

Exploring the Role of Collaboration in the Development of Community Leaders: Student Experiences from a Learning Community in the STEM Foundry Heritage Fellows Program

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Abstract

The purpose of this contribution is to present illustrations from an innovative learning community experience born from the Science Technology Engineering and Math (STEM) Foundry Heritage Fellows (FHF) program^{1, 2}. This program provided students with an interdisciplinary and collegially-supported learning community experience to explore useful solutions addressing the lack of multiculturalism in STEM via community programs. The innovation of this program rests in the integration of the Renaissance Foundry Model (herein the Foundry)³ which features the development of collaboration skills and the swift and iterative acquisition and transfer of knowledge. To better understand how this learning community leveraged collaboration to foster holistic STEM professionals, this contribution will offer insight from the student perspective, formed through reflections and observations, relating to the goals of the program that were achieved through interdisciplinary thinking. Using autoethnographic methods, preliminary outcomes were identified.⁴

Keywords

Interdisciplinary collaboration, holistic STEM, learning community, post-secondary, Foundry

Introduction

This contribution focuses on the STEM Foundry Heritage Fellows Program (STEM FHF), as a mechanism to not only further academic success, but also develop and foster a STEM identity that assigns value to cross-disciplinary, problem-solving, and teamwork skills valuable beyond students' engagement in the program.^{1, 2} Through the use of the Renaissance Foundry Model (herein the Foundry)³, students were empowered in this program towards becoming holistic STEM professionals via the planning and development of community outreach projects that addressed the perceived lack of representation (within the region that the University serves) in STEM. Using autoethnographic methods, this contribution features preliminary outcomes that were identified from student experiences and offer insight to implications of interdisciplinary collaboration in STEM learning communities.⁴ This work in progress will also offer observations for future efforts centered on creating collaborative and community-immersed activities.

Background

In recent years, postsecondary STEM recruitment initiatives have recognized the value of learning communities as vehicles for engagement and retention. In considering solutions to expand the STEM pipeline, it is clear recruitment initiatives require a strong civic engagement

identity that is inherently multidisciplinary with STEM knowledge in balance with a strong sense of societal responsibility as both are necessary knowledge to solve complex global issues.⁵ The interconnectedness of STEM disciplines as a learning objective from collaborative work in community outreach has been found beneficial for developing student identities that are tied to STEM.⁵ This solution is reflective of current federal strategies related to engagement in these fields. The National Science and Technology Council⁶ detailed the benefit of converging disciplines, stating it can “...produce STEM-literate talent capable of asking and answering meaningful local or global questions that blur disciplinary boundaries.” In response, postsecondary institutes have begun to explore the pedagogical narrative from a knowledge-based curriculum to a socially constructed experience rich in service-learning opportunities that clearly connect STEM concepts to community and global issues in a meaningful way, as evidenced in the STEM FHF program.²

The STEM FHF Program

Overview of the Program

The STEM FHF program was funded by a Tennessee Student Engagement and Retention grant that supports new or existing services at the postsecondary level to serve underserved populations.² Representative of this objective, the STEM FHF program recruited students from various STEM and STEM related disciplines across Tennessee Technological University’s campus, reflecting a myriad of academic, social, and cultural backgrounds. The program lasted one academic year and included monthly trainings with interdisciplinary mentors and meetings within student teams. During the program, a constructivist approach anchored students in a knowledge acquisition and knowledge transfer process as guided by the Foundry.³ In the first semester, student leaders engaged in knowledge acquisition training activities including opportunities to gain knowledge in project management, diversity and inclusion, professional development, and teamwork leading to the development of small-scale community outreach projects by student leaders in the Fall semester. The student leaders then used knowledge transfer to apply the concepts learned to develop a large-scale community event in the Spring interdisciplinary teams.

Building Knowledge Through the Foundry

During the STEM FHF program, students were cognitively moving through the six iterative steps (Identify a Challenge, Organizational Tools, Learning Cycles, Linear Engineering Sequence, Resources, and Prototype of Innovative Technology) comprising the Foundry³. Utilizing the Foundry engaged students in metacognition to construct knowledge reflected in a multicultural, STEM outreach event. Due to its collaborative nature, the Foundry also provided a systematic way within which students could leverage different perspectives to better understand a complex issue or topic as the type of “knowing” in the Foundry is not solely technical but also socially-constructed via the interdisciplinary mentor (i.e., facilitators of learning) featured in the program.^{1,3} As a learning platform, the Foundry helped students to develop and be aware of the outcomes that were related to the overall program in terms of outreach and student development by engaging them in a process that activated their metacognition and motivated them to learn from other perspectives as an essential component of producing their desired program objectives.²

Preliminary Outcomes

The analysis of this piece is rooted in autoethnographic representation of the experiences accrued as a member of one of the leadership teams in this program that produced the community-outreach event entitled SMARTS: STEM, Multiculturalism, and the Arts.¹ As a research method, autoethnography necessitates that scholars retroactively and selectively analyze particular experiences through the subjective vantage points of the researcher which are relevant to the primary investigation.⁴ Within the context of this work in progress, two preliminary outcomes were identified from the observations and experiences of one student leader in the program: 1) Developing an Interdisciplinary Lens in STEM and 2) Developing an Inclusive Lens in STEM.

Developing an Interdisciplinary Lens in STEM Learning Communities

Interdisciplinary collaboration simulates the interconnectedness found throughout various STEM fields moving past technical knowledge and bridging the gap between academic knowledge and workforce practice. As an outcome, this type of lens was the result of the constant dialogue between education and engineering student leaders which provided an opportunity for connection-making acknowledging the cohesiveness of the two disciplines and how this partnership produces innovative solutions to community issues like the lack of multiculturalism in STEM outreach. The development of an interdisciplinary lens was a significant outcome of STEM FHF as it allowed students to not only participate in cross-disciplinary thinking activities, but also to develop skills to identify and assign value to interdisciplinary thinking as part of the problem-solving process during and beyond the program.

When building an interdisciplinary framework into STEM learning communities, training activities that focus on localized, community problems need to be incorporated into the experience.³ In the STEM FHF program this was achieved through several intentional community-based events. For example, engineering and education students were asked to volunteer together at the university's STEM outreach nights that serve the elementary and middle school students in the area. After these event, conversational prompts were given to the teams to make connections between the two disciplines as they functioned in the STEM outreach night. Furthermore, the interdisciplinary groups converged on unified efforts to better identify and solve issues in STEM through these experiences. These ongoing dialogues spurred the design of the multicultural STEM community event after identifying socio-cultural challenges (e.g., accessibility) that existed in the STEM outreach nights offered through the university.

Developing an Inclusive Lens in STEM Learning Communities

Competencies within areas of inclusivity and diversity serve as a way to further develop a STEM professional that honors and assigns value to equitable approaches in interdisciplinary collaboration. In this program, an inclusive lens was developed through an array of activities and student conversations aimed to develop a foundational understanding of how interdisciplinary collaboration requires students to not only engage in diverse conversations, but in addition, consciously make efforts to notice institutional and structural barriers that may minimize necessary perspectives participating in the field. By developing equitable approaches to collaboration, responsiveness to issues of equity raise students' understanding of how collaboration is not only a tool, but a necessary action to solving problems.

When building an inclusive framework into STEM learning communities, it should be noted that training activities need to focus on developing students' empathy towards marginalized groups⁷. This was accomplished in the STEM FHF program, for example, by several collaborative activities that featured the strengths of working together. One such activity was the modified Cup Challenge⁷ where students worked together to stack cups by utilizing nonverbal communication and, one, singular string while one team member was blind folded; although teams needed to work together, each team did not utilize their blind folded member to their full potential. As a result, conversations that centered around existing barriers for marginalized groups of people was facilitated, which assisted in the planning of the teams' STEM outreach event by spurring student dialogue on identifying what parts of the STEM event may not be accessible. This development of empathy led the teams to develop and implement accommodations for each of their planned immersive activities to meet the needs of a diverse audience.¹

Conclusions

This preliminary analysis ultimately draws attention to the function of collaboration within a learning community by exploring connections between inclusivity and interdisciplinary collaboration as a mechanism to develop more holistic STEM professionals with the abilities to navigate STEM issues beyond technical knowledge. With the increasing nature of multidisciplinary world problems, it is paramount to provide deeply integrated experiences that simulate the type of collaboration necessary to meet the challenges seen throughout the STEM field.⁵ The implications of intentional collaborative efforts within learning communities, as seen in the STEM FHF program, play a role in increasing retention and creating strong student identities within STEM fields.^{2,3} Thus, as explored within this contribution, to further cultivate a more holistic STEM professional, the development of interdisciplinary and inclusive lenses, guided by platforms like the Foundry, should be driving components within the design of post-secondary learning communities, with further research being warranted in this area.³

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