

Unpacking Critical Socializers Impacting STEM Students' Motivation at a Minority Serving Institution

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Abstract

Socializers refer to the interactions and social influences that shape an individual's motivation, such as from colleagues, mentors, and family. Socializers often inform students' motivation to obtain STEM degrees, yet there is minimal literature that examines the role of socializers among STEM undergraduates, particularly at minority serving institutions (MSI). This critical research gap inequitably disadvantages historically marginalized and non-traditional students. In this work-in-progress, we answer the following two research questions: (1) Who are the socializers that influence student's motivation to pursue and persist in their STEM education? and (2) In what ways do these socializers influence students' motivation? Using the Expectancy-Value theoretical framework, we answer the research questions using constant comparative thematic analysis performed on seven semi-structured interviews with STEM students at an MSI. Preliminary findings reveal that students primarily rely on peers and course instructors as positive motivational socializers. These groups can provide affirmation to improve students' self-confidence (expectations). In contrast, students reported co-workers as negative motivational socializers. Particularly, students described that co-workers may challenge their decision to pursue STEM education, questioning the usefulness (utility value) and costs (cost value) associated with the degree. We present these findings on socializers to lay the groundwork for better supporting students' from MSI in their STEM education pursuits. We discuss these findings for their implications for research and practice.

Introduction

Major attempts have been made to promote involvement in engineering at both the undergraduate and graduate levels among marginalized groups in STEM, such as among women and racial/ethnic minorities [1]. Enrollment of women and Hispanic/Latina/o/x people has remained stagnant for more than 25 years, despite attempts to increase their involvement [2]. Moreover, despite making up a sizable fraction of the working population, both Black and Latina/o/x people are disproportionately represented in computer, mathematical, life, physical, and social science jobs, as well as in architecture and engineering [3]. Aside from the untapped potential needed for the future STEM workforce [2], this underrepresentation illustrates a broader social justice issue. Lack of diversity in STEM promotes monolithic thinking, hindering STEM progress. Whereas numerous studies, including qualitative [4], [5], quantitative [6], content analysis [7], [8], and computational models [9], [10] provide evidence that an increase in diversity fosters a high level of creativity and STEM progress. Differences in postgraduate STEM pursuits are often related to experiences prior to college, suggesting inequities at pre-college levels may perpetuate into post-college decisions to remain in the STEM field.

Studies have increasingly focused on increasing retention of marginalized students in STEM through understanding the persistence and motivations of these students. In seeking to improve retention, researchers have applied asset-based perspectives to studying retention of marginalized students. This approach often emphasizes the role of social capital [1], [11] and socializers [12]–[14] as primary drivers of motivation to pursue STEM education and careers. This present paper

begins to unpack the unique relationship between socializers and the decision students at minority serving institutions (MSIs) make to pursue STEM. We report on the experiences of students gathered using qualitative methods and examined through the lens of expectancy value theoretical framework.

Theoretical Framework: Expectancy-Value

Motivation to pursue a career in STEM can be modeled through Eccles et al.'s Expectancy-Value theory (EV) [15]. EV establishes a direct relationship between individuals' expectancy-related and task-value beliefs with performance, persistence, and choice [15], [16]. EV models motivation through four constructs: expectancy, intrinsic value, utility value, and cost value. In the context of students' motivation to pursue STEM, expectancy refers to the expectations and *self-confidence* that success is attainable. Intrinsic value represents the inherent *interest* students may have regarding STEM. Utility value represents how *useful* students perceive STEM to be for them. Cost value represents what students must be given up in order to pursue STEM, such as money, time, or personal well-being. EV suggests that these constructs are informed by gender, race, and culture, affirming the need to understand how students' background contributes to motivation [17], which has an impact on STEM persistence and career choices. Furthermore, this STEM motivation is not independent of an individual's social milieu and is affected by interactions with others, or socializers.

Role of Socializers on Motivation

Socializers refer to the people with significant relationships with students who *can* shape students' motivation to pursue a career in STEM [13], [18]. However, who these socializers are and the extent to which they affect student motivation varies by background and cultural influences as explained through EV theory [15]. We consider the five categories of socializers shared by Abhyanker et al. [14] as a starting point because of the similarities between engineering and STEM education. These categories include: family-, peer-, university-, work-, and community-related socializers. Family-related socializers include parents, grandparents, aunts and uncles, and family-friends. Prior to entering college, students can be influenced by family related socializers. For example, family may influence students to take on a family business or trade [14]. Peer-related socializers include classmates, friends of friends, recent graduates, siblings, and cousins. Those who are similar in age to the students share many experiences, which can influence students' job search. When students engage with peer-related socializers, they may gain insights on job and internship postings or company and industry culture. This insight from peers can either narrow or broaden students' perceived pathways to a STEM career [14]. University-related socializers include course instructors, academic advisors, club advisors, and research supervisors. University-related socializers can influence students through sharing their professional experience, often guiding students about different career pathways. In addition, instructors can motivate students by igniting student interests within specific courses [14]. Work-related socializers include coworkers, lab colleagues, supervisors, or company leaderships. Like university-related socializers, work-related socializers share their own professional experiences related to STEM, and students recognize that these experiences can push them towards or *away* from STEM careers [14]. Students take on this influence recognizing that coworkers or work leadership do come with real-world experience [14]. Lastly,

community-related socializers include connections through religious-based communities, identity-based communities, and community service groups. Abhyankar et al. describes this as a non-dominant “unique socializers” [14], and we extend this interpretation to include identity and service groups because we recognize how these groups are represented through the “cultural milieu” of EV theory [15].

Research Questions

In this work-in-progress, we answer the following two research questions: (1) Who are the socializers that influence student’s motivation to pursue and persist in their STEM education? and (2) In what ways do these socializers influence students' motivation?

Methods

This study is designed around a minority serving institution (MSI) located in the United States. We interviewed five undergraduate students who were enrolled in a STEM major, high performing among their cohort, and likely belonged to economically disadvantaged backgrounds [19]. We established a semi-structured interview protocol to facilitate these conversations. These interviews were designed to meet two objectives relevant to a broader project on STEM motivation among students at an MSI which focused on gaining insights on how students from MSIs interpret expectancy-value constructs. In the presented paper, we report findings pertinent to the emergent impact of socializers as it relates to EV constructs. Interviews were performed, recorded, and transcribed using a digital video-conferencing tool. Transcripts were verified for their accuracy and de-identifying with pseudonyms. We analyzed these interviews and transcripts using constant comparative analysis [20], [21]. Ultimately, this analysis led to identifying emergent patterns across interviews regarding socializers to students’ motivation.

We referred to the Q3 framework for interpretive research to maintain quality of research [22]. We sought communicative validation by co-constructing a shared narrative using accounts from participants and by relating this narrative to findings from the research community. We sought to establish process reliability by using consistent interview protocol, reviewing transcripts for accuracy, and standardizing the approach to developing analytic memos.

Preliminary Results and Discussion

We identified three major, emergent findings from these analytic memos, which we share here. We found in our data that students frequently identified certain socializers that had positively or negatively affected their STEM motivation. When describing these socializers, we adopt the naming convention used by Abhyankar et al. [14] in the context of engineering education.

Positive Impact of University-related Socializers

Students described how their course instructors positively affect their STEM motivation. Instructors have the opportunity to share expertise and stories that convey the usefulness of the lesson and promote interest. One student (Amory) suggested that to improve the perceived usefulness of STEM (utility value), instructors should discuss impacts, saying, “[instructors

should] discuss some actual experiences with STEM and discuss how it may have changed their lives." Another student described how interest and passion in STEM (intrinsic value) can be inspiring from their instructors:

I have teachers who are very into the subject they have. Sometimes they'll go into detail about it. Sometimes they'll use examples that they have seen or that they have done themselves. That's a big thing for me: backing up with information, knowing what you're talking about, and then loving what you do essentially. -Clara

Student requests for examples and real-life applications of course content aligns with best educational practices [23], [24]. As such, we encourage instructors at MSIs to keep their role as a socializer in mind when designing lessons and course activities.

Negative Impact of Work-related Socializers

Students reported that conversations with work-related socializers about sacrifices (cost value) required for pursuing a STEM career had a detrimental impact on their STEM motivation. Co-workers, particularly those in non-STEM related positions, may have limited experience or insight on STEM and STEM career pathways. These uninformed perspectives can translate into doubts or concerns about difficulty when speaking with students pursuing STEM degrees, which can impair students' motivation. Students from economically disadvantaged groups who are often served by MSIs often juggle work (part-time, multiple part-time, or full-time jobs) alongside their STEM studies. As such, they may face a distinctive influence from work-related socializers due to systemic dependence on employment, leading to increased interactions with these socializers. Two students shared instances where their motivation was challenged by work-related socializers:

They make it seem like everything is so different, and everything is so new, for a person who's not a STEM major. I feel like they can get scared pretty often or pretty hard...I work at a place where most people didn't go to college or most people went to college for business, and when I tell them I'm a [STEM] major, they're like, "Whew! Good luck on that one." And I'm like, it's not that bad. It's actually pretty fun. -Clara

I know a lot of people who say, "Oh, my gosh! Like you're doing a [STEM] degree. [STEM] is so hard." You have to take general [STEM] classes in high school, so I think that forms the expectation of [STEM] being so hard...You just need to take the time to learn it and teach them that it can be difficult, but if you put in the work, then you'll understand it. -Rosa

In both of these quotes, the students recounted these comments as a critique or criticism of their career choices. Despite facing this challenge, these students expressed resiliency in their motivation. Instructors and academic advisors at MSIs (identified as positive socializers through empirical evidence and literature [13], [14]) can leverage this insight to speak with students on navigating work-related relationships to avoid potentially negative influences.

Mixed Impact of Peer-related Socializers

Students frequently reference classmates, students in the same discipline, or siblings of a similar age when asked who affects their STEM motivation. Peers can be positive or negative (mixed) socializers because, as students relate to them, they can retain or hinder their self-confidence (expectancy). When asked to elaborate on how peers affect their expectations, one student described, “...*knowing that even if I'm not feeling good, if there's [a peer] also not feeling good about it, then we both know that it's not our fault, and there's something else going on, and we can ask the teacher about it. That's a big one*”. [Clara]. While this student comment suggests that when their peers share uncertainty in a class, they can retain their confidence despite challenges. Upon further inquiry, the student also recognized that comparing themselves to peers can adversely affect their motivation:

Some people say, “C's get degrees.” Others say that if they can't have an ‘A’ they're gonna die. People have different mentalities... [if] you get paired up with that person who [doesn't match your mentality] you'll feel bad about yourself, because it's like, “Wow, I'm here in the same place as this other person and I feel like I'm not trying as hard.” -Clara

Also, along similar lines, when asked directly about how peers affect STEM motivation, another student reported:

Students may get demotivated from other students because I know, in some parts, it's a lot of studying and a lot of hands-on work that you have to do. And sometimes other people can say things like, “This is difficult. I don't feel smart enough,” and it could also have other people think like, “Oh, my gosh! Like this person is very smart. Like I look up to this person, and all of a sudden, they're not getting this subject. Maybe I won't be able to fit in!” -Rosa

In regard to this preliminary insight, we encourage instructors at MSIs to facilitate social learning. As students interact with their peers, they may learn *together* and minimize knowledge disparities that students reported had hindered their expectations [25]. While not tested in this work, simple active learning strategies [23] may be effective in facilitating inter-peer interactions. Overall, these findings and recommendations are a work-in-progress, but we share these emergent insights for the potential impact they may have among students at MSIs.

Conclusions

Prior work has identified that socializers, those with significant relationships with students, can have a strong influence on the motivation and STEM career choices of students [12], [18], including in STEM education [13], [14]. However, limited work has explored the unique socializers of STEM students at minority serving institutions (MSIs). This study begins to unpack the role of these socializers based on student groups and background. In our study when speaking with students on aspects of their motivation, students revealed that their motivation was influenced by university-related, work-related, and peer-related socializers. STEM educators and researchers should take a holistic perspective on the social influence students feel on their STEM

motivation because students are not siloed to be influenced by only one group. Students will form and maintain significant relationships with multiple groups throughout their college career. Future work may further examine how positive and negative influences from socializers may interact with students' motivation to persist in STEM. Alternatively, future work could experiment with facilitating these interactions to improve motivation. Further empirical insights that unpack the dynamics of different socializer-interactions can build a deeper understanding of the impact of socializers to inform research and practice.

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