Implementing a Seminar Series to Build Collaboration and Community among STEM Education Ph.D. Students

Mrs. Ashton Garner Ward, Louisiana Tech University

Ashton Ward is an Engineering Education Ph.D. student researching students' perceived value of course content. She has five years of industry experience working as an Electrical Design Engineer. She holds a master's degree in electrical engineering and has an active professional engineering license in the state of Louisiana.

Ms. Krystal Corbett Cruse, Louisiana Tech University

Dr. Krystal Corbett is the First-Year Engineering Programs Coordinator and Assistant Professor in the Mechanical Engineering Department at Louisiana Tech University. She is also the Co-Director of the Office for Women in Science and Engineering at Louisiana Tech.

Mr. Casey Kidd, Louisiana Tech University

Casey Kidd is a graduate student in the College of Engineering at Louisiana Tech University. His focus is on project-based learning. He earned his bachelor's degree in mechanical engineering from Louisiana Tech University in Spring of 2004.

Mrs. Lindsay K. Gouedy, Louisiana Tech University

Lindsay Gouedy is pursuing her Ph.D. in Engineering Education, serving as a National Security Fellow at Air Force Global Strike Command, specializing in virtual reality (VR) training methodologies. Concurrently, she works as a Doctoral Researcher and Adjunct Professor at Louisiana Tech University's DECODED Lab, focusing on VR flight simulation programs. She has also worked as Executive Director leading public relations and scientific research for the SGWCD for fifteen years. Lindsay holds a Master of Science in Engineering and Technology Management, a Master of Business Administration, and a Bachelor of Science in Agricultural Business. In addition, she holds black and green belt six-sigma certifications.

Dr. Kelly B. Crittenden, Louisiana Tech University

Dr Kelly Crittenden is a member of Louisiana Tech University's Integrated STEM Education Center (ISERC), and is the Harrelson Family Professor of engineering. He is also the Program Chair of Mechanical engineering and the coordinator for Tech's PhD in Eng

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Abstract

The open-ended nature of graduate school can be overwhelming and challenging for its students. Undergraduate programs tend to have well-defined curricula and support structures. However, at many schools, graduate students rely on word-of-mouth to learn and navigate the graduate school system. At Louisiana Tech University, graduate students are required to attend a seminar class to familiarize themselves with the research process and graduate resources. With a large number of graduate students conducting research in different engineering fields, this type of seminar can quickly become difficult to manage while maintaining a significant impact on each individual student. This is particularly true for students in the field of science, technology, engineering, and math (STEM) education, a growing program that currently has fewer students than other Ph.D. engineering programs. Many of the research presentations that are required as part of the seminar course are arguably not as meaningful to the STEM education students. This seminar course is a missed opportunity to help these students build a foundation for STEM education research and navigate the nuances of the Ph.D. process while also helping them develop a community with peers in the same field.

Two faculty members, who are active STEM education researchers, have instituted a new seminar series specifically for these students that is designed to realign the course with engineering education topics, continuously improve the Ph.D. curriculum, and assist students on their Ph.D. paths. The group of faculty and students began meeting every other week to discuss topics specifically related to STEM education and the needs of graduate school in lieu of attending the general engineering seminars. This new seminar series covers multiple topics applicable to students in STEM education, including developing a plan of study, writing and presenting a proposal for a dissertation, and on-campus graduate resources.

In addition to fulfilling the course requirements for the STEM education Ph.D. curriculum, this series of meetings helps build community among the students and faculty members. It provides an opportunity to share insights and experiences while having faculty members present to help guide processes and discussions. A goal is to create a strong foundation of collaboration that will transcend the course and continue beyond its requirements. As students progress in their respective research, this course can provide a venue to continually give back to the program.

This paper will provide a reflection on the experience of three STEM education Ph.D. students who participated in the redesigned seminar course. STEM education students who participated in the original version of the course are surveyed to gain insights on the topics they perceive would be beneficial in the redesigned course which will contribute to the ongoing improvements to the

new course. This paper will also provide details on the course structure and topics along with lessons learned from the initial implementation.

Introduction

It is known that graduate school can be difficult and isolating, and dropout rates are high. As of 2008, the Council of Graduate Schools found in their study that after 10 years only 65% of males and 56% of females had completed their engineering doctoral program [1]. At the National Conference on Graduate Student Leadership 2003, the report on "Bringing a Sense of Community to Grad Student Life" stressed the necessity of purposeful activities. "Without meaningful interpersonal and community relationships, the graduate experience may spawn mental and emotional hardship [2]."

Two things that can assist students are mentorship and community from peers and faculty members. Fentiman and Fisher noted that "In Three Magic Letters, Nettles and Millett (2006) devote an entire chapter to socialization as a contributing factor in warding off loneliness resulting in greater motivation and persistence to complete the degree program [3]." They also discussed how Purdue created a Graduate Student Advisory Committee to provide the dean with "ways to improve the quality of the graduate experience," which included department-level and college-level community building events. Although it was too early to assess the success of their events, they reported the students who participated were enthusiastic and eager to continue with more events [4].

At the University of Washington, faculty created a seminar model for Ph.D. students that was not required in the curriculum. The students were able to choose the topics they wanted to discuss which included "succeeding with Ph.D. program milestones, choosing good elective courses and selecting advisors, defining effective research questions, authorship, and managing citations." Their first offering of the course was more successful than the second with almost 100% attendance every week, but analysis of the efficacy of the seminar was still underway at the time of publication [5]. Zerbe et al. noted "Events like technical writing and presentation workshops or graduate student socials can help support communication and social health competency development at the department level. Between advisors and graduate students, regular conversations and awareness of often-hidden competencies can help facilitate growth as well." In addition, they pointed out "Thriving graduate students are more likely to have a reasonable time to degree completion, are more likely to complete their graduate degrees, and may consider future careers in academia more seriously than those who simply survive, also contributing to (albeit limited) traditional metrics of success [6]."

At Louisiana Tech University, graduate students are required to attend a seminar class to familiarize themselves with the research process and graduate resources. All engineering Ph.D. students are placed in the same section which can include a wide range of disciplines. The

current version of the course requires students to attend research seminars where topics are discussed, and in most cases, do not relate to STEM education. To help the STEM education students build a foundation for STEM education research and navigate the nuances of the Ph.D. process while also assisting them in developing a community with peers in the same field, a new pilot version of the seminar course was created. For the purposes of the paper, the pilot course will be referred to as STEM education (STEM Ed) seminar and the pre-existing course will be referred to as general engineering (GE) seminar. This paper will provide reflections of past students who took the GE course series. It will also provide reflections of the three students who are currently in the STEM Ed pilot version of the series.

Overview of the Seminar Course

The GE seminar course series is a set of three, one-credit-hour courses that all engineering Ph.D. students must take as part of their curriculum. This includes all of the engineering Ph.D. concentrations which are cyberspace engineering, engineering/STEM education, engineering physics, materials and infrastructure systems, and micro/nanoscale systems. The GE course requires students to attend research seminars where topics are discussed that often do not relate to STEM education.

At the beginning of the 2023-2024 academic year, two professors, Professor A and B, decided to pilot a new STEM Ed version of the course. Three engineering education students, Students A, B, and C, enrolled in the seminar course. A description of each is provided in Table 1.

Table 1. Description of each participant in the STEM Ed seminar course.

Participant	Description
Professor A	Professor A is a tenured faculty member who is the engineering education Ph.D. program coordinator and director of the Integrated STEM Education Research Center (ISERC).
Professor B	Professor B is an early-career, tenure-track faculty member who completed the STEM education Ph.D. program at Louisiana Tech University in 2012. They are active in engineering education research focused on student engagement and retention.
Student A	In Fall of 2023, Student A began their Ph.D. in engineering education after attaining a master's in their engineering discipline at another University. Student A graduated with their bachelor's degree in 2018 and worked in industry for five years.
Student B	Student B is actively working on their dissertation. They have completed their coursework and presented their research proposal in Fall of 2023. Student B graduated with their bachelor’s degree in 2004 and worked in industry for 15 years before returning to the University to pursue their Ph.D.

Student C	Student C has also completed all of their coursework and is completing their dissertation with an expected graduation date of Summer 2024. Student C began their Ph.D. program in Fall of 2020 after and while working as a public relations consultant, predominantly in the environmental and logistics space.

The two professors felt grouping the engineering education students in their own seminar class would be beneficial and created an STEM Ed version that met every other week throughout the quarter. Students are required to take the seminar three times, and therefore, the professors planned to offer the STEM Ed pilot all year which allowed for continuity between quarters and topics. During the first meeting in Fall 2023, the students and faculty members held a brainstorming session to determine key topics that would be beneficial to those involved with the STEM Ed course. Some of the topic ideas included:

- Institutional Review Board (IRB) and Collaborative Institutional Training Initiative (CITI) training
- How to create a Plan of Study
- How to prepare and give a research proposal
- Dissertation writing tips
- Accessing library resources
- Survey Instruments

The environment of the STEM Ed course meetings is casual with most time allotted to open discussion and sharing one's experience of the topic for the day. Specific time during each meeting is set aside to encourage open-ended Q&A to address pertinent issues or concerns that each student may be experiencing. During this time, the faculty members provide their help and insights while the other graduate students share their experiences.

Motivation

Following leadership changes within the college, the STEM education research faculty were empowered to reinvigorate programs that support their research area. A primary support engine for any research program is the graduate students. Professors A and B decided to focus on connecting with and supporting that group who would in turn contribute to the breadth of STEM education research produced by the University. Professor A, who was already the program coordinator for the Ph.D. in Engineering Education program, was named the Director of the Integrated STEM Education Research Center (ISERC). Professor B, who was new to the tenure-track, was beginning to work with two Ph.D. students, Students A and B, and wanted to provide them with the community and support they needed to be retained and successful. Both Professors A & B had a vested interest in the students and a desire to see them all succeed.

GE Course Student Reflections

A survey was distributed to nine students who previously took the GE seminar course; five responses were received. The results of the survey will be presented in two formats. The first format examines the qualitative data and represents the key takeaways quantitatively. Second, the reflections provided through the survey will be summarized.

The qualitative data from the survey was analyzed to determine two factors related to the GE course: what was missing and the type of community formed. Figure 1 highlights the frequency each respondent indicated a particular component was missing from the GE course. Unanimously, providing an understanding of STEM education research and mentorship were listed as components that the GE students wished were in the course. Navigating the Ph.D. and dissertation process was also mentioned by three respondents.

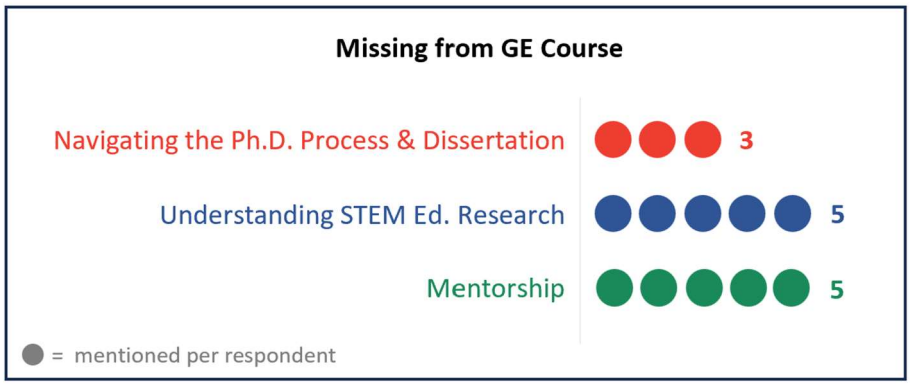

Figure 1. Components survey respondents felt were missing from the GE version of the course.

The GE students felt the presentations provided through the seminar course were not directly applicable to their STEM education research. Instead, they wished the course was more hands-on with the practical aspects of a Ph.D. program, specifically wanting help with structuring a dissertation, formulating research questions, performing research, and selecting the appropriate databases for literature reviews. The wants of the GE students align with the findings of Zerbe et al. which noted there were certain “hidden competencies" of graduate school which included, but were not limited to, research fundamentals and career growth. The authors insisted that these “hidden” aspects “should be made clear to incoming graduate students such that they are no longer hidden so those with less experience in academic settings are not held at a disadvantage for not knowing how to ‘play the game.’” [6]

None of the students surveyed felt that the course built a foundation for STEM education research or connected them with faculty who were conducting similar research. One said the course made them feel like they were “on an island and the only one doing that sort of research.”

Some looked elsewhere for mentorship, with one student mainly leveraging their advisor and their advisor's collaborators for guidance. As a result, that student made a concerted effort to mentor students that came after them to share their knowledge, experiences, and mistakes that could help the new students better navigate the Ph.D. process.

Respondents of the survey also indicated the sense of community that they felt the GE course fostered. Of the responses, three felt there was no community being fostered. Two indicated a general sense of community was fostered with students not in their research area but instead with the broader engineering Ph.D. student population. However, one cited that the overall framework of the course was not set up to encourage interaction among the students despite them all attending the same research presentations. Figure 2 provides the percentage of responses related to the type of community the GE students found.

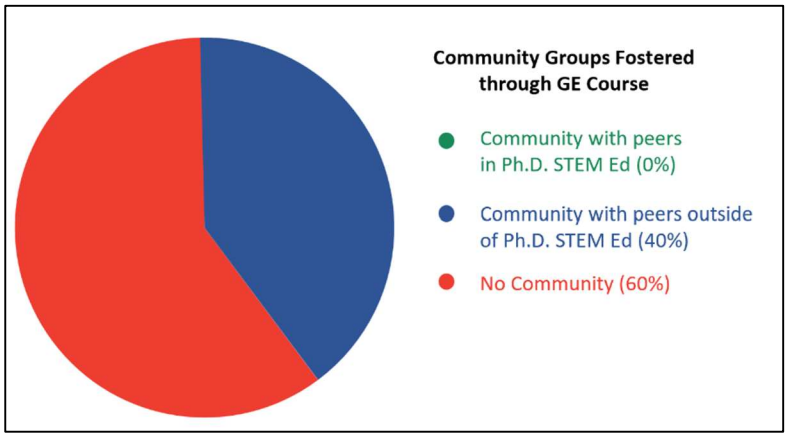

Figure 2. Type of community fostered through GE course.

Comments were made on two perceived benefits of the GE course. One student noted the exposure to the diverse research occurring across campus was valuable and provided a larger context for university research. Another benefit mentioned was the practice giving presentations helped them to build confidence and understand the expectations of professional research presentations. Due to the varying implementations of the course, however, not everyone who provided their reflections experienced the presentation practice.

Current Student Reflections

Student A Reflection

Deciding to leave my full-time job to go back to graduate school to get my Ph.D. in Engineering Education was nerve-wracking. Thankfully, I ended up with a great advisor. However, there were still many questions I had since graduate school is so much less structured than undergraduate school, and I didn't want to burden my advisor with too many questions on top of their already busy schedule. When I found out I would be taking the seminar course, I wasn't

sure what to expect since I heard it would be a new version of the course. At the first meeting, it was extremely encouraging to realize the other two students in the course were in the process of writing a dissertation and preparing their proposal for research because I knew they were significantly further along in the process than me. Not only have the topics in the STEM Ed course introduced me to things I have never heard of or had any experience with, the other students have provided encouragement and advice for different aspects of the process. I know that if I were simply sitting in research seminars, this would not have been possible, and I would have significantly less community with faculty and students in the program.

Student B Reflection

When I joined the Louisiana Tech University College of Engineering and Science graduate program, I had only obtained an undergraduate degree in Mechanical Engineering. With no experience in graduate school, I decided to take on both my master's and Ph.D. degrees at the same time. Needless to say that was a daunting task, and I was very unaware of my path forward. I had a very difficult time navigating the intricacies of the graduate program and stumbled quite a bit along the way. On top of that, the COVID-19 pandemic hit early on in my graduate career. Not only did that cause stress on my graduate curriculum, I also was homeschooling my children through the school shutdown. All that to say, had it not been for the people I met in the program and the connections I formed with them, I doubt I would still be in the graduate program. Having friends and colleagues guide me through the various processes was a necessary crutch I needed to persevere. Having a course dedicated to that service is a definite advantage to anyone coming into the program and that is what the seminar series is intended to do. Even though I never took the GE version of the course, from what I understand it is a somewhat disjointed and disorganized series of lectures and presentations. While the intentions are good, I believe that would make it difficult to form the connections necessary to thrive in the program. This STEM Ed form of the seminar series, as described in this paper, is geared more towards making those connections and forming a community, while still providing the student with the required information through various lectures and discussions.

Student C Reflection

I joined the Engineering program at Louisiana Tech University amid the challenging circumstances of the COVID-19 pandemic. The pandemic significantly impacted those of us in the public relations and logistics sector, where I had been working since 2009. This prompted me to explore opportunities to enhance my education and diversify my career prospects, seeking avenues that might be more resilient to the realities of the world at that time. Choosing the Engineering and Technology Management program, I initially entered the Master's program without the intention of pursuing a Ph.D. I successfully fulfilled the Master's requirements in the Fall of 2021 while balancing a full-time job and caring for my family of five.

During this period, I received encouragement from one of my professors to consider continuing my education journey and delve into statistical research related to aviation. Motivated by this opportunity, I decided to pursue the Ph.D. program in Engineering Education in the Spring of 2022, all while maintaining my existing commitments. However, this transition felt somewhat unstructured, and I often found myself unsure of the best way to navigate through the process. While there were content classes, there were also informative courses designed to guide non-traditional academics like myself. Unfortunately, these were not systematically arranged, resulting in my enrollment in the Engineering Dissertation Seminar toward the end of my Ph.D. journey, rather than at the start where it may have been more beneficial.

Nevertheless, this late-stage enrollment has allowed me to participate in a practical approach to the course content. While the information discussed would have been more valuable at the beginning of my program, it has been a rewarding experience to engage in applied structures and collaborate with Ph.D. students at various stages of their academic journey. The exchange of ideas and insights has played a crucial role in my academic development.

Conclusion

The STEM education PhD students who completed the GE version of the seminar course felt strongly about its shortcomings in helping them to build community, learn about the research and dissertation process, and provide mentorship. In contrast, the students who enrolled in the pilot version of the STEM Ed seminar course reflected positively on their experience. Many of the goals set forth for the class were achieved specifically in the areas of community engagement, collaboration, and navigating the graduate school process. While the STEM Ed version of the course has only been implemented for one academic year, the positive responses are promising and encourage the faculty members to continue offering it. Continued improvements and additional topics will be included in future versions of the course. Specifically a feedback loop is anticipated to where as students progress in their respective research, the STEM Ed seminar course will provide a venue for them to continually give back to the program by allowing them to provide insights to new students.

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