JOURNAL OF ASTRONOMY & EARTH SCIENCES EDUCATION

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EDITOR'S NOTE

Yes, Your Methods Section is Boring, But Critically Important

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ABSTRACT

When judging how important and influential a published article is in a refereed journal, the most important thing one might pay attention to is the evidence-based conclusion and the implications of that conclusion (Slater, 2019). At the same time, another way to judge an article's influence is by looking at how frequently the article is cited, using a tool such as scholar.google.com: The caveat to high citation numbers being a great measure of importance and value is that sometimes a published paper is highly cited simply because its conclusions are incorrect and many authors are capitalizing on the opportunity to correct its mistaken message (Slater, 2018a). A third important component to a great paper is how well the research is situated in the existing literature landscape - the compulsory literature review. The best papers clearly specify the research question's space by stating what is known, what is not known, and why the paper in question fills an important gap in the scholarly community's understanding (Slater, 2018a). What is missing in the most common list of criteria for greatness - conclusions, citations, and situation in the existing literature - is an acknowledgement of the critical importance of the methods section.

Let's face it. The METHODS section of a science paper is usually the most boring to write, and perhaps even more boring to read. The methods section of a scientific paper is where your step-by-step procedure for conducting your study is outlined in great detail. For discipline-based science education papers, the methods section usually starts with a detailed description of who the participants were and how they were selected. This is important as reviewers need to make a judgement about the relative "specialness" of the people being studied. If one were studying 10-year old students' knowledge of astronomy, and all of the students were kids of professional astronomers or lived in a town where everyone spent weekends at the local planetarium, those research-subjects might have a very different knowledge, experience, and motivation base than a sample of students who have never been to a museum in the first place.

As another example of why this is important, studies of science teacher training often struggle with the nature of their sample because researchers use the people in front of them, their own students - a sample of convenience. Convenience samples where education researchers study their own students are subject to inherent bias of the researcher/teacher who often hopes that their own students to do well and learn regardless of any teaching method being employed, which can inadvertently influence how data is collected and how results are interpreted. Any methods section needs to carefully describe who the research-subjects are so that any biases can be considered.

In addition to a detailed description and analysis of who the research subjects are, a full description of any instruments, surveys, tests, or interview scripts needs to be provided for the reader to consider. If you were giving students a rock identification test in geology using English, and most students were weak English readers, one might end up getting a result that more closely measures students reading ability rather than their geology knowledge. Similarly, for multiple-choice tests where the pre-test score is 25% correct, this could very well be interpreted as students simply guessing at answers rather than revealing anything substantive about their incoming knowledge. In science education studies, it is usually better to use tools developed by someone other than the researcher themselves so that there is no inherent bias in these cases either.

Such an analysis leaves out the critical reason that science education research papers—and all scientific reports for that matter - need an especially strong methods section. The top-line reason for providing an accurate description is that one of the heralded hallmarks of the scientific process is that science is reproducible. Reproducibility is so

important that there was once even a journal dedicated to the special situation of irreproducible results named The Journal of Irreproducible Results. This perspective is further buoyed up by most of us having memories that every science teacher in every grade we had emphasize the importance of carefully writing out one's procedure in step-by-step detail a science project. If your methods section lacks detail, then not only can readers judge the appropriateness of your approach to answering your question, other researchers would be unable to reproduce your study accurately, which is demanded by the nature of science.

Are methods sections boring? Methods sections are definitely boring. Methods sections should be free from flowery or poetic language and focus on specifying enough detail so that the work can be reproduced and, if necessary, argue for why the chosen research method best fits the problem being tackled (Slater, 2018b). Paying attention to the methods section will definitely improve your chances of successfully navigating the review process.

REFERENCES

Slater, T. F. (2018a). Improving your argument by identifying a literature gap. *Journal of Astronomy & Earth Sciences Education, 5*(1), i-ii.

Slater, T. F. (2018b). Does your article need a methods or methodology sub-section? *Journal of Astronomy & Earth Sciences Education, 5*(2), i-ii.

Slater, T. F. (2019). Editor's note: Your article benefits from a compelling conclusion. *Journal of Astronomy & Earth Sciences Education, 6*(1), i-v.

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