

Technical Engineering Research, Publication and Pedagogical Scholarship in a Teaching Oriented Small Campus Environment

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Abstract

The experience of conducting technical research and publishing technical research and pedagogical papers at a small campus location is fundamentally different from that of most faculty in a major research university environment. At the same time, this campus experience has many similarities with graduate student research at a major research university. This information may be useful to potential tenure-track faculty members as they make decisions about positions and to new tenure-track faculty members in the early or middle stages of the tenure process. Specifically the issues of research funding, graduate students, solo research and publication, collaborative research and publication, and the difference between pedagogical research and scholarship are discussed. The general findings can be summarized as follows. Obtaining external funding for research projects, a critical concern for faculty at a major research university, is usually not a concern for faculty in a small campus environment. While this relieves the campus faculty of this concern, it means that there will be severe limitations regarding the type and scope of research that he/she can perform. Furthermore; because of the lack of funding, and more often than not, the lack of graduate students themselves, the small campus faculty must conduct their research either solo or in collaboration with other faculty members. Realistically, the opportunities for conducting collaborative research may make it difficult, impractical, or impossible. While similar to graduate research, solo research and publication presents its own unique challenges. Pedagogical endeavors represent additional publication opportunities; however, faculty need to understand the difference between pedagogical research and scholarship. Furthermore, all these considerations should be made with the understanding that maintaining a single research focus is important for a small campus faculty member. This is particularly true given the high teaching loads and the lack of graduate research assistants available for such a faculty member.

I – Introduction

For tenure-track faculty the publication of papers, either technical or pedagogical, often determines whether tenure is granted. As a result, understanding how the process of conducting research, writing and publishing the associated papers, and producing other scholarly works in different university environments is important to many new and perspective faculty. This paper will discuss this process based on the author's experience in a small teaching-oriented campus environment.

The paper will be presented in four major sections. First, an overview of typical major and non-major research locations is provided. Second, the challenges that must be faced by faculty at non-major research locations are discussed. Third the distinction between pedagogical research and scholarship is drawn. An important implication of this distinction is the regard one's peers

will have for such publications. Fourth, the author's research and publication experience is presented to help place the preceding discussion in context.

II – Major and Non-Major Research Locations

In a major research campus location the predominant faculty responsibility is to obtain funding for and conduct research that will produce work that can be published in highly respected technical journals. Much of the research is conducted by graduate students who work with varying degrees of direction from the faculty member. Providing this direction to the graduate students requires significant time, effort and managerial skill on the part of the faculty member. The aforementioned funding is required to pay for such things as administrative overhead, laboratory space and equipment, graduate students' assistantships, faculty stipends, materials and other consumables, travel expenses and so forth. These research projects may often include faculty interaction that is intradepartmental, interdepartmental, or interuniversity in its scope. Faculty at such locations would generally have lower teaching loads than at other types of campuses. It should be noted that the numbers of students in the courses taught by the faculty would typically be larger than at other types of campuses, but teaching assistants are generally available. The teaching assistants perform much of the grading functions and typically provide student consultation to supplement the faculty member's office hours. It should also be noted that the expectations for the volume and quality (usually measured by the reputation of the publishing journal) of the papers resulting from the research are generally higher than at other types of campuses.

In a small teaching-oriented non-major research campus location the predominant faculty responsibility, in addition to providing instruction to undergraduate students, is to conduct research that will produce work that can be published in respected technical journals and presented at technical conferences. The research projects are of a much smaller scope and cost than those at a major research location. In most cases, the research is conducted directly and solely by the faculty member. In fact, depending on the discipline, some locations will have only first and second year undergraduate students. Faculty at such locations would typically have significantly higher teaching loads than at major research locations and thus have a smaller fraction of their time available for research and scholarly activity. It should be noted that the numbers of students in the courses taught by the faculty are typically smaller than at a major research location; however, teaching assistants are generally not available. Also, the expected number of papers resulting from the research is typically lower than at a major research location.

III – Challenges Faced by Faculty at Non-Major Research Locations

When faculty are considering a non-major research campus location, they must consider the amount of funding required to do their intended research and whether that funding is readily available. The faculty member must be aware of the difficulty and risks involved in trying to obtain external funding. King [1] and Sullivan, Erevelles and Doyle [2] have discussed the process of obtaining external funding and many of the issues associated with this process are not easily overcome by faculty in a small teaching-oriented environment. The process of obtaining external funding is extremely competitive, and faculty at the major research locations have

significant advantages in this competitive environment. They have the facilities, the collaborative projects which include established principle investigators and available graduate students. The author strongly believes that while faculty at small teaching-oriented campuses can successfully produce high quality research papers, albeit in smaller numbers than their counterparts at major research locations, they cannot realistically expect to compete with them for external funding. Given the limitations of the amount of time that faculty at non-major research locations have to apply to research and scholarly endeavors, they must avoid spending that time pursuing efforts that do not have the highest probability of leading to producing publishable work. The faculty member must remember that obtaining external funding is typically not a tenure requirement at a small teaching-oriented campus; however, the production of publications on a regular basis is. In light of these realities, the author believes that the risk of spending time and efforts on something that is not a tenure requirement is unwise. Furthermore, that effort, if unsuccessful, will likely decrease the number of publications. This is the first of several cases where a decrease in the number of publications might occur because of unproductive use of the limited time available for research and scholarly activity. Of course, there is a positive side to the external funding issue for faculty at a small teaching-oriented campus: namely, that the faculty member, freed of the requirement to obtain funding, need not consider if proposed research work can obtain funding, only whether it is likely to lead to a publishable paper.

As previously mentioned, small teaching-oriented campuses generally do not have graduate students. In addition, at some campus locations faculty may have only first and second-year students in their disciplines. The impact on the production of research papers published in respected refereed journals is significant. A topic of considerable interest recently is undergraduate research. Much has been written about undergraduate research and some examples can be found in references [3-6]. However it is highly unlikely that freshman and sophomores can contribute to technical research that will lead to an archival quality research paper. Therefore, unfortunately, the commonly discussed opportunity of using students to increase the number of publications is typically unavailable to faculty at many small teaching-oriented campuses.

Based on the discussion presented thus far, it is apparent that in many instances the faculty member will be conducting his/her research work without the assistance of graduate or undergraduate students. These conditions are actually quite close to those that the faculty member probably experienced when he/she was a graduate student, with the important distinction that he/she no longer has a faculty or thesis advisor. Thus, the faculty member must either find a technical sounding board for his/her research or become disciplined enough to function without one. The former solution can occur in two possible ways, either through unofficial or official collaboration. This will be discussed after the latter solution is investigated, namely solo research and publication.

There are some subtle stumbling blocks associated with solo research and publication that are worthy of discussion. These issues go beyond the obvious one of not having others to share the workload. If that were the only issue, then the only repercussion would be the requirement for

more time to successfully complete the research and publish the associated paper. The more serious issues have to do with lack of other perspectives. During the planning and conducting of research the absence of someone else's independent ideas presents significant challenges. To overcome these challenges, the solo researcher must be especially careful when performing literature reviews so that no important prior work is overlooked. However, the greater threat comes from the possibility of suffering from getting lost in the details, which could be called tunnel vision. This is a pitfall that all scientists and engineers need to carefully avoid. All scientific and engineering endeavors occur in two interrelated frameworks. The first is a strategic or overall framework that represents the big picture. At the same time, the execution of this framework requires much detailed work. Any successful scientific/engineering endeavor requires that the scientist/engineer to be able to effectively work in both frameworks and to easily move back and forth between them. There is an inherent danger of getting lost in the details of execution and to lose sight of the direction from the big picture. In a solo research effort, one must be especially careful of this trap because there is no one else to remind you not to lose sight of the big picture.

The author definitely encourages solo researchers to seek out some technical sounding board to try and provide some additional perspective. This is most important in the first or second solo research effort; however, the danger of suffering from tunnel vision never completely goes away. While it is admittedly often difficult or impossible to find someone who is intimately knowledgeable about your work, almost anyone involved in technical work can provide some sort of sanity check.

Once the research has been successfully completed, the solo researcher has additional hurdles involved in the process of writing the technical paper. The best resolution is to find a reader to provide both structural as well as mechanical critiques of the paper. It is worth noting that finding someone capable of reviewing the paper from a writing standpoint is much easier than from a technical standpoint. It is also quite helpful to avoid "last minute" time crises, as this makes editing one's own work more difficult. This difficulty follows from the tendency to read what one intended to write rather than what one actually wrote. Of course, letting the paper sit for several days before the final editing process will make it easier to read what one actually wrote.

The previous discussion shows that collaborative research and publication efforts are highly desirable from many standpoints. However, finding colleagues to collaborate with is not always easy or in some cases not possible or desirable. One must be careful about working with previous thesis or graduate advisors. Depending on the perspective of those involved in one's tenure review, this may indicate a lack of "independence" or "professional growth". Ultimately, finding a colleague with similar research interests may be difficult. Working at a small teaching-oriented non-major research campus will only make that harder. The author believes that the most successful collaborations are those that occur almost naturally. It may be necessary to weigh the benefits of collaboration with the possibility of detracting from a single well-defined research focus.

Having a single well-defined research focus is highly desirable no matter the type of campus location. One's goal should be to have the research work published in the most respected journal possible. In order for this to occur, the work will have to be new and innovative. It will be difficult to accomplish this in more than one research focus path, especially considering the relatively limited amount of time involved in the tenure evaluation process.

IV – Pedagogical Research and Scholarship

Another possible avenue for publishing scholarly work is in the area of pedagogy. This is often a new and not well-understood area for tenure line faculty. It is important to appreciate that there are two very distinctly different types of pedagogical publications: pedagogical research and what I will term general pedagogical scholarship.

Pedagogical research is like technical engineering research, except that it deals with the topic of teaching. As with all types of research, it requires a well conceived and executed scientific approach. As a result, it must have a hypothesis that is then rigorously investigated and either proved or disproved. This, in turn, will generally require data from a test group and also a control group. Furthermore, given the nature of the type of research, it may require collaboration with colleagues with an education, rather than an engineering, background. Pedagogical research can certainly lead to publications in refereed journals and therefore would be an accomplishment on the same level as a technical research publication.

General pedagogical scholarship, which this paper exemplifies, does not require the degree of effort involved in pedagogical research. At the same time, it is highly unlikely that such work will lead to publications in referred journals. As a result, this type of work, which can be published in conference proceedings such as this venue and others, will not carry with it the prestige of a pedagogical research publication. It does, however, afford the faculty member an additional avenue to publish scholarly work, and it can be based solely on the faculty member's experience. It is also important to note that since pedagogical scholarship is not intended for referred journals, maintaining a single focus in the subjects covered is not critical.

V – Contextual Experience

It may be helpful to understand the actual publication experiences of the author in able to place this paper in context. First, it should be noted that a final tenure decision has not been made on the author so it is uncertain whether the perspective presented here will ultimately lead to successfully completing the tenure process. However, the author has successfully completed two and four-year reviews, and the assessment of research and scholarly work at the four-year review was quite positive. In five and a half years the author has produced seven technical papers that have been accepted at a nationally and internationally renowned conference. Three of these papers have been published in refereed engineering journals and two are currently under consideration for publication in refereed journals. Including this paper, the author has produced five pedagogical papers that have been published in the proceedings of ASEE annual conferences. It should be noted that with the exception of one of the pedagogical papers, all the

papers discussed have been single authored papers. The author has expended a significant amount of time trying to find colleagues to collaborate with on technical research projects. Unfortunately none of these efforts have been successful to date. Despite the inability of finding someone to collaborate with directly, the author has found some engineering colleagues that have been able to provide technical sanity checks. That is, while the work is not in a field that they are actively involved in, they have been able to provide an independent feedback on the technical coherence of the initial papers. The author has benefited significantly from editing assistance from an English instructor who specializes in technical writing. The technical research and pedagogical scholarship has been completed with minimal funding which has covered travel money to attend conferences, \$600 for software, the use of up-to-date personal computers, and release from two contact hours one semester. The author's typical semester teaching load is nine contact hours.

VI – Summary

The author has shared his perspective on technical research and publication and pedagogical scholarship in a small teaching-oriented non-major research campus environment. While based mostly on personal experience, the perspective has been presented in general terms so that it may be of the most use to a general audience. Finally, the author's specific experience has been conveyed in an effort to place the discussion in context.

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