-18.41, 10.1175/AMSMONOGRAPHS-D-18-0026.1.

LeMone, M. A., and Coauthors, 2019: 100 Years of Progress in Boundary Layer Meteorology. *Meteorological Monographs*, 59, 9.1-9.85, 10.1175/AMSMONOGRAPHS-D-18-0013.1.

Meteorological Monographs Volume 28 (2001): Severe Convective Storms (Doswell, C. A., III, Ed.), 561pp has 13 chapters that are essentially review papers on convective storms and tornadoes.

Reviews of Geophysics is an invitation-only reviews journal that provides overviews of recent research in all areas of the Earth and space sciences. It has an impact factor of 22. See <https://agupubs.onlinelibrary.wiley.com/journal/19449208>.

Examples of review papers

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