

Original Research Paper

Humanizing STEM Faculty: Enhancing STEM Students' Sense of Belonging Through Student - Faculty Interaction

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Abstract: A Professor Panel Event was organized and promoted to first- and second-year STEM students. During the event, STEM professors shared insights about their backgrounds, personal experiences, academic challenges, and strategies for effective studying and office hour utilization. Students had the opportunity to ask questions and engage directly with the panelists. Surveys completed by both students and professors assessed the panel's impact, highlighting key takeaways. A follow-up survey measured students' sense of belonging within their chosen STEM fields. Data Analysis indicated that the event enhanced students' feelings of belonging, comfort in approaching professors, and willingness to seek help. These findings suggest that facilitating informal interactions between students and professors outside the classroom positively influences students' self-perception and their views of faculty members.

Keywords: Belongingness; First-Generation; STEM Education

Introduction

Belongingness refers to feeling connected to and socially accepted within a specific context or group (Baumeister & Leary, 1995). In higher education, a student's sense of belonging reflects their perceived levels of support, connection, and respect, along with the belief that they are valued and accepted members of the campus community (Strayhorn, 2012). Within STEM education, belongingness is a critical factor linked to academic engagement, motivation, and persistence. Research suggests that students who feel a sense of belonging are more likely to identify with their discipline, persist through academic challenges, and pursue long-term careers in STEM fields (Wilson et al., 2015; Godwin, 2016).

Addressing belongingness is especially vital for First-Generation, rural, and low-income college students, who often encounter stereotype threat, discrimination, and social isolation. These negative experiences can undermine academic performance, self-efficacy, and long-term persistence in STEM

(Gutierrez et al., 2022; Fink et al., 2020, Seymour et al., 1997). However, evidence shows that intentional practices can foster belonging and promote equitable outcomes in STEM education.

A key strategy for fostering belonging is creating inclusive learning environments where students feel valued, respected, and accepted. Classroom practices such as consistently affirming students' capabilities, designing inclusive assignments, and facilitating collaborative learning opportunities help promote success and equity (Fink et al., 2020).

Beyond the classroom, cultivating positive relationships between faculty and students is essential. One promising approach is the development of Pedagogical Partnerships, where students and faculty collaborate to co-design curriculum and learning experiences. These partnerships not only give faculty insight into students' perspectives and needs but also empower students to see themselves as active contributors to the learning process. Research shows that such

collaborations foster more inclusive learning environments, strengthen students' sense of agency, and humanize faculty in the eyes of students (Cook-Sather et al., 2023).

Demonstrating humanity is another powerful way for faculty to build positive relationships with students. In a study of 354 organic chemistry students, positive relationships with professors were linked to higher final grades, greater confidence in course material, and stronger science identity (Micari et al., 2012). Key factors in these relationships included students feeling comfortable approaching faculty, feeling respected, and perceiving professors as role models. Faculty can foster these connections by sharing personal stories, encouraging office hour attendance, showing genuine interest in students' learning, and incorporating students' interests into class discussions (Micari et al., 2012; Cook-Sather et al., 2023).

By prioritizing inclusive teaching practices and cultivating meaningful faculty-student relationships, STEM education can become more equitable, supportive, and empowering—particularly for at risk students. These efforts not only enhance students' sense of belonging but also contribute to their academic success, persistence, and long-term engagement in STEM fields.

Through collaboration with the First2 Network, one of 17 Alliances across the US funded through the NSF INCLUDES initiative, researchers sought to investigate whether special events outside the STEM classroom could promote meaningful, positive faculty-student relationships. One such event was a Professor Panel, where STEM professors participated in an hour-long question-and-answer session. The panel discussion engaged students by exploring professors' backgrounds, personal experiences, academic challenges, and strategies for effective studying and office hour utilization. By providing opportunities for students to engage with faculty in more personal, low-stakes settings, these events have the potential to humanize professors, break down perceived barriers, and foster supportive learning environments. Understanding the impact of such interactions is essential for promoting student belongingness and success in STEM education.

Materials and Methods

Design

A Plan-Do-Study Act (PDSA) was used to explore a specific “change idea”. A PDSA is an iterative four-stage problem-solving model used in improvement science. PDSAs are used throughout the First2 Network to test and refine “change ideas” aimed at addressing barriers faced by rural, first-generation, and low-income STEM students.

The “change idea” for this project was explored through the research question: *Do events that facilitate informal interactions between students and professors outside the classroom promote students' feelings of belonging in STEM fields of study?* To explore this idea, two Professor Panel events were organized and implemented—one during the Spring 2024 semester and the second during Fall 2024. Each panel featured five professors who regularly taught introductory STEM courses for first- and second-year students. The one-hour sessions were designed to foster dialogue between faculty and students, with professors sharing their backgrounds, personal experiences, academic challenges, and advice for effective studying and office hour utilization.

For both panel events, questions were developed in advance by the student lead for the project in collaboration with the WVU First2 Network Institutional Team shared with the panelists beforehand. Time was allocated for audience questions, allowing students to engage directly with the panelists. The events were promoted through the STEM Student Listserv, targeted emails to STEM faculty, and in-class announcements. Faculty were encouraged to advertise the panels in their courses and offer extra credit incentives to increase student participation.

As students entered the Professor Panel, they were asked to sign in using a QR Code so attendance could be recorded and sent back to professors offering extra credit. Next, the student lead welcomed attendees, introduced the Panelists, and ran the panel.

Data Collection

Data collection methods evolved between the two panel events to strengthen the assessment of the panel's impact on students' sense of belonging. During the Spring 2024 panel, a pre-survey including a belongingness scale (Good et al., 2012) was distributed electronically at the start of the event, and

two post-surveys: one with the same belongingness scale and another with the open-ended questions like “What did you like most about the event?” and “What did you like least about the event?”, were administered at the end. The belongingness scale is a validated instrument designed to assess individuals’ feelings of membership, acceptance, and value within the mathematics community. Research has demonstrated its strong reliability and predictive validity, showing that a higher sense of belonging is associated with greater motivation, confidence, and intent to persist in math-related fields (Good et al., 2012). Of the 111 students who signed into the Spring event, 78 students completed the pre-survey, 73 students completed the belongingness post-survey, and six students completed the post survey with open-ended questions.

For the pre- and post-survey belongingness scale, students rated their agreement with various statements using a 5-point Likert scale (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree). The survey instructions asked students to ‘read each statement carefully and select the number that best reflects your level of agreement.’ An example statement included, ‘I feel accepted in my campus’s STEM community.’ The percentage of students selecting each response option was then calculated for every statement. Since there were only six responses to the open-ended questions, a formal qualitative analysis was not conducted. However, the responses were reviewed for any notable insights that could inform future event planning and improvements.

For the Fall 2024 panel, the survey design was refined based on lessons learned from the previous event. Instead of administering both pre- and post-surveys, a single survey was distributed electronically at the conclusion of the event. This survey included a retrospective belongingness scale (Good et al., 2012) along with the same open-ended reflection questions from the Spring panel. This streamlined approach was chosen to increase the response rate and to better capture students’ perceptions of belongingness by prompting them to reflect on their experiences after the event. Of the 404 students who signed into the Fall event, 201 students completed the post-survey which included both the belongingness scale and 6 open-ended question..

Data Analysis

Data analysis for the post-survey began with examining responses to the belongingness scale, followed by a content analysis of the open-ended questions to identify recurring themes and insights. For the retrospective belongingness questions, students rated their agreement with various statements using a 5-point Likert scale (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree). The retrospective survey instructions directed students to “read each statement carefully and indicate the number that best reflects your level of agreement both BEFORE and AFTER attending the Professor Panel.” For each statement, the percentage of students who disagreed (Strongly Disagree or Disagree) and those who agreed (Strongly Agree or Agree) was calculated separately for both the BEFORE and AFTER responses.

A content analysis approach was used to examine responses to each open-ended question. The process began with an initial review of student responses, allowing preliminary themes to emerge. These emerging themes provided a foundation for categorizing the responses. Next, responses were systematically coded according to these categories to identify patterns and key insights.

Results

Findings were presented based on our research question, with a primary focus on data collected from the second panel. While the first panel showed a slight increase in students’ feelings of belongingness between the pre- and post-surveys, its greatest impact was in guiding improvements for the second panel.

Research Question: Do events that facilitate informal interactions between students and professors outside the classroom promote students’ feelings of belonging in STEM fields of study?

Among the 201 students who completed the retrospective post-survey on feelings of belongingness, there was a 15–36.5% increase in the number of students who agreed with the belongingness survey statements. See Table 1 for a sample of statements and a comparison of responses.

Table 1: Comparison of Student Agreement with Belongingness Statements Before and After Attending the Professor Panel

Survey Statement	% Strongly Agree/Agree - Before	% Strongly Agree/Agree - After	% Increase
I feel accepted in my campus's STEM community	56.40%	77%	36.50%
I feel I fit in with my campus's STEM community	52%	67.60%	30.00%
I feel comfortable in my campus's STEM community	57.80%	70.60%	22.15%
I feel respected in my campus's STEM community	58.30%	73.50%	26.07%
I feel a sense of belonging in my campus's STEM community.	54.90%	70.60%	28.60%

To better understand the impact of the panel, open-ended responses were analyzed, revealing key themes across each question. When asked about their favorite experience or moment from the event, the most common theme (39.5% of responses) was hearing professors share their personal backgrounds and experiences. Students appreciated learning about their professors' academic journeys, with one stating, *"Learning about my professors' experiences throughout college made me feel better as a student and gave me hope seeing where they ended up."* Another prominent theme (14% of responses) was the value of receiving advice and study tips for succeeding in college. One student noted, *"I really enjoyed hearing about the professor's time in college and what worked for them."*

Students were also asked how the event influenced their feelings about approaching professors. More than half (52%) indicated that the panel helped them feel more comfortable seeking help, as it made faculty seem more approachable. One student explained, *"It made me more comfortable asking for help. It's personally embarrassing to show that I'm struggling, so I usually just let myself struggle instead of doing anything about it."* Additionally, 13.8% of responses reflected an increased willingness to seek academic support, with one student commenting, *"I feel more comfortable going to my professors for help if I need it now."*

Finally, students provided suggestions for improving the event. A common theme (24% of responses) was the need for better audio, as many struggled to hear the panelists. One student suggested, *"Microphones would help us hear the professors better."* Another recurring recommendation (10.2% of responses) was to increase student interaction and participation. One student proposed, *"I think the event could be improved by allowing attendees to submit questions on an online forum before the event."* These insights highlight the panel's effectiveness in fostering connections between students and faculty while also providing considerations for future improvements.

Discussion

We recognize that fostering a sense of belonging in STEM is particularly critical for first-generation, rural, and low-income students and encourage institutions of higher education to hold similar events. Our findings indicate that events like these, which create opportunities for informal student-faculty interactions, can cultivate a sense of belonging. Prior research (Micari et al., 2012; Cook-Sather et al., 2023) has shown that when professors are perceived as more relatable and approachable, students are more likely to feel a sense of connection within their academic community. The Professor Panel supports these findings by providing students with an opportunity to get to know their professors outside of an academic setting. Students can see their professors as real people with similar experiences, challenges, and successes.

One way that the Professor Panel event could have been improved was to allow students to submit their own questions before or during the event. This would serve as a way for the students to further interact with the professors and thus strengthen the student-professor relationship.

The observed increase in feelings of belongingness as well as the number of students who reported feeling more comfortable approaching their professors and more willingness to seek help connects events that facilitate informal interactions between students and professors, such as this Professor Panel to student feelings of belongingness. Therefore, holding Professor Panels and allowing the students to engage with the panelists can effectively strengthen student-professor relationships and foster

a more inclusive academic environment.

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