

A Case Study on Federal Work-Study Community-Based Research Impact on Underrepresented Women in STEM Through Situated Expectancy-Value Theory

Monica L. Miles*, Rachel Bonnette, Ann Ditto, Matilde Sánchez-Peña

Assistant Professor, Engineering Education, School of Engineering and Applied Sciences, 721 O'Brian Hall

*Corresponding author: Dr. Monica L. Miles, Assistant Professor, Engineering Education, School of Engineering and Applied Sciences, 721 O'Brian Hall. Tel: 716-507-6147. Email: mlr25@buffalo.edu

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Abstract

This exploratory case study examines the impact of a community-based research project on four undergraduate women participating in the United States Federal Work-Study FWS program in an urban area of the North Eastern United States. Utilizing Situated Expectancy-Value Theory, the study investigates how these experiences and economic challenges shape students' perceptions of their success, the value they place on Science, Technology, Engineering, Mathematics, and Medicine fields, and their sense of belonging. The participants, including three women of color and one white student, come from diverse STEM-related programs, providing a nuanced perspective on how community-based research influences their academic and career trajectories. The findings highlight the role of practical experience and mentorship in enhancing students' confidence, aligning their personal motivations with research goals, and fostering a strong sense of belonging. This research contributes valuable insights into supporting underrepresented students in STEMM and underscores the need for further exploration of such interventions.

Keywords: Situated Expectancy Value theory, Federal work-study students, undergraduate education, community-based research.

Introduction

Women remain underrepresented in Science, Technology, Mathematics, and Medicine (STEMM) because of a plethora of reasons, including lower opportunities for pre-college engagement [1], experiences of marginalization while pursuing such degrees [2], [3], which end up affecting their persistence and success in those fields [4], [5]). Research to increase the presence of women in STEMM has focused on enhancing pre college motivation to pursue those degrees, the understanding of such marginalizing experiences while in college, as well as the strategies that can be used to improve their experiences [6], [7]). In particular, interventions aiming to increase their confidence [8], motivation [9]), and sense of belonging [10], have shown promising results in increasing the engagement of women and other minorities. Nevertheless, many of these interventions have been documented in the classroom, with research about the effect of non-traditional college experiences needing to be expanded [11].

It is known that a sizable number of college students need to work. According to the National Center for Education Statistics, 40% of full time and 74% of part-time undergraduate students were employed in 2020 [12]). The government-sponsored Federal Work-Study (FWS) program offers a valuable option for campus-related employment that can have multiple formats, including most on-campus jobs and some types of off-campus community-service jobs [13]. Despite the longevity of the FWS program, the empirical evidence about its impact is still limited. It is argued that the variety of employment options that students have under the FWS program represents a significant barrier to a thorough assessment of its impact (Scott-Clayton, 2011). Therefore, in this study we aim to capture the impact of an FWS

program specifically designed as a community-based research experience for undergraduates in a group of undergraduate women in STEMM.

Study Purpose

This exploratory case study focuses on four women undergraduate students at a university in an urban area of the Northeastern United States, who are involved in an FWS program through a community-based research project. This study employs Situated Expectancy-Value Theory to explore how the intersection of community-based research experiences and economic challenges impacts students' perceptions of their potential success, the value they place on Science, Technology, Engineering, Mathematics, and Medicine (STEMM) fields, and their sense of belonging within these disciplines. By focusing on these dimensions, the study aims to provide insights into how such experiences shape and influence underrepresented students' academic and career trajectories in STEMM. The group comprises four economically disadvantaged female students in the Federal Work-Study (FWS) program, including three women of color and one white student. All participants come from diverse programs that require strong STEM backgrounds. This composition allows for an in-depth exploration of the varied academic and career challenges students face in this context. Towards this goal we sought to answer: *How does participation in a community-based research project, within the FWS program influence the expectancy, value, and sense of belonging in STEMM fields of underrepresented students analyzed through the lens of the Situated Expectancy-Value Theory (SEVT)?*

Literature Review

Minoritized women in STEMM

According to the National Science Foundation's 2023 Diversity and STEM report on Women, Minorities, and Persons with Disabilities, although women make up 51% of the total population, the 2021 labor force statistics indicate that women hold only 35% of the jobs in the STEM workforce (2023). The underrepresentation of women and minorities in STEMM fields is a complex issue with historical roots [11]. Despite the growing emphasis on diversity and inclusion, minoritized women continue to face significant barriers that hinder their participation and success in these fields [14]. Historically, minoritized women have been marginalized in STEMM disciplines due to systemic barriers in various forms, including unequal access to educational resources, biased curricula, and lack of representation among faculty and mentors [15,16,3]. For example, research has shown that minoritized women are less likely to have access to advanced coursework in high school or to attend schools with strong STEMM programs [17]. This educational disparity creates a pipeline problem, where fewer minoritized women are prepared to enter STEMM fields at the postsecondary level.

Societal stereotypes and cultural expectations also impact the experiences of minoritized women in STEMM. Gendered and racialized stereotypes about STEMM ability can undermine the confidence and academic performance of minoritized women [18]. For instance, stereotypes that suggest STEMM fields are more suited to men or that certain ethnic groups are less capable in STEMM subjects can discourage minoritized women from pursuing or persisting in these careers [15]. Additionally, cultural expectations and familial responsibilities can place additional pressures on these students, further complicating their academic and career paths [17]. Institutions often need more structures and support systems to foster the success of minoritized women in STEMM. The absence of diverse role models, mentors, and supportive networks can contribute to feelings of isolation and reduced retention rates among these students (Brown & Watkins, 2021). Furthermore, institutional practices and policies may need to adequately address the unique challenges faced by minoritized women, such as implicit bias in hiring and promotion processes or the need for culturally responsive pedagogy (Wilson & Anderson, 2018).

Increasing diversity in STEMM is not merely a matter of social justice but is essential for driving scientific innovation and addressing complex societal challenges. A diverse STEMM workforce brings a broader range of perspectives and problem-solving approaches, which can lead to more innovative and effective solutions [17]. Research has demonstrated that diverse teams are better equipped to tackle multifaceted problems and develop solutions that are more inclusive and equitable [15].

Working Undergraduates

Despite FWS ambitious goal of decreasing poverty and increasing the professional workforce, the typical program award is about \$2,340 per year, which covers only a small portion of university tuition and fees (CCRC, 2021). Today, this amount doesn't come close to covering student expenses given the stark rise in tuition and fees, meaning students likely cannot simply work their way through college on FWS (Scott-Clayton, 2011) like they did when the program began. Although the program has existed for almost 60 years, research on the impact

of working while in college, particularly through the FWS program, is limited (Scott-Clayton & Minaya, 2016). The overall effectiveness of combining work and education remains unconfirmed (Triventi, 2014; Scott-Clayton & Minaya, 2016). Existing studies yield contradictory results regarding academic achievement, time allocation for academic work, graduation rates, retention, and health concerns (Miller et al., 2018; Scott-Clayton & Minaya, 2016; Triventi, 2014).

However, a study by Soliz and Long (2016) offers promising results, indicating that the benefits of FWS potentially outweigh any negative effects; the positive impact of increased work study funding may increase the number of credits accumulated by the end of the first year, which could suggest holding an FWS job may balance such negative effects with potential benefits. Additionally, non FWS part-time positions held may not take into consideration students' academic schedules, as highlighted by Scott-Clayton (2012). Studies show that working more than 22 hours per week can lead to lower grades and higher dropout rates, while no work or a moderate amount (10–19 hours) is associated with benefits beyond financial gains (Owen et al., 2018). For example, Yu and colleagues (2020) investigated the impact of FWS participation on academic success in a large urban community college system in Texas. Findings indicate that FWS participants, often comprising marginalized groups, showed higher cumulative GPAs and increased odds of program completion or vertical transfer to another institution or advanced program. This underscores the equity implications of FWS, suggesting potential redesigns and expansions could better serve community college students. In another study by Akos and colleagues (2021), they explored the impact of FWS participation on career readiness competencies. Their study, conducted over three academic years, suggests a positive influence on the growth of career readiness competencies. The data highlights the potential for universities to strategically design FWS opportunities to enhance intentional career development, emphasizing the need for further research on career development outcomes.

Studies on FWS impacts also suggest wider impacts for improving representation within the STEMM workforce. Within the field of STEM education, Carver and colleagues (2017) launched the Operation STEM (OpSTEM) initiative, targeting FWS students from underrepresented populations. These students, having completed the summer program and pre-calculus courses, underwent training to become STEM peer tutors, compensated through work-study arrangements. The study highlighted the pressing demand in the local workforce for the successful completion of a post-secondary degree and subsequent hiring of more individuals in STEM fields. The university, in response, increased the number of underrepresented graduates, thereby contributing to the local workforce's needs. In light of these findings, the researchers suggest that further research is essential to explore the various ways in which FWS programs can influence and enhance the STEM pipeline.

Federal Work-Study (FWS) Program in US Higher Education

The Federal Work-Study (FWS) program is a government initiative designed to offer financial assistance to students facing financial need, aiming to help cover their college expenses. Working from a mission stance of "Funding America's Future,

One Student at a Time” (U.S. Department of Education, 2023, p. 23), FWS primarily supports economically disadvantaged students, many of whom are from under-resourced communities (Akos, et al., 2021; U.S. Department of Education, 2023). The FWS program was established in 1964 and originated as part of the Economic Opportunity Act, designed to combat poverty, and later transferred to the Higher Education Act of 1965 with a revised goal of developing a workforce (U.S. Department of Education, 2023). FWS provides approximately \$1 billion annually to roughly 600,000 students over 3,000 campuses across the U.S. (U.S. Department of Education, 2023). To date, over 33 million students have benefited from the program since its inception (Community College Research Center, 2021). FWS supports students with unmet financial needs, typically providing on-campus employment for 10 to 15 hours per week (Scott-Clayton, 2011). Beyond financial assistance, it is intended to influence academic and labor market outcomes, flex with students’ schedules, introduce students to professional networks, and offer valuable employment experience (CRCC, 2021).

The FWS program encourages effective time management, teaching students to balance work, academics, and extracurricular activities. Students build extensive networks with faculty, staff, and peers through on-campus jobs, fostering a sense of belonging and campus integration. Additionally, FWS serves as a stepping stone to future career opportunities, offering relevant work experience and enhancing students' resumes. Research indicates that FWS participants often exhibit higher persistence rates, degree completion, and post-college employment, contributing to overall student success (Scott-Clayton & Minaya, 2016). Furthermore, the program promotes financial literacy, inclusivity, and community engagement, leveling the playing field by providing valuable work opportunities often aligned with students' academic interests (Edwards, et al., 2010). Therefore, the FWS program can play a pivotal role in enhancing students' academic journeys, facilitating financial responsibility, and fostering a sense of community and professional growth.

Addressing the Underrepresentation through an FWS community-based research project

Efforts to address the underrepresentation of minoritized women in STEM must focus on creating more inclusive educational and professional environments. This includes providing targeted support such as mentorship programs, scholarships, and professional development opportunities that specifically cater to the needs of minoritized women (Brown & Watkins, 2021). Programs like the Federal Work-Study (FWS) initiative are unique opportunities that provide essential funding for students while offering practical work experiences, especially for students of low socioeconomic status who may otherwise be excluded from higher education achievement. Such opportunities play a vital role in bridging the gap between academic learning and real-world application (Scott-Clayton & Minaya, 2016).

While the FWS program aims to target work experiences that align with the student worker major, a vast majority of on-campus jobs limit the opportunity to apply the breath of skills that students are acquiring in their training. As such, innovative approaches to FWS considering both on campus, and community-engaged FWS endeavors can provide unique

opportunities to strengthen students’ training in contexts closer to those that they will engage in after graduation. Nevertheless, such endeavors are scarce and consequently their effectiveness influencing student development positively is limited.

In this study we present a unique FWS opportunity offered at a college in the US northeast, that is designed for students to engage in community-based research projects as part of their FWS working assignment. We hypothesize that by offering hands-on experiences and professional networking opportunities these programs can help build the confidence and skills necessary for success in STEM fields, and will positively impact women students in particular. As such, we present this case study as an exploratory assessment of the first edition of this program.

Theoretical Framework

This study draws upon the Situated Expectancy-Value Theory (SEVT) framework (Wigfield & Eccles, 2000) to understand student motivation in research experiences. SEVT focuses on three key factors: expectancy (belief in their ability to succeed), value (importance they place on the activity), and sense of belonging (feeling they are a part of the community). The current disconnects between FWS and research opportunities can negatively impact all three factors. Students may not believe they can be successful in research (expectancy) if their FWS tasks are unrelated to their field. They might not see the value of research (importance) if their tasks don't align with their career goals. Finally, feeling like their work is unrelated to their academic interests can lead to isolation and a lack of belonging within the research environment.

Situated Expectancy-Value Theory (SEVT), builds on the foundational components of the Expectancy-Value Theory (EVT) developed by Eccles-Parsons et al. (1983). SEVT emphasizes the role of context and situational factors in influencing an individual’s motivation and behavior. In 2022, Rosenzweig, Wigfield, and Eccles further expanded SEVT by addressing the "why, when, and how" for the next steps in expectancy-value intervention research. They recognized a gap in their initial study, which primarily focused on enhancing utility value. Their theoretical advancements provided insights into why certain interventions yield positive outcomes, offering a more comprehensive understanding of motivational dynamics in various contexts [7].

More recently, Matthews and Wigfield addressed the “unfortunate and dangerous omission of critical and cultural perspectives throughout the history of motivation theory and research” by intertwining Critical Race Theory (CRT) into their study (2024). This was the first attempt at adding the additional lens of race and racism to SEVT by proposing the impact of cultural milieu on motivation outcomes. In this study, we use Matthews and Wigfield’s (2024) [19] construct in addition to the “why, when, and how” to introduce culturally relevant targeted interventions in the form of community-based, hands-on research to enhance motivation. This includes reflection, supportive, engaging activities to spark enjoyment, and increasing expectations of setting students up for future academic and career success [7].

Application of SEVT to This Study

In this study, we examine how students' beliefs in their ability to succeed in STEM (expectancy) are influenced by their

experiences in the FWS research project. Participation in a project that aligns with their academic interests and career goals is anticipated to boost their confidence and self-efficacy in that field. In contrast, if FWS tasks are perceived as irrelevant, their expectancy for success in STEMM may be lower. We also investigate the perceived value of the research experience in relation to students' academic and career aspirations. The community-based nature of the project offers practical applications of STEMM concepts in contexts that reflect the students' backgrounds and interests, enhancing the intrinsic and utility value of their work. Moreover, the opportunity to work with people they care about and in communities that mirror their own experiences can significantly boost their sense of belonging and engagement in the research. By understanding how students perceive the alignment of the research with their long-term goals and personal interests, we gain insights into how value influences their motivation. Additionally, the study explores how the research environment and community interactions impact students' sense of belonging within the STEMM field. A supportive and inclusive setting is expected to improve students' feelings of connectedness and integration, while mentorship, peer collaboration, and the community focus of the project are assessed for their effects on students' identification with the STEMM community and their persistence in the field.

Methods

This study employs a qualitative exploratory case study approach [20] to gain a comprehensive understanding of the experiences of four undergraduate women in STEMM fields who engaged in a community-based research project through the FWS program run through a local university in an urban, Northeastern city in the United States. The case study is focusing on these students based on their FWS eligibility by their economic status. The participants included three women of color and one white woman, each from varied STEMM disciplines. The data were collected between late fall 2023 and the end of Spring 2024 semesters. This diverse cohort was chosen to capture a broad range of perspectives and experiences within the context of STEMM education and community-based research. Data collection for this study involved a multi-faceted approach consisting of three primary assessments: a pre-project interview, a self-assessment using the Indigo Me assessment to explore students' interests, strengths, and career aspirations, and a sense of belonging survey.

The pre-project interview was conducted using a set of five open-ended questions adapted from Singer, Montgomery, and Schmoll's study on fostering STEM identity (2020) [21]. These questions aimed to elicit detailed responses about the students' expectations, challenges, strengths, and goals related to their research experience, capturing their initial perceptions and anticipated outcomes. Singer et al. (2020) [22] focused on building a positive STEM identity by intentionally creating "learning and living environments" that offered role models, connections to the student's institution, and relevant, meaningful learning experiences.

To assess students' feelings of inclusion and connection within the research context, the team administered a sense of belonging survey adapted from Singer et al. (2020) [22]. This validated instrument uses a Likert scale to capture varying degrees of agreement or disagreement with statements related to belonging and integration within the research team, peer group, and

broader STEMM environment. (See Singer et al., 2020 for the complete survey instrument) [22].

The self-assessment component utilized the Indigo Me assessment, developed by Indigo Insights Assessments, which served as a starting point for discussions. It was not treated as a validated assessment instrument but rather as a tool to students explore and understand their responses, rather than investigating them in a formal sense. This conversation allowed the research leadership team and students to evaluate the students' interests, strengths, and career aspirations. By identifying these elements, the self-assessment discussion provided insights into the students' personal and professional motivations, which were instrumental in tailoring their roles and responsibilities within the research project to align with their individual growth areas.

The combination of these data collection methods allowed for a nuanced exploration of the participants' experiences. The pre-project interviews provided qualitative insights into the students' expectations and goals, while the self-assessment discussion revealed their strengths and career interests. The sense of belonging survey offered a quantitative measure of their integration and connection within the research and academic community. Analyzing these data collectively enabled a comprehensive understanding of how participation in community-based research influenced the students' academic experiences and career trajectories.

Through this detailed methodological approach, the study aimed to uncover how the research team developed the undergraduate research experience which captured FWS students' participation in community-based research placements within the FWS program impact the students' motivation, sense of belonging, and overall academic and career development. The findings are expected to contribute to a deeper understanding of how such research experiences can be leveraged to support the success and persistence of underrepresented women in STEMM fields.

Participants

This research was exempt by the institutional IRB, as it was considered an anonymized records review of an evaluation of an intervention. We use pseudonyms to refer to our participants, which are described next.

Aisha: An Asian first-year student majoring in Public Health. With a notably high GPA, Aisha is focused on improving community health outcomes and addressing health disparities.

Chloe: An African American transfer student in her first year, studying Environmental Design within Architecture. Chloe is passionate about sustainable design and aims to innovate within the field of environmental and urban development.

Victoria: A White senior who majored in Environmental Sustainability during the study. She transitioned to the university's doctoral program in Engineering Education after the study's conclusion. Victoria's background in Environmental Sustainability highlights her commitment to environmental issues and her interest in interdisciplinary solutions.

Jasmine: A Black senior majoring in Mechanical Engineering. With d, Jasmine's academic journey began in fall 2020 and included a major change in Spring 2021. She has since been accepted into a master's program in Environmental Studies, reflecting her dedication to integrating engineering skills with environmental initiatives.

Community-Based Research Undergraduate Intervention

The research team behind this intervention consists of Dr. Monica Miles and Dr. Rachel Bonnette, who are faculty members committed to mentoring marginalized undergraduate students in STEM fields. The team's initiative is deeply rooted in their development of the Environmental Justice Scholars Program, which has successfully engaged underrepresented students in STEM disciplines through community-based research projects. This undergraduate research intervention aims to address local environmental issues and contribute to community needs by involving students in hands-on, impactful research experiences.

The Environmental Justice Action Research (E-JAR) Lab represents the core of this intervention, providing a platform for students to engage in meaningful research related to environmental justice. Dr. Miles and Dr. Bonnette have developed to fostering student development through personalized mentorship and practical research experiences. This program integrates rigorous academic training with community engagement, ensuring that students are not only equipped with research skills but also have the opportunity to directly influence their communities.

The intervention includes comprehensive support, from assessing individual student needs to providing personalized guidance and career development. Through a cohort model, students benefit from collaborative learning environments, mentoring, and community involvement. Students commit to the program on a semester-by-semester basis, allowing the team to reassess their participation and support those who are graduating in developing transition materials and preparing for their next steps in graduate school or the workforce.

Students typically work 10-16 hours per week, although this may fluctuate due to academic demands such as midterms and finals. This approach ensures that students gain valuable research experience, develop critical thinking skills, and prepare for future academic and career paths. The research experience is designed to empower students, foster a sense of belonging, and enhance their engagement with both their academic and local communities.

Data Analysis

The data were analyzed using SEVT (Wigfield & Eccles, 2000) as a guiding framework for organizing and coding. The analysis focused on intrinsic value, utility value, and attainment value. *Intrinsic value* refers to the enjoyment or inherent interest in the task itself. For STEMM students, this might involve their passion for scientific inquiry, curiosity about natural phenomena, or the satisfaction derived from problem-solving (Wigfield & Eccles, 2000). *Utility value* pertains to the perceived usefulness of the task for achieving future goals. This includes how students view the community-based research project as beneficial for their academic pursuits, career aspirations, or personal development (Eccles & Wigfield, 2002). *Attainment value* involves the personal importance of doing well in a task, often linked to identity or self-concept. For example, students from underrepresented backgrounds in STEMM might see their success in research as a validation of their abilities and a means to contribute to their communities (Eccles, 2005). The coding process was systematically guided by these constructs, allowing us to categorize and interpret the data in alignment with the SEVT framework.

Results

The study explored how aligning individual student profiles with specific research roles can enhance their engagement and effectiveness in community-based projects. By matching students' strengths, motivations, and work styles with appropriate responsibilities, the research leadership team optimized each participant's experience and contribution.

Identifying Relevance through the Federal Work study Program

This study targeted FWS students to develop a comprehensive experience aimed at enhancing their development and retention. To tailor our approach, we administered a pre-survey to all FWS applicants considering placement on the research team. This intake survey conducted in Fall 2023 revealed that 81.8% of FWS applicants faced transportation challenges, as the university does not provide public transportation access for these students despite its green initiatives and the metro card availability at the medical school. Additionally, concerns were raised about the flexibility of schedules for community-based research, which, while not preventing participation, did influence how we facilitated their involvement with community partners and activities. Three out of the four in this cohort were not originally from the urban community in which the work took place. They appreciated opportunities to engage with the local community through various events and activities.

For instance, the students attended a local art museum in a northeastern city, where they participated in an outreach event organized by a Black-led food pantry, the only Halal organization in the area that focuses on local food justice issues. They also visited a historic art museum and explored landmarks under the guidance of the research leadership team to learn about the community's rich history in rising up from oppression. These experiences not only provided cultural enrichment but also deepened their connection to the urban community of color they were serving. These events were a common occurrence for the team, offering students opportunities to engage with the community beyond their research projects.

Harmonizing Student Strengths and Motivations with Research Project Roles

Using the Indigo assessment as a starting point for a discussion, which provides insights into students' strengths, motivators, and career aspirations, the research leadership team tailored each participant's role within the community-based research project. This discussion allowed us to align their individual strengths with specific project tasks, ensuring that each student's motivations and skills were matched with appropriate responsibilities. This approach facilitated effective engagement and supported each student's development by placing them in roles that resonated with their intrinsic (internal drives) and extrinsic (external rewards) motivators, thus enhancing their overall experience and sense of belonging within the project.

Aisha, a first-year Public Health student's results suggested that she would be well-suited for engaging with community members and building relationships. She was highly motivated to connect with and help others, while also possessing a drive for knowledge and understanding. She has a strong orientation towards patience and teamwork, which made her effective in community engagement. Her positive responses to statements such as "Group projects are valuable" and "I can effectively be a member of a team to design and build a hands-on project"

reflected her effective contribution to these aspects of the project. Aisha expressed her desire to "gain practical research skills and critical thinking abilities," underscoring her excitement about the community-based nature of the project.

Chloe, an African American transfer student studying Environmental Design, was driven by her strong motivation for knowledge and learning, while social motivators indicate a drive to connect with and help others. This alignment with the community-focused aspects of the research was evident in her enthusiasm for addressing lived experiences. She strongly agreed with statements like "Being a STEM professional is an important part of my self-image" and "STEM professionals help to make the world a better place." Chloe shared, "I want to sharpen my skills to be there for the community," highlighting her goal of personal development and contributing to a more inclusive campus environment.

Victoria, senior majoring in Environmental Sustainability, showcased her qualities by taking on a leadership role in advancing the project. Her preliminary reflections identified assertiveness and a drive to lead, in addition to a strong ability to persuade and motivate others. Her confidence, as indicated by her responses such as "I am confident in my ability to succeed" and "I can effectively lead a team to design and build a hands-on project," underscored her effectiveness in driving the research forward. Victoria articulated her aspiration to "learn more about [her] city, make greater connections, and make a positive impact with the knowledge and resources."

Jasmine excelled as a team motivator. Her influential abilities indicated her potential to persuade and inspire others, and she was highly motivated to connect with and help others. Her strong sense of belonging was evident from her agreement with statements like "I feel accepted in the EJAR research team" and "I feel comfortable in the EJAR research team," illustrating how the collaborative nature of the project positively impacted her experience. Jasmine emphasized the importance of gaining experience, stating, "More experience helping communities and ideas for future career - good experience."

Early checkpoints for assessing and reflecting on strengths can significantly improve student outcomes when assigning students to research roles, thereby maximizing their experience and ensuring that deliverables and work align with their strengths and motivations. By evaluating individual profiles, including communication styles, motivations, and career interests, research team leaders can make more informed decisions about role assignments. This approach ensures that each student is placed in a role that leverages their unique skills and aligns with their personal goals, leading to more effective contributions and a more fulfilling experience.

According to SEVT, students' motivation and performance are influenced by their expectancy (belief in their ability to succeed) and value (importance they place on the task). By aligning students' roles with their strengths and motivations, the project was founded on an approach designed to enhance their expectancy for success and the value they placed on their work. We hypothesized that this would lead to increased engagement and a stronger sense of belonging. This alignment not only enhances student engagement and productivity but also optimizes the quality of the research outputs. The findings emphasize the need for incorporating assessment and reflection

into research team formation processes to better support students and achieve project objectives. Overall, these results illustrate the importance of aligning students' roles with their individual strengths and motivations to enhance their engagement, productivity, and sense of belonging in community-based research projects.

Impact of the Community-Based Research Project

The study revealed that the community-based research project positively impacted students' confidence, value, and sense of belonging in STEMM fields. Aligning individual strengths and motivations with specific research roles was key to maximizing student engagement. The hands-on experience and mentorship enhanced students' expectations of acquiring practical skills and making meaningful contributions. The project's collaborative environment fostered a strong sense of belonging among participants. These findings indicate that aligning student interests with project roles can significantly boost engagement and empowerment, although further research is needed to evaluate the long-term effects on students' academic and career paths.

The hands-on experience and mentorship provided by the research leadership team significantly bolstered students' confidence in their ability to succeed in STEMM fields. For instance, Aisha expressed her expectation to "gain practical research skills and critical thinking abilities through the project," highlighting how the direct application of these skills contributed to her belief in her potential for success in STEMM. This illustrates the vital role of research leadership in not only guiding project work but also in assisting with students' professional development and confidence. Chloe also shared, "I want to sharpen my skills to be there for the community," emphasizing her goal of personal development and contributing to a more inclusive campus environment.

The project's alignment with students' personal motivations and interests notably increased their perceived value of STEMM education and research. Jasmine reflected on her desire to "learn more about my city and make greater connections," emphasizing her high utility value for the project. This alignment with her personal values and career goals enhanced her commitment to and engagement with the research, demonstrating how ensuring that research projects resonate with students' individual goals can maximize their investment and enthusiasm. Victoria articulated her aspiration to "learn more about [her] city, make greater connections, and make a positive impact with the knowledge and resources," reflecting the importance of cultivating inclusive and supportive environments that actively challenge discriminatory practices and address the needs of historically marginalized groups.

Additionally, the collaborative and inclusive nature of the project fostered a strong sense of belonging among the students. Chloe's positive responses to the Sense of Belonging survey, including her feelings of acceptance and comfort within the EJAR research team, illustrate how the supportive research environment contributed to her overall sense of integration and community. This highlights the importance of creating an inclusive atmosphere that nurtures students' feelings of belonging, which can significantly impact their overall experience and engagement in research activities. Victoria emphasized, "It's important to have that leadership role but it's

also important to have listening ears," underscoring the need for both leadership and inclusivity.

Grounded in SEVT, the responses from Aisha, Chloe, Jasmine, and Victoria highlight their motivations and expectations within the community-based research project. SEVT posits that students' motivation and performance are influenced by their expectancy (belief in their ability to succeed) and value (importance they place on the task). Aisha expressed her desire for "more research skills and... the ability to... do data analysis and... critical thinking skills," and shared her excitement about community-based research: "I'm really excited for community-based research because it is centered around people and the community they live in." Chloe articulated her goal of personal development, sharing, "I want to sharpen my skills to be there for the community. Develop me at the end of the day. That's like my ultimate goal. That's what I want to do." Victoria highlighted the significance of gaining experience to help communities and explore ideas for future career paths, aligning with SEVT's focus on expectancy and value.

While the students shared concerns about working in groups and doing community-based research, scheduling and working well with others on their team rose to the top of challenges. Working in the actual community was not considered a barrier unless it was related to transportation issues and the lack of transportation from campus to the east side of the city. Aisha noted, "I think some challenges when working in a group is like the ability to delegate... So it's more about communications and ability to compromise and just work well with other people in the team in general." Chloe emphasized, "I intend to be a listener... I'm very confident in my leadership abilities." Victoria added, "It's important to have that leadership role but it's also important to have listening ears." Jasmine pointed out the importance of being "open-minded - able to understand different mindsets, viewpoints, kind, easy to talk to, and research skills."

These findings share the effectiveness of community-based research projects in enhancing underrepresented students' engagement and empowerment in STEM fields. The data highlight the importance of aligning research experiences with students' individual strengths and motivations to maximize their impact and satisfaction. According to Situated Expectancy-Value Theory (SEVT), students' motivation and performance are influenced by their expectancy (belief in their ability to succeed) and value (importance they place on the task). By aligning students' roles with their strengths and motivations, the project enhanced their expectancy for success and the value they placed on their work, leading to increased engagement and a stronger sense of belonging. However, further research is necessary to investigate the long-term effects of such experiences on students' academic and career trajectories.

Discussion

Our findings demonstrate how well-designed research experiences tailored to student strengths and needs can improve students' expectancy, value, and sense of belonging in STEM Federal Work Study learning experiences. The hands-on experience and mentorship notably enhanced students' confidence in their ability to succeed in STEM fields, as evidenced by their eagerness to acquire practical research skills. The project's alignment with individual interests and its community focus increased the perceived value of STEM,

reflecting how personal motivation and project relevance can elevate students' engagement. Additionally, the collaborative nature of the project, supported by effective mentorship, fostered a strong sense of belonging among the students.

Community-based research projects offer a unique opportunity to bridge the gap between academic learning and real-world applications, particularly for students from marginalized communities. By engaging in research that directly addresses the needs and challenges of their communities, students can develop a sense of purpose and relevance in their studies, which can enhance their self-efficacy and motivation to succeed in STEM fields. Additionally, by focusing on students' strengths and interests, these projects can foster a sense of belonging and empowerment, encouraging students to see themselves as capable contributors to their communities and the broader STEM field. Our study found that all four participants were new to assessments that explore their communication styles, motivations, and career interests. Their feedback highlights the value of such tools in helping students better understand themselves and their fit within research teams. These results highlight the importance of research team leadership that has the necessary professional development and resources to support and mentor students effectively. Research indicates that exposure to role models and mentors significantly enhances underrepresented students' sense of belonging, self-identity, and self-efficacy in STEM fields [23]. This mentorship not only provided practical guidance but also motivated students and affirmed the value of their research efforts.

This work also demonstrates how Federal Work Study opportunities to conduct meaningful research can provide an important and equitable balance between funding for low-resource students while also increasing their experiential learning. Situated Expectancy-Value Theory relies on an understanding of context; the situation in which students are learning and the conditions that influence their performance both play a significant role in their motivation to engage in the learning experience and in STEM fields broadly. Here, we saw that the design of the program and the FWS nature of the experience (paid and limited to hours that provide students with sufficient time to study and participate in school work) supported students' participation and the value they saw in the program. This highlights the important equitable considerations of providing students with experiences that both mitigate the resource burden of low-socioeconomic status students in meeting needs like equipment costs and transportation while still providing vital learning experiences for long-term engagement in STEM. The FWS program plays a pivotal role in higher education, providing financial assistance, fostering personal and professional development, and contributing to career readiness. Leveraging FWS in higher education and the STEM pipeline is essential for promoting equity and expanding opportunities for diverse student populations. Future research should continue to explore the multifaceted impacts of FWS and identify mechanisms for optimizing its benefits. Given the incomplete and inconsistent nature of outcome research on FWS (Akos, et al., 2021; Scott-Clayton & Minaya, 2016) this study provides value insight into undergraduate education and FWS opportunities.

While the study shows the benefits of aligning research placements with students' strengths and interests, it also suggests exploring how involving students in co-creating research projects based on their individual profiles might further enhance engagement and self-efficacy. Future research should investigate the impact of such approaches on student outcomes and examine the long-term effects of community-based research experiences on career trajectories for underrepresented students.

Limitations

This study is constrained by several limitations. Firstly, the small sample size limits the generalizability of the findings. With only a few participants, the results may not be representative of the broader population of students in community-based research projects. Secondly, the qualitative nature of the study, while providing in-depth insights, may not capture the full spectrum of experiences and outcomes. The reliance on self-reported data and subjective assessments introduces potential biases and limits the scope of the findings.

Additionally, this study focuses on a specific intervention within a particular institutional context. The supports and resources available, such as the unique mentorship and project environment, may not be present at other institutions. As a result, the findings may not fully reflect the experiences of students in different settings or with varying levels of support. To enhance the robustness and applicability of future research, it is recommended that studies be conducted with a larger and more diverse sample. This would enable a more comprehensive analysis and potentially yield findings that are more broadly applicable to various student populations and institutional contexts.

Conclusion

The study reveals that aligning students with specific research roles based on their individual strengths, motivations, and work styles significantly enhances their engagement and effectiveness in community-based research projects. This tailored approach not only improved their overall experience but also facilitated their meaningful contributions and professional growth. The community-based research project positively influenced students' confidence, their perceived value of STEMM education, and their sense of belonging. The combination of hands-on experience, mentorship, and a collaborative environment contributed to increased confidence, aligned personal motivations with the project's objectives, and fostered a strong sense of community. These findings underscore the importance of strategically aligning research roles and creating an inclusive environment to maximize student engagement and impact. Further research is needed to explore the long-term effects of such experiences on students' academic and career trajectories.

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