[Work-In-Progress] A Systematic Review of S-STEM Programs in Community Colleges: Program Features and Student Decision-making

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Community colleges are critical to increasing access to higher education. 43 percent of students are enrolled at a two-year institution (National Center for Educational Statistics, 2018). With almost half of the student population enrolling at a two-year institution, having National Science Foundation (NSF) Scholarships for Science, Technology, Engineering, and Mathematics Program (S-STEM) funding and resources is crucial. Community college students are likely to come from marginalized communities (e.g. low-income, first-generation college students, racial/ethnic minorities; Price & Tovar, 2014). Additionally, students often attend community colleges by being enrolled part-time and have externally added responsibilities (e.g. commuting to campus, family, multiple jobs, etc; Cohen & Brawer, 2008; Gonzalez, 2000).

The NSF S-STEM program supports low-income academically talented Science, Technology, Engineering, and Mathematics (STEM) students with demonstrated financial need in postsecondary institutions through a scholarship program that provides financial support and also allows for the institutions to develop enhanced curricular and co-curricular supports and interventions with the hope of broadening participation and pathways to STEM (e.g. S-STEM; National Science Foundation, 2021; Rodriguez et al., 2021). The program is substantial and there are currently approximately 100 grants that have been awarded to community colleges. Grants can range from 30,000 to five million dollars (NSF, 2023). Previous literature has provided insight into the successes and challenges that community colleges have with the college success of STEM students (Bahr et al., 2023; Cohen & Kelly, 2020; Harper & Thirry, 2023), yet there needs to be more research that focuses on NSF S-STEM programs in community colleges and the various implementation resource methods they provide. Through this systematic literature review, the team examines the literature on community colleges and the S-STEM program. A systematic review of the literature reveals current and missing literature to be further explored. In addition, systematically examining the literature allows scholars and practitioners to understand the role of the community college and the implementation of S-STEM programming nationally.

Methods

This study was a systematic literature review on NSF S-STEM programs and community colleges (Baumeister, 2013; Baumeister & Leary, 2007; Oxman, 1994). Due to the limited information on this topic, systematic literature review was selected as the appropriate methodology to understand the full landscape and grasp of literature in this field; this type of review utilizes clear methods to identify, evaluate, and synthesize studies addressing a focused topic (Newman & Gough, 2020). Initial searches allowed the research time to refine and narrow the aim for this systematic literature review. The research team used five databases to examine peer-reviewed literature on community colleges and their use of S-STEM funding. The databases that were used for this study included ProQuest, Compendex, EBSCOHost, PsychInfo, and Association for the Study of Engineering Education (ASEE) Conference Repository (ASEE peer document repository). Additionally, the team conducted searches in prominent community college journals: Community College Review, Community College Journal of Research and Practice, New Directions for Community Colleges, and the Journal of Applied Research in the Community College.

For this review, the team bound the study and selection criteria to ensure that the scholarship included was relevant to the topical area rather than simply relying on the researchers' familiarity or agreement with the available scholarship. Exclusion criteria were identified to outline how researchers eliminated studies from consideration and defined the purpose of the study (DePoy & Gitlin, 1994). For this study, inclusion and exclusion criteria included:

1. The study was published between 2013 and 2023.
2. The study was peer-reviewed articles, book chapters, and conference proceedings published.
3. The study was available in full-text and written in English.
4. The study was about an awarded S-STEM scholarship program in a community college or involving a community college.

From the criteria, Compendex was screened for "NSF and Community Colleges" which resulted in 237 results. In the second search, "S-STEM and Community Colleges," this resulted in 81 results. To further gauge the results, from these 81 results, 40 relevant articles we furthered read and evaluated. "NSF and Community Colleges" deemed 10 more non-duplicated articles. Similarly, the research team searched Community College Review, Community College Journal of Research and Practice, and New Directions for Community Colleges with both "NSF and Community Colleges" and "S-STEM and Community Colleges." "S-STEM and Community Colleges" resulted in zero results in all three journals. For the "NSF and Community Colleges" search, Community College Journal of Research and Practice resulted in 6 articles, Community College Review in 4 articles, and New Directions for Community Colleges in 14 articles. Of these 318 results, we compared both results for duplicates and others that did not meet our set criteria resulting in 37 as the final number of included articles that met the screening criteria. As mentioned, this is an ongoing study as we continue to triangulate for duplicates through the rest of the searches. To keep the information managed, there was a Microsoft excel sheet that was developed to maintain the search terms, to find each document, the Authors and Year, Full citation, Framework, Method, and Key Findings.

Preliminary Findings

After the review of the literature, there were a total of 36 articles that emerged with S-STEM and community colleges as the topic. Due to being a work in progress, we will have preliminary findings in the various methodological approaches at a later date. Currently, the literature consists of three major themes: (1) the importance of intentional programmatic support systems for STEM success, (2) lack of theory focussed program in implementation, (3) the decisions that influence STEM decision-making in the community college for career or post community college experiences. Although these findings are significant, there are also areas of future work that are needed to be emphasized for community college students involved with the S-STEM program.

Importance of intentional programmatic support systems for community college S-STEM student success

In the preliminary analysis of the systematic literature review, we are finding various types of programmatic support that S-STEMs in community colleges provide to their students. These programs focus on faculty, students, or interventions for both. For faculty, this is seen through faculty development programs, curriculum development, faculty research, faculty mentorship, and faculty advising. For students there is peer tutoring, bridge programs, transfer support, undergraduate research, industry and faculty mentors, and conference and writing workshops. These each contribute to the S-STEM community college success as they navigate their career in the community college and their goals beyond. The breadth and depth of different support reflects the unique needs of the campus where the S-STEM grant originated. Each campus or consortium of campuses creates their own program and therefore emphasizes different approaches to curricular and co-curricular supports.

Lack of theory focussed program in implementation of S-STEM Program

Through the systematic literature review, we find that there was a range of theoretical frameworks used to develop curricular and co-curricular supports to a variety of frameworks that are used in S-STEM programs. Some of the frameworks that arose from the literature include Cultural and Social Capital (Bourdieu, 2011), Self-Efficacy (Bandura, 1977), Situated Learning (Lave, 1990), Social Learning Theory (Bandura, 1971) Transformative Learning (Meizrow, 1991), to name a few. As we continue to explore this finding, it is crucial to note that the majority of the scholarship included came from the Association for Engineering Education (ASEE) conference papers. In these conference proceedings, majority did not have a theoretical or conceptual framework in its underpinning. Commentators have long suggested that the research to practice the exchange of information needs to be tightened and our initial results suggest this is still an issue and that theories developed by scholars may not be making their way to the field as an underpinning of programs that serve students. For the studies that did have a framework, the approach to studying S-STEM and community colleges may need to investigate experiences from a variety of angles thoroughly, it also demonstrates that there is a need to understand student experiences and implementation of programs in community college S-STEM programs in relation to theory to continue to build understanding.

Community college and Four Year collaboration and Transfer for S-STEM students

As we continue to analyze the data, we also see that there is a strong topical focus on four-year and community college transfer support and engagement in pathways. Scholarship reviews focused on the way that community colleges are collaborating with four-year institutions and desiring to create a more streamlined pathway through S-STEM. These findings point to the importance of transfer support and engagement specifically for supporting the transfer of S-STEM students to another S-STEM or finding the resources to fill the support services they receive through the S-STEM at the other institution.

Implications for Research, Policy, & Practice

With the increasing focus and distribution of S-STEM funds, there is little research that has incorporated S-STEM programs and community colleges. Given that these programs focus on financially needy students the lack of research on this critical group of students, low-income STEM students in community college is critical. The overall dearth of a robust grouping of studies connecting these topics emphasizes the need to more fully understand and explore S-STEM community college recipients and the tools and resources that they provide their students. This study shows that there is a need to focus, explore, and ultimately provide the community with understanding and access to S-STEM funds in community colleges. Additionally, there is research that focuses on the college student student experiences in S-STEM programs.

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