Work in Progress: Annals of Research on Engineering Education

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Abstract - **The Annals of Research on Engineering Education website, containing research summaries and reflective essays written by authors of rigorous engineering education research articles, exists to build a collaborative community of engineering education researchers. This paper presents a preliminary examination of the challenges faced by the website in developing collaboration among researchers. Both quantitative and qualitative information are presented. A survey of site users is currently underway and will also provide information about the development of and issues facing the website. In addition, the developers and maintainers of the site have offered their views on its development. The resulting analysis will be used to improve the site as well as inform other education researchers of potential challenges in building collaborative communities.**

Index Terms - Case study, collaborative community, engineering education research, rigorous research

INTRODUCTION

The Center for the Advancement of Scholarship on Engineering Education (CASEE) of the National Academy of Engineering (NAE) maintains a website serving to summarize and collect scholarly articles about engineering education research as well as bring together engineering education researchers and practitioners from all engineering disciplines. The website, the Annals of Research on Engineering Education [1], includes summaries of research articles as well as reflective essays written by the authors. AREE also affords comments or discussions in several areas, and provides visitors with numerous resources regarding scholarly research on engineering education.

Contributions to the AREE website are drawn from articles published in AREE participating journals. There are currently 12 AREE participating journals. These journals are: *Cell Biology Education*, *Chemical Engineering Education*, *Computer Science Education*, *European Journal of Engineering Education*, *IEEE Transactions on Education*, *Inroads of SIGCSE*, *International Journal of Engineering Education*, *International Journal of Mechanical Engineering Education*, *Journal of Chemical Education*, *Journal of Engineering Education*, *Journal of Science Technology Engineering and Math Education Innovation and Research*, and *Journal of Women and Minorities in Science and*

Engineering. The editors of the AREE participating journals, who also form AREE's editorial board, nominate articles for inclusion. The authors of the nominated articles are then invited to write both a summary of their article as well as an essay reflecting on the research experience documented in the article (e.g., how the research topic was selected). AREE issues only include those articles for which their authors complete a summary and reflective essay. Issues of AREE are published three times a year.

This paper presents an analysis of the AREE website from both a quantitative and a qualitative standpoint. This includes analysis of the number of articles, number of visitors, topics addressed, reflective essay themes, and comments made. In addition, several site visitors have completed an online survey about AREE, and its developers are completing an open-ended questionnaire regarding their experiences with the website.

CASEE RESEARCH THEMES

All article summaries on the AREE website fall into at least one of six CASEE research themes; four articles were assigned to two themes each. The most popular research theme is Teaching, Learning, and Assessment Processes (TLAP), which accounts for 41 of the 89 article summaries. This category includes all aspects of instructional or assessment practices, including academic, service-based, and informal learning environments.

Twenty-six of the articles fit into the Teachers and Learners (TL) category, involving the interactions between, perceptions of, and individual differences between engineers at all educational levels. Twenty-one articles appear in the Courses, Laboratories, Curricula, Instructional Materials, and Learning Technologies (CLC) category, which focuses on how these elements affect learning and engineering education.

The Educational Management and Goal Systems (EMGS) category, which includes broad perspectives of educational organizations from the viewpoints of all potential stakeholders as well as research on indicators or educational effectiveness, includes only two articles. Two articles also fit into the Political, Economic, and Social Influences on Engineering Education (PESI) which focuses on how cultural factors and opinions can affect engineering education. Finally, one article fits into the Diffusion of Educational Innovations category that includes research on the applicability of educational research as well as experimental methods for educational research. In addition, two articles fit into both the TLAP and CLC

categories, one fits both the EMGS and PESI categories, and one fits both TLAP and TL categories.

REFLECTIVE ESSAY THEMES

Each article summary catalogued on the AREE website includes a link to at least one reflective essay written by one or more of the authors. Authors are asked to write a brief essay describing their thoughts on the research questions, methods, data analysis, chain of reasoning, rigor of design, generalizability and replicability of their study, or the lessons they learned from the research. Authors are free to incorporate more than one theme into their essay.

One-hundred and twelve authors contributed a reflective essay, with a total of 187 themes addressed. Lessons Learned is the most popular theme, with 55 essays incorporating that topic. The Methods (49 essays) and Research Questions (37 essays) are also popular theme choices. Fourteen essays include the Chain of Reasoning theme, while the Data Analysis and Generalizability and Replicability themes both included 12 essays. Finally, Rigor of Design appears 8 times.

ENGINEERING EDUCATION TOPICS ADDRESSED

The 89 articles posted on the AREE website cover a wide range of issues, methods, and populations. Fifty-two articles focused on engineering students, either in a single course or program of study or across an entire department. In addition, many of the authors performed synthesis research that summarized either past research or publicly available data. Almost one-third of the articles explained some type of curricular change assessed by a wide variety of analysis tools, such as surveys, student performance, or observations. Fifteen articles discussed methods of assessing student learning, and another 13 focused on increasing the diversity of the engineering field by encouraging and supporting more women and underrepresented minorities in their education. Authors also studied the individual differences between students that contributed to success or failure in engineering education, new pedagogies for teaching engineering content, teaching professional ethics in engineering programs, student development, professional skills, and methods of increasing recruitment and retention in engineering programs.

USER SURVEY RESULTS

In the fifth AREE issue, visitors were invited to complete a web-based survey regarding their experiences with the site. Fifteen visitors have responded, about half (8) of whom had contributed an article summary and essay to a prior issue. Of the 15, eight are professors, 3 are graduate students, and 4 indicated "other" for their title. Almost all (14) of the respondents work in academia, and the final respondent is self-employed. About half (8) are women, and over half (10) heard about the AREE website when they were invited to participate. Of those who had submitted an article and essay, all indicated their willingness to participate in a future issue.

Of the eight respondents who had submitted an article summary, most provided positive feedback about their experiences. The majority were either satisfied or very satisfied with the feedback received on the essay and summary and with the time allowed for submissions. However, one respondent was not at all satisfied with the feedback, and one was unsure. Respondents were also somewhat (4), very (2), or extremely satisfied (1) with AREE staff responses to questions, although one participant was unsure. All but one participant indicated that writing the reflective essay was at least somewhat useful to them and all but three (two unsure) indicated that they received useful feedback on their essays.

DEVELOPER SURVEY RESULTS

Three of the website's developers provided their insights as to the challenges involved in launching and maintaining AREE. Several questions resulted in agreement across two or three of the website developers. First, they agreed that the biggest challenge at the launch of the website was implementing the software and ensuring that all the site functions were working correctly and that the biggest challenge in the maintenance of the site is encouraging engineering faculty and engineering education researchers to visit the site, comment on the information in the issues, and participate in discussion threads. All developers also concurred that the response of the authors to the invitations to submit their summaries and reflective essays has been better than anticipated.

Developers were also asked to give input on their thoughts for improving the website. The main theme in improving the website was to encourage dialogue and discussion, which may help the engineering education researchers interacting on the site to come to a deeper understanding of the mechanisms behind their results. Two comments focused on having the authors provide more theoretical frameworks in their summaries as well as articulating their decision processes at all stages of the research, from hypothesis to interpretation of results. In addition, there were suggestions to include other journals in the website. For example, there are journals that describe education research that is not specifically related to engineering as well as education research articles focused on engineering students that are published in other journals. Including a wider range of research communities and journals in this way would improve engineering education research.

There were also suggestions to reach out to small groups of engineering education researchers and have those groups draw in their immediate colleagues, which would increase the overall participation in the website. This could be accomplished by contacting deans, student associations, or faculty members who could serve as editors for special issues.

ACKNOWLEDGMENT

REFERENCES

[1]   Annals of Research on Engineering Education. Accessible at http://www.areeonline.org