

Guide to Aspiring Authors

Kristen St. John,^{1,a} Editor-in-Chief, JGE, Dan Dickerson,² Editor for Curriculum and Instruction, and Karen S. McNeal,³ Editor for Research

In summer 2013, one of the Editors of JGE had the opportunity to help facilitate an *On the Cutting Edge-InTeGrate* professional development workshop on Teaching Oceanography (<http://serc.carleton.edu/NAGTWorkshops/oceanography/workshop2013/index.html>). We know many readers have been participants in workshops such as this one, in which ideas, activities, and strategies about teaching and learning in a particular geoscience subject area are shared between leaders and participants, and often are disseminated through online portals and professional meetings beyond the workshop itself. However, a way to extend the impact of workshops to the broader community, as well as enhance one's individual scholarship, is to share original teaching activities and instructional strategies through academic publication in JGE. When this possibility was raised with several participants, it was clear that there was strong interest, but also uncertainty among the group as to the steps needed to transform their exemplary teaching practices and original geoscience curriculum into solid geoscience education manuscripts.

The editors of JGE think that this reaction reflects the realities of geoscience education being a young field of scholarly research. As Tony Feig elegantly explores in this issue (p. 306) we are at a juncture in geoscience education, where challenges and opportunities exist both for our scholars and for the community. One of the challenges is that, unlike other subdisciplines in the geosciences (e.g., geomorphology, geochemistry), the vast majority of postsecondary geoscience curricula do not include formal training to become a geoscience education scholar (Feig, 2013). How then does one make the transition from being a traditionally trained geoscientist with a strong commitment to quality teaching (a descriptor applicable to many workshop participants) to also being a geoscience education scholar?

We agree with Feig (2013), that the most common gateway to geoscience education research for many aspiring scholars are descriptive papers in which, at the most basic level, authors describe something they did in a course that they deemed effective and may therefore serve as a model for others. Descriptive papers have been at the core of JGE since its beginning in the 1970s, providing readership with many interesting ideas for teaching and learning that have applications to their own courses. The discipline of geoscience education continues to mature, however, becoming evermore rigorous and scholarly. This maturation is reflected in the rising expectations associated with JGE

manuscript submissions. For example, we have moved away from “data-free” descriptive articles and toward more robust, evidence-based Curriculum & Instruction (C&I) papers. We also have seen an explosion in empirical Research papers that employ rigorous quantitative and qualitative research methods commonly used in education and social sciences research.

Yet, it is clear from the workshop conversations this summer, and from the fact that few NAGT members regularly published in JGE (St. John, 2012), that we need to do more to support the many excellent educators and traditional geoscientists who are interested in pursuing geoscience education scholarship and publication. Therefore, what follows are a set of strategies that the editors for the JGE recommend to aspiring JGE authors. The advice is based on our collective observations of common impediments to publication that we see in submitted manuscripts, and on our own scholarly practices. The emphasis is largely on C&I papers, as that is the JGE submission category that most naturally aligns to the gateway paper described above, however, much of the advice applies to Research papers as well. Note that this does not replace the review criteria (<http://nagt-jge.org/page/review>) or the prepublication guidelines (http://jge.allentrack.net/cgi-bin/main.plex?form_type=display_auth_instructions&j_id=73), but provides a jargon-free, fundamental framework in which to consider these more detailed manuscript guidelines, and provides a place to begin for the novice geoscience education scholar.

1. **Do your homework, and put your work in a literature-based context.** Your good ideas cannot be communicated in a vacuum. Just like a traditional geoscience research paper, it is important to find out what has already been published that relates to the topic you plan to write about. Use the published literature to define the teaching and learning problem that your work addresses. Describe relevant studies and approaches to the same or similar problem and let readers know how your paper adds to the specific body of knowledge. The literature will set the stage for your unique contribution. A narrow (or missing) review of the literature is the second-most common mistake seen in new manuscript submissions. It is your responsibility to do your homework, read what has already been done, and summarize the relevant literature in the introduction of your paper. Reading recent JGE articles is a good start, but be sure to include a broad range of peer-reviewed journals (e.g., *Journal of Research in Science Education*, *International Journal of Science Education*, *Journal of Geography in Higher Education*). Not only will you gain richer and more relevant background information for your paper, you will also learn how science education

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¹Department of Geology and Environmental Science, James Madison University, Harrisonburg, Virginia 22807, USA

²Old Dominion University, Norfolk, Virginia 23529, USA

³North Carolina State University, Raleigh, North Carolina 27695, USA

^aAuthor to whom correspondence should be addressed. Electronic mail: stjohnke@jmu.edu. Tel: 540-568-6675. Fax: 540-568-8058

scholars effectively communicate their ideas and support their arguments.

2. **Evidence of effectiveness is essential to a strong argument.** While admittedly it is a great feeling to *intuitively* “know” when a particular curriculum unit or instructional method worked well in your course, intuition (or opinion) is not very convincing in peer-review scholarship. Weak (or complete lack of) evidence is the greatest mistake made in submissions by new authors. An argument that lacks firm evidence is a proposal, not a paper. Sound geoscience research uses empirical data to draw conclusions about geoscience materials and processes. Sound geoscience education research also uses empirical data to draw conclusions regarding the teaching and learning of geoscience. While this can be daunting, it is achievable, especially since evidence of effectiveness can take many forms (e.g., pre–post content tests, representative examples of student work (i.e., artifacts), semistructured interviews, etc.). A few notes of caution: Unless your goal is to explore changing student attitudes as a result of some intervention, student perception surveys are likely not the best way to go; in other words, just because students liked something you did in your class, does not mean they learned it. Also, bear in mind that the end of course grades are usually not a very strong indicator that a student learned a specific content learning goal during the course. Therefore, design appropriate ways to collect evidence that can be strongly linked to your learning goal. Additionally, be sure that your test is measuring what you think it is measuring. One way that education researchers provide evidence of this is by including information on psychometrics: the construction of instruments (i.e., assessments such as pre–post tests) and procedures for measurement. If you are not familiar with the development of educational research instruments, then consider using published instruments that have psychometrics reported. You can often find these when conducting your literature review; therefore, revisit point #1—do your homework and see what methods others have used to measure student learning outcomes. Do that homework now so that the next time you teach the course (or curriculum unit) you have data collection measures in place that can help you address your particular instructional objective or research question.
3. **Get familiar with IRB.** If the study you want to conduct and later describe in the manuscript involves human subjects (e.g., students, workshop participants, children, or adults), then it is your responsibility to seek and obtain Institutional Review Board (IRB) approval or exemption. The first time you do this it may be a little confusing, but do not let it be a roadblock. The purpose of these university or college committees is to comply with federal regulations (<http://www.hhs.gov/ohrp/assurances/irb/index.html>) and ensure that all research (i.e., medical, psychological, and even educational) done on people is ethical and responsible, and that no harm is done to the human subjects as a result of the methods used or data collected. Therefore, contact the chair of the IRB committee at your institution, and talk to others who have sought and gained IRB approval (or exemption) to get a sense of how it works at your institution. Unlike some research in the health sciences, the ideas you have on collecting data for a C&I investigation or geoscience education research study are probably low risk to the human subjects; they are either part of the normal educational practices, or can be collected in such a way that identifying information on students will not be reported (and not putting them at undue risk). For this reason, many of the methods used for geoscience education research will likely be considered exempt studies; however, it is the IRB committee that determines exemption status, not you or the editors at JGE. A good resource to learn more about IRB and how it applies to geoscience education research is Libarkin and Kurdziel (2004). If your academic institution does not have an IRB (K–12 schools and some 2-year colleges do not), then discuss your plan for conducting research with your administrator to seek appropriate approval and guidance.
4. **Consider collaborating.** Like many subdisciplines in the geosciences, geoscience education scholarship is interdisciplinary. Therefore, it may be beneficial to team up with a colleague in your institution’s college of education. They can provide added expertise, and should be familiar with additional relevant literature and appropriate education research methods. Be sure that you can communicate effectively with each other as you develop your shared interdisciplinary ideas on how to move forward in research and writing. Unnecessary jargon detracts from effective communication in collaborations and in manuscripts.
5. **Be concise but complete in describing what you did, how you did it, and who you did it with.** Assuming you have addressed a problem of broad concern in geoscience education teaching and learning (point #1 above), and have evidence of effectiveness (point #2 above), other instructors will likely want to apply some (or all) of what they have learned from your paper to their own teaching or research. That is not possible unless you have provided enough detail in the description of what you did, how you did it, and who you did it with. The challenge is to also be concise. Therefore, make good use of figures and table to communicate your ideas. Also consider including supplemental materials (e.g., syllabi, student handouts) that can be published on the journal website in conjunction with your JGE paper to support readers who want to use your approach as a model for their teaching.
6. **Do not just report results; discuss why they are meaningful both to your particular situation and more broadly.** A manuscript is not a lab report. The discussion section of a paper is where you connect again to the published literature and with your readership, so that the implications of your findings are meaningful to the broader community. This is the place to explore such extension questions as, How would your instructional method need to be modified for other class sizes, populations, or field locations? However, be cautious and do not overstep your

results by making assertions not supported by the study data or literature. It is also a place to describe potential next steps to your study that would address secondary questions that arose from your findings.

7. Lastly, **make good use of the peer-review comments when you revise your manuscript.** While no one likes reading critical reviews of one's own work, the constructive comments and questions posed by reviewers and editors are vitally important to the publication process. Be aware that it is common for manuscripts to undergo more than one cycle of revision and review. However, careful attention to reviewers' questions and concerns will improve your paper, help you become a stronger author and better scholar, and likely reduce the number of revisions necessary and the time to publication. And, if major or minor revisions are required, please indicate in the response letter that should accompany your revised manuscript exactly what changes you made and

where you made them (refer to line numbers); this will help to expedite secondary and tertiary reviews.

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