Learning to Play the Game: An Enhanced Indicator to Investigate Graduate Training Programs in Science and Engineering

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ABSTRACT

The need to encourage future generations of students in the pursuit of science and technological research has been viewed as a cornerstone of US efforts to maintain leadership in research, development, and innovation. However, few indicators of student intellectual activity at the graduate level are tracked on an ongoing basis. The aim of this paper is to provide evidence about graduate student publishing as an indicator of pre-doctoral research activity and, given the benefits of cumulative advantage to early producers of intellectual output, future scholarly success.

Significant scholarly attention has been devoted to understanding what factors shape scientific careers. This is an important topic not only because of issues of fairness and adequate rewards, but because of its impact on knowledge production, as more successful academics are also generally more productive. Existing research points to the existence of an "accumulative advantages" process, where early training and experiences shape scientists' careers by facilitating resource acquisition, knowledge sharing, and so on. As such, several projects have attempted to evaluate graduate school training. Yet, from an evaluative perspective, metrics to account for the learning and development outcomes of doctoral graduate student research experiences are woefully inadequate, particularly on a broad scale. Within this population, attention has been given to attraction, attrition, and retention of doctoral students, including issues related to student advising and mentorship experiences, dissertation experiences and completion, and student career intentions. The lack of information about doctoral student integration and socialization into the profession via the research experience has been identified as a critical and necessary component. Further, research on doctoral education has acknowledged the importance of student publication as an indicator of success, and one critical for securing employment. Within this process, the doctoral advisor, as well as relationships with other faculty, can play an important collaborative role, both regarding the dissertation, but also other academic publications and related activities .

This study addresses the gap in knowledge about student publishing through a distinctive dataset that merges bibliometric publication data with survey data from a study of academic scientists. To address this issue, we use two robust sets of data. First,

we use survey data collected from an NSF-funded nationally representative sample (n=1598) of academic faculty employed in Research I institutions. The purpose of that study was to develop longitudinal survey-based social network data for academic scientists. In addition to the survey, we also include lifetime bibliometric data for all survey respondents through 2010 drawn from the Web of Science Citation Index (SCI), resulting in more than 80,000 publications, which have been organized by year of publication. Because bibliometric records were linked to survey respondents using a unique id, this pairing allows for an unique and extended analysis of the bibliometric data and respondent characteristics and offers an opportunity to use those data beyond their original purpose. In particular, it allows for more detailed analysis of the demographic and career history data together with pre-PhD publication patterns. The survey also asked respondents to name their dissertation advisor, which allows for linkage between advisor and student in the co-authors in the bibliometric data; it also enables compilation of faculty-dissertation advisor publication patterns in and of themselves. Further, based on the survey data, we are able to analyze bibliometric patterns by a range of demographic and career histories.

We argue that co-publication with advisors is important in providing students with essential training and socialization in one of the most important aspects of an academic career, publishing. Learning how to write and speak in discipline-specific ways, how to frame research questions, and how to effectively collaborate are all greatly helped by publishing with advisors and supervisors. The results of analyzing this distinctive merged dataset will show that the share of students with at least one publication is substantial and is growing over time. In investigating the drivers of student publishing, we will demonstrate that co-publication with advisors is an important driving factor in publication activity, along with certain demographic and field characteristics. Our analysis also suggests graduate student publication and collaboration is a powerful and useful predictor of later career success and productivity, and as such an important tool in evaluating graduate programs. A potential and important measure that bridges aspects of academic socialization with actual knowledge outcomes may in fact be measured through the student co-authorship/publication activities and outcome. This project is innovative in its combination of social network data obtained through surveys and bibliometric data obtained through text mining, and highlights the potential contributions of this approach in both graduate program evaluation and as a way of understanding academic labor market dynamics.