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When it comes to publishing research results in a thesis or journal article, a disconnect between advisor expectations and student abilities can be a source of frustration, fear, and deteriorated relationships. Publishing in conference publications, including Proceedings of Meetings on Acoustics (POMA), represents an opportunity to bridge this gap. This paper describes several benefits of publishing in conference proceedings, how to use POMA as a springboard to further publication, and some suggestions to help students and advisors overcome publication barriers.

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1. BACKGROUND

This article stems from a talk given at the 177th Meeting of the Acoustical Society of America, in a special interdisciplinary session entitled "Promoting Student Publishing Success." The session itself grew out of a discussion between Michael Haberman and me about the characteristics and skills possessed by highly productive student writers in physical and engineering acoustics and how we might effectively teach these traits. The session scope grew to include other organizers, Rajka Smiljanic and Anders Lofqvist, representing other technical committees, but the purpose of the session remained the same: to help academic advisors and students bridge the gap between expectations and abilities when it comes to scholarly writing. This paper describes how conference proceedings, and in particular *Proceedings of Meetings on Acoustics* (POMA), can be used to empower students to publish. Thus, this paper is directed at the student, and at the advisor, and at prospective advisors. However, it may be also useful for others, such as senior personnel in industry who grapple with teaching trainees to write clearly and concisely for a technical audience.

I concede at the outset that writing this article is a daunting task, as it could undergo an infinite number of revisions of scope and content as I learn how to implement effective principles and best practices in writing and how to teach those principles to others. However, I have two sets of experiences that I hope allow me to provide useful insights. First, I began as an associate editor of POMA when it was created in 2007, and have been its editor since 2011. During that time, I have been able to observe substantial growth and change in the journal and have interacted with many authors and heard their viewpoints and experiences. Second, I have tried to focus on helping students publish, and have been fortunate to publish articles (including POMA!) and papers with a relatively large number of students over the past 14 years. In any event, the study and thought that has gone into producing this paper will hopefully help me more effectively mentor students in research and writing, by empowering them to publish.

2. MENTORED RESEARCH RELATIONSHIPS

At the outset, a critical point to consider is the limited timeframe for a student's productive research and writing. I believe publication is the academic product of a fruitful mentored research relationship between student and advisor. Ineffective or adversarial advising founded on frustration or fear will almost certainly lower productivity. Kram[1] described four stages of a mentoring relationship that are certainly applicable to mentored research: Initiation, Cultivation, Separation, and Redefinition. These phases are natural and inevitable parts of the academic relationship. Initiation begins after a student is recruited, and consists of training and establishment of concrete research objectives. The transition from Initiation to Cultivation occurs with research productivity. Papers are most naturally written in the Cultivation phase because Separation, which occurs in tandem with the thesis defense and graduation, is may be fraught with tension due to the rapidly changing nature of the relationship. Even if the relationship survives into the rewarding peer-to-peer Redefinition phase, it is much more difficult to continue to try to publish papers from the Cultivated research. The student has begun new professional or academic challenges and time is limited. (My students and I continue to learn this painful lesson!) Therefore, it is essential that the Cultivation phase begin as early as possible and be designed to maximize the student's potential. Gee and Popper[2] have recently offered suggestions in that regard, and this paper adds to those suggestions by describing how Cultivation may be enhanced by using conference proceedings as an academic gardening tool.

3. STUDENT WRITING DIFFICULTIES

To cultivate published academic fruit, the "growing season" must be made as long as possible and the proper "implements" used. Although the Cultivation phase of mentored research is almost certainly longer for a doctoral candidate than for an undergraduate student, all mentoring relationships benefit from the student making the transition from Initiation to Cultivation as early as possible. However, a transition to meaningful research progress does not necessarily translate into an ability to produce a well-written manuscript. I have observed remarkably talented student writers at each academic level. Likewise, I can empathize with the students who, for one reason or another, struggle piecing together research into a cohesive flow. There are numerous difficulties that students encounter in writing, and in learning to write, and an understanding of the difficulties students face can be helpful in overcoming them.

To publish an article, a student must be able to write as an expert, and there are numerous barriers to achieving that goal. One of the most difficult barriers is stagnant writing ability. A 2009 study[3] of nearly 100 graduate students in higher education showed that they performed no better on a standardized writing test than high schoolers. The depressing conclusion, therefore, is that a university undergraduate education may do nothing to improve a student's writing skills. A review of the recent literature on writing pedagogy suggests that many universities in many disciplines are grappling with this problem, hopefully improving the situation. Other challenges include language, writer's anxiety[4], a new rhetoric, and lack of formative feedback by teaching assistants or professors.

Another challenge in writing is the difficulty in following logical, sequential steps. Ondrusek's[5] literature review of research into graduate students' writing ability discussed the Flower-Hayes[6] model for text creation, which is made up of the following steps:

- conceptualizing the rhetorical problem comprising the topic, the audience, and the writer's own goals
- retrieving knowledge from memory and external sources
- planning by generating and organizing ideas and setting goals
- translating ideas into written words
- reviewing progress through continuous evaluation and revision of the text.

Ondrusek further described research by Torrance and Galbraith[7] that describes how for an inexperienced writer, these different steps end up competing for attention, rather than flowing sequentially. Whatever the barriers, the reality is that the average undergraduate and graduate student simply does not have the tools to fully Cultivate mentored research. How do we improve the situation?

4. IMPORTANCE OF CONFERENCE PROCEEDINGS

Two acoustics-related analogies may be helpful to describe why I believe the Cultivation phase of mentored research can be prolonged and enhanced using conference proceedings as a tool. The first deals with impedance and the second with feedback control.

A. AN IMPEDANCE ANALOGY

In an acoustic system, the transmission of power between different media is determined by their relative impedances. The greater the difference, the more incident energy is reflected, rather than transmitted. On the other hand, impedance matching can greatly improve coupling between different systems or media. For example, a horn increases radiated power from brass instruments. In medicine, an impedance-matching gel is used to couple an ultrasound probe to the body in order to more efficiently transmit energy and improve the return signal strength. The ossicles in the human ear act as an impedance matching medium; without the function of the middle ear, little power would be transmitted from the air-filled outer ear to the liquid-filled cochlea.

Hopefully, the analogy between power transmission across two disparate media and the disconnect between scholarly writing expectations and abilities is clear. The faculty advisor and the discipline demand the student write as an expert, whereas the student is ill-prepared for this jump. Consequently, the ability to produce transmission of new knowledge in the form of publications is inefficient. Journal article manuscripts may require revision after revision, as the advisor and student simultaneously hunt for the proper scope, content, organization, language, and style. The impedance mismatch is simply too large and frustration grows.

The conference proceedings paper effectively serves as an impedance-matching layer, to provide a legitimate publication opportunity that helps the student learn to rise to the expectations of scholarly writing. Rather than approaching the eventual goal of journal publication by producing draft after draft as mutual frustration grows, the conference proceedings paper – likely more limited in scope and length – allows the student to produce a complete work as he or she is learning. A former student shared this anecdote, "I already considered myself a decent writer when I began graduate school. However, my first submission to JASA [Journal of the Acoustical Society of America] was rejected, mostly because it had an inappropriate scope or 'story' to support the main idea I was trying to convey. I then wrote two POMA articles, during which process I learned about paper scope and other technical writing fundamentals. At this point I was able to rewrite the original article and have it accepted as an Express Letter, followed quickly by a second article accepted in Noise Control Engineering Journal."

B. A FEEDBACK CONTROL ANALOGY

A feedback control analogy is also illustrative. A completed proceedings paper and its publication serve as motivating feedback for the student, but the analogy may be extended further. For example, in active noise control, a successful feedback controller requires minimization of latency, especially for broadband global noise reduction. Latency refers to the system delay and dictates how much control can be achieved. Latency minimization could have at least two meanings here. First, the time it takes to see a publication finished is reduced for a conference proceedings. Second, latency minimization can also be achieved with early feedback from an advisor, which is more likely to occur with a shorter publication. This early, timely feedback is important in another way: Bloom[4] has described how feedback helps reduce novice writer anxiety, thus reshaping the student's attitudes about writing.

Early, formative writing feedback does more than also help the student learn the process of text creation. It also helps to impact the scientific thought that produces the research. Gopen and Swan[8] argue that learning to write clearly will improve the research process: "The results are substantive, not merely cosmetic: Improving the quality of writing actually improves the quality of thought." In my own efforts to mentor students in research, I have repeatedly found this to be the case. The earlier we begin to plan to write and to try to organize a logical, complete, and cohesive scientific story, the earlier we identify gaps in that story. The written draft, or even outline, of preliminary results to be presented on at a conference serves as an opportunity to impact the actual research process – resulting in more efficient preparation of journal manuscripts to be submitted for peer review. Ultimately, a writer's ability to produce a written journal manuscript is the sum of her skill, attitudes, and the technical content to be conveyed, and there is evidence that early feedback can help improve all three. The conference proceedings paper provides a meaningful vehicle for providing that early feedback.

5. REASONS FOR PUBLISHING IN POMA

I hope to have made a case for encouraging students to publish in conference proceedings, even if the effort and sacrifice are not always accepted at academic altars. I believe, based on mentoring experiences and discussions with others, that publication in proceedings helps the student transition into the Cultivation phase earlier, leading to increased student confidence and overall greater productivity.

Proceedings papers are, of course, tied to conferences. Some conferences require a conference paper, whereas the biannual Acoustical Society of America (ASA) meetings typically do not. But, POMA was created in 2007 to help fill a gap in the ASA's publication portfolio of the ASA and, to date, has published over 3400 articles. The ASA meetings offer students a generally supportive, professional environment in which to present an oral paper or poster, and an appreciable fraction of papers given at ASA meetings are by students. Likewise, POMA has been structured partially with the student in mind. Its submission process includes allowing flexibility in the length of the manuscript (shorter sometimes is equally as effective) and a meaningful review by an editor. The student who wants the most out of his ASA experience should not only attend the meeting and the various student activities, but also publish in POMA.

A. A SUMMARY

Summarized below are reasons I would give to a student author (and any author, for most of these!) regarding why they should author a POMA in conjunction with their ASA talk or poster:

- It gives you an opportunity to practice scholarly writing skills, such as learning to organize content into a scientific story, while converting this practice into a lasting product. If you begin to write now, you will establish a habit of fruitful writing that will enhance Cultivation.
- It gives you an opportunity to receive early feedback from your advisor and others on your work and identify areas for development.
- Authoring a POMA article can help you identify holes in your research, which will help lead to an improved thesis/dissertation and articles in the Journal of the Acoustical Society of America (JASA).
- Unlike some conference proceedings that end up behind a paywall or in a hard-to-get book, POMA is archived online and is open-access. Articles are usually quickly featured on social media and are easily found on Google Scholar and Compendex.
- Publishing in POMA is rapid. On average, a submitted article is reviewed, revised if necessary, accepted, and published within four weeks. Thus, POMA provides an opportunity to describe the most current research progress.

- You can use these proceedings to quickly build your resume or CV for a prospective employer or graduate school. Unlike a thesis, or a double-spaced journal manuscript with the figures at the end, they can be readily located as a digestible, professional writing sample for job interviews.
- Early publications are motivators – tangible results that you can and should be proud of, demonstrating to your peers and others that you are striving to be a complete researcher.
- With some thought, you can structure your ASA talks and POMA articles in such a way that they complement and enhance, rather than compete with, fully peer-reviewed journal articles. (More on this in the following subsection.)
- A POMA allows you to take further charge of your education. A student who has published both in POMA and in JASA recently said, "POMA's existence has empowered me to take charge of my education and publishing to a degree. I don't feel like I am able to independently initiate a journal article at this point, but I can easily suggest a POMA on a talk I have done or will do, and it does feel empowering."

B. ADDRESSING "PRIOR-PUBLICATION" CONCERNS

There are advisors who will argue with the position I have taken in this paper, and will stress that conference proceedings are not worthwhile, or that they jeopardize one's chances of publishing in a fully peer-reviewed journal. As Editor of a relatively new proceedings journal that has undergone significant transformation within a professional society without a proceedings culture, I have heard and tried to address these and similar concerns over the past several years. To the anxious student and advisor, let me suggest how POMA can complement future publications while enhancing a student's academic and professional development.

The most common concern about publishing in POMA and conference proceedings in general is the fear of "prior publication" potentially restricting ability to publish the work in a fully peer-reviewed journal. The validity of this concern varies with the targeted journal. For JASA and JASA-EL, there is no conflict as ASA has clearly indicated that POMA is not considered prior publication. For a non-ASA journal, the potential for conflict is greater. While I believe there is a broader question to be resolved (Why do authors find ASA meetings an ideal forum in which to present their work, but then find for-profit journals more attractive than JASA?), here I try only to explain how POMA need not compete with a journal publication.

The most common ASA talk is approximately 12 minutes long, which, in my experience is too short a time to tell the complete scientific story found in a regular-length, peer-reviewed journal article. Although I have been guilty of trying, it is simply impossible to provide a fully contextualized problem statement, objectives, methods, results, analysis, and conclusions. In a related fashion, poster presentations are space-constrained. The ASA meeting format is intended to provide a current, but limited, view into research activities and findings for the scientific community. Consequently, the author invariably makes choices as to what content to include or emphasize in the talk or on the poster. The submitted POMA article should always represent the scope of the presented research, i.e. tell a complete story, but like the talk, some choices can be made in terms of its level of detail and emphasis. To the extent that the author is worried about prior publication, the length of the article can vary. Although manuscripts up to 12 pages in length are presently acceptable, there is no minimum number of pages. Shorter articles are acceptable provided they are sufficiently clear and complete, thus allowing the author to reference the rapidly published POMA as a as a preliminary or initial investigation. Regarding choices made in article emphasis, there may be benefit in emphasizing background or applicable historical research or providing more complete mathematical derivations as part of a methods section. Or, because research often results in more evidence than can be contained in a single journal article of reasonable length, the POMA could emphasize a unique data subset that could be referenced in other publications. To review, the POMA article should stand on its own as a written summary, but maintaining the scope of a typical talk or poster and possibly emphasizing certain portions of the research allows it to easily complement, rather than compete with, a future fully-refereed journal manuscript. These suggestions hopefully alleviate a concern that prevents student authors and their advisors from taking advantage of this publication opportunity and the associated academic development.

6. FURTHER SUGGESTIONS FOR STUDENT EMPOWERMENT

Conference proceedings are a valuable tool for helping to quickly empower a student and to maximize the Cultivated fruits during a mentoring research relationship. I conclude with a few additional suggestions intended

to help facilitate impedance matching between advisor expectations and student ability, and to enhance scholarly output. These are written to the student, but I recognize my own need to improve in nearly every area:

- Establish a scheduled writing time and report the amount of time spent writing each week to your advisor. The monograph How to Write a Lot[9] discusses at length the need for consistency, and Boice[10] has described the benefits of regular, rather than binge, writing.
- Learn to create an outline and to then frequently edit it. It is much easier, and far less painful, to edit an outline for overall content than paragraphs and pages. Furthermore, until you have a mental image of the entire outline organization and its underlying story, it is difficult to write efficiently.
- Learn to create an extended outline, filling in references to support key points and inserting publication-ready graphs and tables.
- Improve your writing by reading. Not only should you read articles for technical content, but you should study how they use references and how they organize the information flow.
- Use resources to improve your writing. There are a number of excellent articles and books about scholarly and scientific writing,[8,11,12] and additional online resources.[13,14,15]
- Seek peer evaluation. Many universities have a writing center that, although they may not be able to help with technical content, can often spot organization difficulties. Exchanging manuscripts with another student can be enormously helpful, as it teaches you to critically view a manuscript written in another voice. One way this exchange may be carried out is in a "writing circle." A writing circle is comprised of like-minded writers that meets regularly (e.g., weekly) to offer support and feedback on specific portions of text. I have participated in writing circles with other faculty members and have organized them for my students, and they have been a good use of my time. Silva[9] calls one form of these circles "Agraphia" groups (agraphia is Latin for fear of writing).
- Remember to reward yourself when you reach a writing goal or submit a manuscript.

In conclusion, I will make two comments, one to the student and one to the advisor. To the student: There are many more excellent writing suggestions[16] that could be made, but remember that there is no replacement for beginning to write early, and writing daily. Early writing can be made purposeful and lasting by writing conference proceedings; the feedback and skills gained along the way can help you become a better writer and a more productive scholar more quickly.

To the advisor: Please remember that convenient, productive tools are available to help you mentor your students as they learn to write at the required level. Consider using conference proceedings to accelerate their learning, extend the Cultivation phase of mentored research relationships, reduce the writing impedance mismatch, and provide meaningful feedback.

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