Unlocking the Potential of Interdisciplinary STEM Programs: Leveraging Campus Resources for Enhanced Outcomes

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ABSTRACT

In recent years, STEM (science, technology, engineering, and math) research has evolved into complex and ambitious scientific endeavors, emphasizing collaboration and pivoting away from solo work disciplines (Andersen, 2016; Sachmpazidi et al., 2021; Stokols et al., 2008). This shift in the research landscape underscores the importance of understanding the dynamics of collaborative work within higher education environments, particularly in interdisciplinary STEM programs.

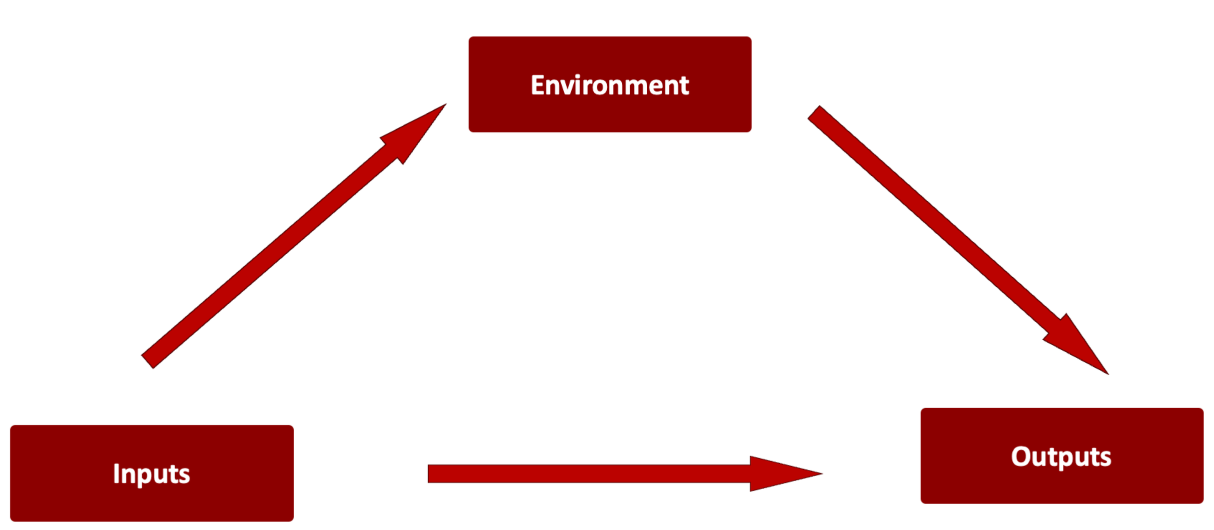
Our study aims to gain insights into the specific educational experiences and environmental factors students in interdisciplinary training programs perceive as stimulative to their growth as team scientists.

Using case study methodology, we interviewed graduate students (n = 14) and organized three focus groups (n = 16). The data indicated that participation in the interdisciplinary STEM program increased the student's reflective practices (critical thinking skills and knowledge synthesis) and aided in developing the student's personal and academic goals and relationships and collaboration with industry thanks to their mentor. In addition, students expressed challenges with the program, specifically confusion about technical jargon used across different disciplines and low levels of peer engagement, which appeared to decrease the sense of community.

We recommend three areas for program improvement to increase the graduate students' development as team scientists: creating a technical jargon guide, providing opportunities for the students to lead workshops or presentations on their area of expertise, and offering an online discussion forum for additional communication.

CONCEPTUAL FRAMEWORK

Astin's (2012) I-E-O model was adapted to understand how environmental conditions in interdisciplinary STEM programs influence the development of students as team scientists.



RESEARCH METHOD

The data for this study were collected through 2020-2023 at a large Midwestern public research university within the interdisciplinary training program.

This study relied upon Stake's (2005) case study methodology for an intrinsic, embedded case in which the phenomenon of interest is internal to the case itself rather than exogenous to it, and in which the phenomenon of interest is not easily separable from the functioning of the case elements.

We applied six-phase approach thematic analysis (Braun & Clarke, 2006) to identify, analyze, and report patterns from participants' transcripts.

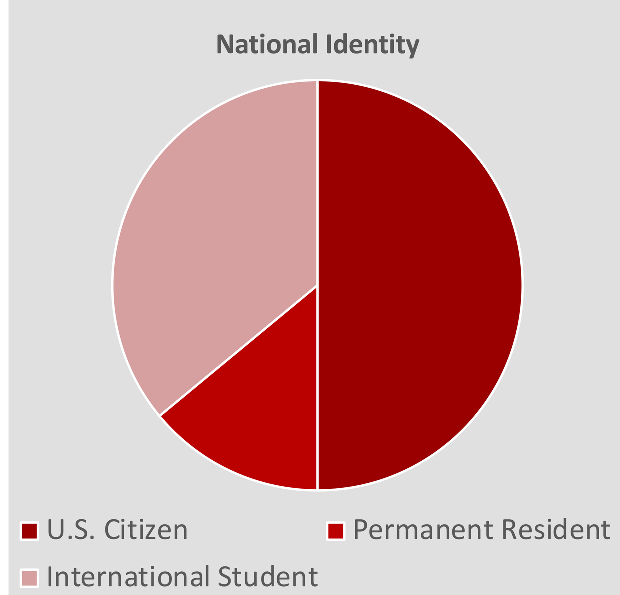
RESEARCH QUESTION

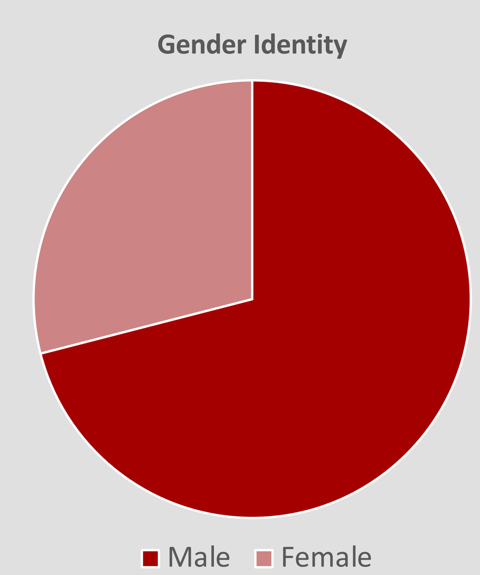
How do students make meaning of their interdisciplinary training program as a mechanism for stimulating their development as team scientists?

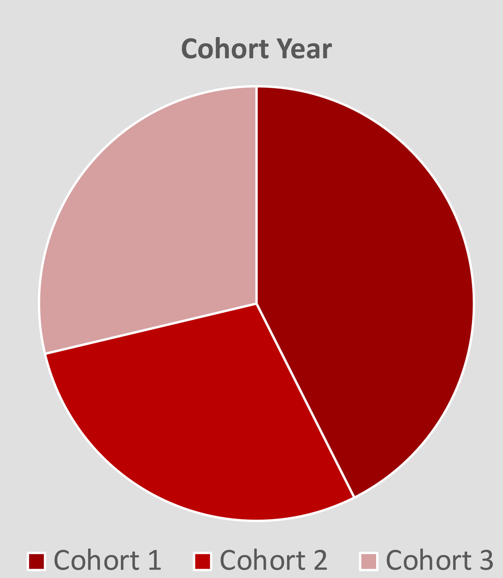
PARTICIPANTS

Individual interviews: 14 graduate student trainees across 9 STEM departments.

Focus group: 3 focus groups with participation by cohort year. All participants were STEM graduate students.







RESULTS

Reflective Practices

Develop critical thinking capacities :

"A lot of the reflections within the the data driven course, were guided around, you know, how, how is this module changed? You as a researcher? What have you taken away from this? What are some questions that you could now ask that you may not have been asked before? A lot of that reflection that we reflections from the course helped to kind of develop that critical thinking component."

Synthesizing knowledge:

"weekly reflections were useful to kind of synthesize and put in our own words like what we had learned that week, and what we had kind of taken away from, from the readings and from the lectures and the assignments and everything. So I think that was really good practice."

Mentoring

Achieve personal and academic goals:

"the mentorship that I've received is actually helping me reach my personal goals, because there's this part, a lot of things that that are better off, learn through it, like, you know, that a mother of two, not through advice tend to learn through experience. Because it can get pretty challenging when you when you experience it yourself. And having a mentor, you know, allows me to not make, repeat the same mistakes he's made, or repeat the mistakes he's heard somebody else make."

Ignite industry relationship and collaboration:

"My external mentor has been by far the most meaningful thing… He helped me to connect with non-academia [people], nonacademic resources, and he got me in contact with people who I ended up giving me an internship."

Challenges

Paradigm difference:

"most people are in engineering department in some fashion, and so it kind of difficult in that way because we speak different languages, but it like you have to work together on things like in this capstone course. and in our first course especially I found that to be true is like working with people in other departments is hard, but something that people in my field do a lot and I think people in every field are starting to do a lot more so."

Trainee engagement :

"the level of involvement that I've seen between between trainees is a little low. A lot of a lot of things is restricted to you know, those, those biweekly meetups, it's pretty much it's either us meeting in class for like the first very first mandated course or meeting up in that biweekly activities.."

RECOMMENDATIONS

1. Develop a guide that helps trainees understand technical jargon and terminology among disciplines to facilitate smoother communication when team members come from diverse backgrounds.
2. Promote peer-to-peer learning by encouraging trainees to offer workshops or presentations on their areas of expertise, fostering a culture of knowledge exchange and a sense of community.
3. Introduce additional communication channels, such as online discussion forums or a dedicated platform, to facilitate ongoing interactions among trainees outside of the bi-weekly meetings.

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