WIP: Using Career Panels to Spark Curiosity and Career Awareness Among Mathematics Majors

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Introduction

For many mathematics majors, professional pathways are less explicitly structured than in disciplines with clearly defined industry pipelines. Academic positions remain limited, and employers outside academia may not immediately recognize the breadth of skills developed through mathematical training. Consequently, departments face particular challenges in helping students identify viable professional trajectories and in communicating how mathematical expertise translates into professional practice.

Recognizing these challenges, the Mathematical Association of America's 2015 Curriculum Guide to Majors in the Mathematical Sciences (CUPM) recommends that "Mathematical sciences major programs should offer their students an orientation to careers in mathematics" [1]. Similarly, the BIG (Business, Industry, Government) Math Network encourages departments to engage students with professional pathways beyond academia [2].

In response to these recommendations, the authors organized several virtual career panels during the Fall Quarter. The panels were hosted by a national organization and the University of Louisiana at Monroe, and were selected in part to reduce logistical barriers and allow programming to begin immediately. These events were supported by the Louisiana Board of Regents Departmental Enhancement Grant under contract number LEQSF(2025-26)-ENH-DE-07. This grant established the Applied eXploration In Open Mathematics Lab (AXIOM Lab), an informal learning space designed to centralize undergraduate research engagement, mentoring, and professional development within the mathematics program. The present study examines this initial programming intervention within that broader initiative, which seeks to understand how structured informal programming influences students' research engagement and career awareness.

To examine how students engaged with these panels, the authors adapted a previously validated survey instrument [3] to the context of mathematics and added a curiosity construct. This Work-in-Progress paper reports preliminary results from the first implementation of the panels and the instrument, and outlines next steps for refinement and future data collection. In particular, this exploratory study addresses the following questions:

RQ1: What themes emerge in students' open-ended reflections following mathematics career panels?

RQ2: How do students articulate curiosity, awareness, and remaining questions about mathematics-related careers?

RQ3: What considerations emerge from this initial implementation for designing career-orientation programming that meaningfully supports mathematics majors in identifying viable professional pathways?

Context

Louisiana Tech University is a public, doctoral-granting university classified as a Research University with High Activity (R2). The institution has a strong emphasis on engineering and science, and undergraduate mathematics instruction plays a central role in supporting a wide range of STEM programs. The Mathematics and Statistics program is housed in the College of Engineering and Science (COES), situating mathematics education within a broader engineering- and science-oriented academic environment.

This institutional context is relevant for interpreting the findings of the present study. Although the career panels examined here were designed with mathematics majors in mind, the surrounding academic culture and student population mean that mathematics-related programming often engages a broader STEM audience, particularly students in engineering and applied sciences. As a result, participant perspectives reflect not only disciplinary views of mathematics as a major field of study, but also perceptions shaped by mathematics' role in professional preparation across STEM disciplines.

Methods

The authors organized three panels for mathematics majors at Louisiana Tech University during the Fall Quarter. Two events were panel discussions in the Business, Industry, Government (BIG) Math Network Industry Connect Series. The third event, a career talk by an Amazon Web Services (AWS) Research Scientist, was organized by the math club at the University of Louisiana at Monroe. Collectively, these events were designed to expose students to professional perspectives beyond the university and local community, introduce a range of potential career paths, and provide opportunities to hear from mathematics professionals working in industry.

The BIG Math Network Industry Connect Series is a national program that connects students in the mathematical sciences with professionals working in business, industry, and government through virtual panel events. The first panel focused on professional communication in the mathematical sciences, with panelists discussing communication skills across different career stages and professional contexts. The second panel featured recent graduates working in industry, who shared experiences related to the transition from academic study to professional roles. Both panels consisted of moderated discussions followed by question-and-answer periods with student participants.

The third event was a one-hour virtual career talk organized by the mathematics club at the University of Louisiana at Monroe. The talk focused on career pathways for mathematics majors beyond academia, with particular emphasis on data science, cloud computing, and related applications of mathematics. The speaker described how mathematical training can be applied in industry settings and discussed skills and experiences relevant to careers in these areas. Time was reserved for questions and discussion with student attendees.

Event organization and recruitment varied across the three events. The communication panel was hosted by the mathematics club at Louisiana Tech University and advertised through student-organization social media and a weekly COES newsletter. As an event organized by a student organization, attendance at this panel was eligible to count toward mandatory professional development requirements for first-year engineering students. Approximately 70 students attended this event; of these, three identified as mathematics majors. While the event was targeted to mathematics majors, most attendees were early-career engineering students participating for professional development credit, and a subset of attendees completed a post-event survey.

The recent graduates panel was hosted and advertised by the authors. Since the focus was on data science, students majoring in mathematics, computer science, and cyber engineering were targeted. The virtual career talk with an AWS Research Scientist was hosted by the authors and facilitated by the mathematics club at the University of Louisiana at Monroe. These events were advertised by email and in-class announcements. Attendance at each of these latter two events consisted of a single student.

Exit survey responses were unevenly distributed across events. Of the 38 total responses, 37 were submitted following the panel on communication and one followed the recent graduates panel. The student who attended the AWS career talk declined to complete the exit survey.

Data Collection and Instrument

Data were collected using a voluntary, anonymous exit survey administered at the end of each event. The survey was designed to capture students' learning, curiosity, and remaining questions related to careers in mathematics.

The exit survey instrument was adapted from a previously validated survey [3] used to examine the influence of career panels on student perceptions, attitudes, and career intentions. Items were selected and modified to reflect the context of mathematics majors and mathematics-related careers, drawing on the underlying constructs measured in the original instrument with the addition of a curiosity construct. The adapted survey included both open-ended reflection prompts and Likert-scale items aligned with career awareness, perceived value, confidence, and curiosity. The full survey instrument is provided in the appendix.

Participants

Survey respondents were drawn from STEM programs within the College of Engineering and Science and were predominantly early undergraduate engineering majors. As shown in Table 1, most respondents were first-year students enrolled in engineering programs, with smaller numbers of participants majoring in mathematics, computer science, and physics, as well as one respondent with a declared double major in mathematics and engineering. The respondent pool also included one post-baccalaureate student. Most respondents reported little or no prior experience attending career panels. As participation in the exit survey was voluntary, respondents represent a subset of event attendees rather than the full population present at each event.

Table 1: Distribution of respondents by class and field of study.

	Math	CS	Eng.& Math	Eng	Phys	Total
Freshman	2.63%	5.26%	2.63%	60.53%	0.00%	71.05%
Sophomore	0.00%	0.00%	0.00%	18.42%	0.00%	18.42%
Junior	0.00%	0.00%	0.00%	2.63%	0.00%	2.63%
Senior	2.63%	0.00%	0.00%	0.00%	0.00%	2.63%
Post-bacc	0.00%	0.00%	0.00%	0.00%	2.63%	2.63%
No response	0.00%	0.00%	0.00%	2.63%	0.00%	2.63%
Total	5.26%	5.26%	2.63%	84.21%	2.63%	

Data Analysis

Open-ended survey responses were analyzed using first-cycle Descriptive Coding [4], in which each response segment was summarized using a concise noun-based label capturing its primary topic. Initial codes were generated inductively from the data rather than from a predetermined codebook. One author conducted the first round of coding across all open-ended responses, after which both authors collaboratively reviewed and refined the code set.

Coding records were maintained in a structured spreadsheet that included raw responses, assigned first-cycle codes, and a running list of unique codes. During collaborative review, codes were clarified, merged, or revised as needed to improve consistency. Selected responses were re-coded when discrepancies or ambiguities were identified, and the finalized code set was applied consistently across questions.

Following first-cycle coding, codes were grouped into broader thematic categories through iterative comparison based on conceptual similarity. These second-cycle themes were developed to capture patterns across survey prompts rather than to construct a formal grounded theory. Frequency counts of codes and themes were calculated to summarize distributional patterns, but thematic development was guided by conceptual coherence rather than frequency alone. The resulting themes and their associated first-cycle codes are shown in Table 2.

Responses to Likert-scale items were summarized descriptively and used to contextualize patterns identified in the qualitative analysis. Demographic data were reported descriptively but were not used for subgroup comparison given the small and uneven sample distribution.

Ethical Considerations

This research was conducted under institutional review board approval (IRB #26-027). Participation in the exit survey was voluntary, and no identifying information was collected.

Table 2: Second-Cycle Themes and Associated First-Cycle Descriptive Codes

Theme	**Associated First-Cycle Codes**
Communication as a Central Component of Mathematical Work	Importance of Communication; Audience-aware communication; Presentation communication strategies; Foundations of mathematical communication; Communication challenges in math
Career Preparation, Decision-Making, and Entry	Career motivation; Career decision-making; Career planning strategies; Career entry timeline; Career challenges; Flexibility of job requirements; Earnings potential; Mathematics as an alternative career pathway
Broadening Awareness and Perceptions of Mathematics and Mathematical Careers	Awareness of mathematical careers; Awareness of mathematics fields; Exposure to new career field; Career scope; Typical career outcomes; Perceived relevance of mathematics; Perceptions of mathematics as a field; Identity; Clarification of specific field or role; Funding challenges in mathematics; Perceived difficulty of mathematics
Interdisciplinary and Applied Nature of Mathematical Work	Interdisciplinary careers; Interdisciplinary skills; Collaborative nature of mathematics; Application of mathematics to data problems; Use of mathematics in professional practice; Comparison of mathematics and engineering career pathways
Limits of Panels and Signals from the Instrument	No response; Explicit no question; Vague question; Non-substantive negative response; Non-substantive positive response; Non-substantive response; Perceived lack of mathematical content; Learning math; Interest in non-math fields

Preliminary Results

As most exit surveys were completed after the BIG Math Network panel on professional communication, the results reported here primarily reflect participants' engagement with that event rather than cross-panel comparisons.

The distribution of second-cycle themes across survey prompts is displayed in Table 3. Communication-related themes were concentrated in responses to Q1 and Q2, while career preparation themes emerged primarily in Q3–Q5. A large proportion of responses to later questions were coded within Theme 5, reflecting nonresponse, explicit indications of no remaining questions, and instrument-related signals.

Table 3: Distribution of Second-Cycle Themes Across Open-Ended Survey Prompts. Frequencies represent the number of coded segments within each theme by survey prompt. Totals reflect aggregate code applications rather than the number of individual respondents.

Theme	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Total**
Communication as a Central Component of Mathematical Work	21	18	3	0	3	45
Career Preparation, Decision-Making, and Entry	1	1	8	2	4	16
Broadening Awareness and Perceptions of Mathematics and Mathematical Careers	5	5	3	3	3	19
Interdisciplinary and Applied Nature of Mathematical Work	1	2	2	2	1	8
Limits of Panels and Signals from the Instrument	12	12	23	31	25	103

Communication as Central to Mathematical Work

Participants frequently emphasized that communication is integral to professional mathematical practice. Responses highlighted explaining ideas clearly, adjusting explanations to different audiences, and organizing presentations effectively. As one respondent noted, "Communication is an integral part of explaining math. You need to be able [to] not only clearly describe the topic, but also be able to communicate it in an understandable way."

Career Preparation and Entry Questions

Across prompts about careers in mathematics, respondents commonly raised questions about how to translate undergraduate training into employment, including decision-making, timelines, and challenges in entering the workforce. For example, one asked, "What would be a way to start my career after college?" and another asked, "What was the most challenging part of entering a real-world job in the mathematics field?" These questions suggest uncertainty about concrete pathways and early-career transitions.

Broadening Awareness of Mathematics-Related Careers

Some responses suggested increased awareness of the range of careers connected to mathematical training. Participants framed mathematics as versatile and applicable across settings, as reflected in questions such as, "Are you able to go into multiple industries with a mathematics degree?" These responses tended to indicate broadened perceptions rather than specific career plans.

Signals About Fit and Engagement

A substantial portion of coded responses fell within the theme "Limits of Panels and Signals from the Instrument", which captures nonresponse, explicit indications of no remaining questions, and brief or off-prompt responses (e.g., "I like MAF."). Given that the communication-focused event satisfied professional development requirements for first-year engineering students, these response patterns suggest variation in participant engagement and perceived relevance. These signals are useful for interpreting the qualitative themes and for informing refinements to recruitment and survey administration in future implementations.

Likert-Scale Items

Likert responses (Table 4) generally skewed toward agreement, particularly on items related to the value of mathematics and confidence in learning. Items tied more directly to curiosity and career exploration showed more neutral responses, with the lowest agreement on exploring math-related careers not previously considered. Overall, the Likert patterns complement the open-ended data: participants reported generally positive views about mathematics while expressing more mixed responses on future-oriented career exploration.

Table 4: Summary of Likert-Scale Responses by Item

Item	Agree	Neutral	Disagree	No response
Question 6	47.37%	31.58%	13.15%	7.89%
Question 7	60.53%	21.05%	13.16%	5.26%
Question 8	63.16%	23.68%	7.89%	5.26%
Question 9	73.68%	18.42%	2.63%	5.26%
Question 10	76.32%	15.79%	2.63%	5.26%
Question 11	81.58%	13.16%	0.00%	5.26%
Question 12	71.05%	18.42%	5.26%	5.26%
Question 13	31.58%	39.47%	18.42%	10.53%

Discussion

This exploratory study examined how students responded to mathematics career panels implemented within a newly established informal learning environment. Consistent with perspectives on informal learning environments, learning in this context is conceptualized not as mastery of technical content, but as shifts in awareness, curiosity, and perceptions of professional mathematical practice.

Guided by RQ1–RQ3, the analysis focused on thematic patterns, articulations of curiosity and uncertainty, and implications for program design. While the panels were intended for mathematics majors, most responses were provided by early-career engineering students attending a communication-focused event.

A notable pattern in the responses was the emphasis on communication as a central component of mathematical work. Participants described communication as integral to explaining ideas, collaborating with others, and functioning effectively in professional contexts. Given the panel's explicit focus on communication, this pattern suggests that students were attentive to professional dimensions of mathematical practice that are often less visible in coursework. More broadly, this finding suggests that when particular aspects of professional practice are foregrounded, students readily recognize and articulate those dimensions of mathematical work. From a curricular perspective, career panels may therefore serve as effective venues for making non-technical aspects of mathematical work explicit.

Alongside these reflections, participants' questions suggested uncertainty about career preparation and entry into the workforce, while also surfacing curiosity about how mathematics connects to professional practice. Even in a communication-focused panel, some students asked how to begin a career after graduation and how academic training translates into professional roles. These responses illustrate that students articulate curiosity not only through expressions of interest, but also through concrete questions about pathways, timing, and entry points into professional roles. Although based on a limited and context-specific set of responses, these questions suggest that the exit survey instrument can elicit expressions of career-related curiosity that may be useful for departments seeking formative feedback on career-oriented programming.

Beyond questions about career pathways, some responses reflected on the interdisciplinary and applied nature of mathematical work, describing mathematics as embedded within broader professional practice. Given that most respondents were engineering majors, these reflections are notable in that they articulate connections between mathematics and professional contexts that are not always foregrounded in formal training. In this sense, career panels that situate mathematics within interdisciplinary settings may help students reconsider how mathematical expertise operates alongside applied science and engineering work.

Patterns of minimal, off-prompt, or nonresponse in the qualitative data highlight how institutional context shaped student engagement. In particular, mandatory participation for professional development credit and disciplinary misalignment between panel content and attendees' primary fields appeared to influence the depth of reflection for some participants. Rather than viewing these patterns as failures of the panel or the instrument, they can be interpreted as signals about the conditions under which career-oriented interventions are more or less likely to elicit substantive engagement. These findings suggest that career-orientation programming intended for mathematics majors may require targeted recruitment and clearer disciplinary framing to ensure alignment between audience, content, and programmatic goals.

Taken together, these findings provide preliminary insight into how students respond to career-orientation programming within an informal learning environment designed to support mathematics majors. While the present study does not support claims about causal impact or construct validity, the combination of open-ended prompts and descriptive Likert-scale items enabled a structured examination of students' perceptions, questions, and uncertainties. The adapted exit survey instrument thus serves as a formative tool within this broader initiative, informing ongoing refinement of programming design and recruitment strategies. Future iterations will prioritize mathematics-major participation across additional events and pursue more systematic validation of the instrument. In this way, the project contributes to departmental efforts to more intentionally orient mathematics majors toward viable professional pathways.

References

[1] Mathematical Association of America, *CUPM Curriculum Guide to Majors in the Mathematical Sciences*. Washington, DC: Mathematical Association of America, 2015. [Online]. Available: https://www.maa.org/sites/default/files/CUPM%20Guide.pdf

[2] R. Levy, “Mathematical Sciences Internships: Building Career Pathways,” Los Angeles, CA, Oct. 2015, report from the September 1–2, 2015 NSF–IPAM Mathematical Sciences Internship Workshop. [Online]. Available: https://bigmathnetwork.org/resources-for-departments/

[3] J. W. Merhout, J. S. Benamati, and T. Rajkumar, “The influence of career panels on student perceptions, attitudes, and intentions toward the information systems profession,” *Decision Sciences Journal of Innovative Education*, vol. 20, no. 2, pp. 61–75, Apr. 2022.

[4] J. Saldaña, *The Coding Manual for Qualitative Researchers*, 2nd ed. Los Angeles, Calif.: SAGE Publ, 2013.

Appendix A: Exit Survey Instrument

Career Panel Exit Survey

About this study
You are invited to participate in a research study about student experiences in mathematics career panels. The purpose of this study is to understand what students learn from career panels, what questions they still have, and how such panels can be improved.
What you will do
If you choose to participate, you will complete this short survey. It should take about 5–7 minutes.
Voluntary participation
Your participation is completely voluntary. You may skip any questions you do not wish to answer, and you may stop at any time without penalty.
Confidentiality
The survey does not ask for your name or any identifying information. Responses will be reported in aggregate, and individual answers will not be linked back to you.
Consent
By completing and returning this survey, you are indicating your consent to participate in the study.
For more information
Drs. Ann Clifton and Blake Farman are the principal investigators for this study. For any questions regarding the research, subjects' rights, or related matters, you may contact them at aclifton@latech.edu or bfarman@latech.edu.

Background Information

1. Major/minor:

2. Year in program:

3. Prior experience with career panels (None, 1-2, 3+):

Appendix A: Exit Survey Instrument

Thank you for attending today's mathematics career panel! This survey will help us improve future events and better understand what math majors are curious about when it comes to careers. Your responses will remain confidential. **Please complete both pages. This survey will take approximately 5-7 minutes.**

Survey Questions

1. One thing I learned today that I didn't know before was...

2. The part of the discussion that surprised me most was...

3. What questions do you still have for the panelists?

4. What questions do you still have about the specific careers discussed today?

5. What questions do you still have about careers in mathematics in general?

Appendix A: Exit Survey Instrument

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
6. This panel increased my curiosity about careers in mathematics.	◯	◯	◯	◯	◯
7. Working in mathematics-related fields is very exciting.	◯	◯	◯	◯	◯
8. There are many career opportunities available to math majors.	◯	◯	◯	◯	◯
9. Mathematicians often work as a team to solve problems.	◯	◯	◯	◯	◯
10. I study Mathematics because I know how useful it is.	◯	◯	◯	◯	◯
11. I am confident in my ability to learn mathematical concepts.	◯	◯	◯	◯	◯
12. I enjoy solving challenging mathematical problems.	◯	◯	◯	◯	◯
13. After this panel, I am more likely to explore mathematics-related careers that I had not previously considered.	◯	◯	◯	◯	◯

14. What careers in mathematics would you like to learn more about in future panels?