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Investigating pre-health students' science identity and the factors that influence them to change programs or tracks.

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Investigating Pre-health Students' Science Identity and the Factors That Influence Them to Change Programs or Tracks

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Abstract

Retention is a particularly pressing issue for undergraduate students, specifically those in pre-health programs or tracks. This can be affected by a students' science identity, which is referred to as viewing oneself as a "science person." This study focused on investigating science identity and influencing factors that can cause program or track change of pre-health students. Previous studies have investigated these factors regarding pre-health students applying to medical school, but this study opened the investigation to a variety of pre-health students and focused on characterizing students' experiences prior to their health professional school applications. The analysis of peer-led focus group interviews was framed using Science Identity Model and Social Learning Theory frameworks. Analysis with a phenomenographic approach revealed recurring patterns and themes amongst the transcripts that indicated a strong science identity, feelings of support, and readily available resources are necessary for retention in pre-health programs or tracks. Feelings of competitiveness and disconnect, extensive campus involvement, necessary employment, unmet university expectations, and a desire for upper-level tutoring were identified as factors that result in students changing programs or tracks. These findings suggest for the continuation and expansion of resources that students believe aid in their success.

Introduction

Science identity refers to viewing oneself as a "science person", which is important for student outcomes such as tenacity and retention (Stets et al., 2017). Students' perceptions of their science identity have been identified as an important factor in feeling qualified to pursue careers in a science field (McCartney et al., 2022). These views, in tandem with additional factors, play a role in a students' decision to continue pursuing their intended program or track.

This work is a continuation of a project using focus groups to investigate factors influencing attrition among undergraduate STEM (science, technology, engineering, and mathematics) students. The previous project found factors including resources, science identity, and course structure to influence attrition. Within the realm of resources, students most frequently utilized REACH (Resources for Academic Achievement) and PAL (Peer Assisted Learning) materials; however, students infrequently utilized office hours and found the university website difficult to navigate to find appropriate resources. Regarding science identity, all students stated they had prior exposure to STEM that motivated and influenced them to choose a STEM major/career. Common course structure themes included a preference for biology courses over chemistry courses, a dislike for flipped classrooms (an inverted classroom where students assimilate lecture videos at home and engage in problems or discussion during class (Nouri, 2016)) due to management difficulty, and multiple-instructor courses being neither helpful nor harmful to students' success.

Background

Retention is a particularly pressing issue for undergraduate students, specifically those in pre-health programs or tracks. In 2020, only 16.5% of students who intended to follow a pre-med track graduated with the course requirements to apply to medical school, indicating that many

students did not complete their goal of medical school preparations. The year prior, only 42.6% of applicants were accepted to any medical program, with the median number of applications per applicant being 15 (Zhang et al., 2020). In addition to the rigorous academic requirements needed for admittance into these programs or tracks, "hidden curriculum" such as community service, shadowing experiences, and research (Williams, 2016) act as roadblocks that prevent students from progressing. These "hidden curriculums" take time and dedication off-campus that students may not have time for if they are juggling outside responsibilities or do not have a reliable means of transportation.

Attrition has its highest rates early in undergraduates' careers, with most students dropping out within their first year (Matz et al., 2023). A 2013 study found that around one-third of nursing students reported intentions of dropping out during their first and second semester due to the coursework load (Dante et al., 2016). Although coursework plays a large role, demographics and academic preparedness have also been identified as factors linked to attrition in pre-health students (Zhang et al., 2020). Women and members of underrepresented racial and ethnic minority groups have been found to experience a decline in interest as well as a lower likelihood of applying to medical schools (Fiorentine, 1987). As for academic preparedness, students with low GPAs or performances in courses experienced a decline in their interest and their perceived ability to continue their studies (Barr et al., 2008). One or more of these factors has the potential to influence students' perceptions of their belonging and value in their chosen program or track.

With many pre-health students having prerequisites within the STEM field, it was found that pre-med and other pre-health students were more likely to have a higher STEM identity than their peers with performance-competence, recognition, and interest playing a role as contributing

factors. Pre-health students' higher interest in science and math courses and strongly developed career-related goals led them to exhibit these characteristics (Dou et al., 2021). Students that think of themselves as a "science person" often exhibit behaviors that acknowledge their performance abilities. The self-perception one carries of their science identity has a direct impact on their choice of a science occupation which means that it must be very closely monitored to promote STEM achievements (Stets et al., 2017).

Readily available academic resources are extremely important and useful, but students often do not seek them out during difficult times. A student's seeking out of these resources gives insight to their academic mindset and feelings towards their program or track through their eagerness and willingness to make productive changes to their study habits. The academic mindset and achievement goal orientation were identified as significant in how a student performs and persists. A 2018 study found that of 15,000 students that took an introductory science course, 20% completed four or more additional science courses. The students that did continue with additional courses identified motivation and passion for their long-term goals as driving forces that compelled them to succeed and persist (Dumke et al., 2018). For students that do not persist in their STEM courses, fear of failure has been identified as a large contributing factor (Henry et al., 2021).

While taking advantage of offered academic resources is important, so is building a social support system. Many pre-health students report a disconnect from their pre-health peers due to competition and grade obsession. It is common for many students to cut ties with their peers over time, or only reach out to them sparingly (Grace, 2018). The highly competitive scene of these communities prevents them from helping and advocating for each due to the fear of a peer's

accomplishments overshadowing their own (Lin et al., 2014), which often results in students befriending individuals not in a pre-health program or track.

To promote deeper responses and understanding of pre-health students' perceptions relating to their academic experiences, focus groups have been used to collect qualitative data (Dumke et al., 2018). Focus groups allow for a small number of participants with similar interests or qualities to discuss a series of open-ended questions. The group environment allows students to express their opinions and build off those of other participants (Glitz, 1997). For more uncensored responses, peer-led focus groups have been used. Students often use familiar vocabulary and lingo when conversing with their peers that may shift to use more professional terms in the presence of an authoritative figure (Djohari & Higham, 2020).

Research Questions

Literature has emphasized the importance of further investigating students' science identity, retention, and available/needed resources, but it has not discussed why these factors are important in students' decisions to change programs or tracks. While studies primarily focused on the retention and attrition rates of pre-health students in pre-medical school programs or tracks, there are a variety of other pre-health programs or tracks (pre-dental, pre-pharmacy, pre-optometry, pre-nursing, pre-physician assistant, pre-physical therapy, pre-veterinary, pre-occupational therapy, etc.). All these programs follow a similar undergraduate prerequisite curriculum focusing on the natural, physical, and social sciences; therefore, it is important to open the investigation to these other programs and tracks to understand a variety of pre-health students' experiences and obstacles that influence their education. Data collection via peer-led focus group interviews and subsequent analysis of this project were guided by the following research questions:

RQ1. How do pre-health students define and describe their science identity?

RQ2. What factors cause pre-health students to change their program or track?

RQ3. What resources or experiences would be beneficial to increase the retention rate of pre-health students?

Theoretical Frameworks

Science Identity Model

The Science Identity Model uses the three interrelated dimensions of competence, performance, and recognition to capture science identity. Competence refers to knowledge and understanding of science content, performance refers to social performances of scientific practices, and recognition refers to self-recognition and recognition by others as being a "science person" (Carlone & Johnson, 2020). This lens looks at how students define their own science identity in addition to their sense of belonging within their programs or tracks. This makes its use appropriate for assessing how pre-health students' science identity plays a role in their decisions to remain in or change their programs or tracks.

Social Learning Theory

Social Learning Theory emphasizes the influence of observational learning. Individuals obtain behavior, knowledge, and expectations through observing, imitating, and modeling others (McLeod, 2023). This lens looks at what experiences have shaped students' perspectives of their programs or tracks and which factors may have led them to change programs or tracks. This makes it particularly helpful for characterizing our data to understand the influences and power these factors hold.

Methods

The study design and participant recruitment were approved by the Institutional Review Board at the University of Louisville (IRB #: 23.0186).

Participants

A convenience sampling approach was utilized by recruiting participants from general biology, general chemistry, and organic chemistry courses to take part in a focus group interview for a research study looking at STEM students' experiences at the University of Louisville (UofL). After completion of the interview, participants were compensated with a gift card for their time. Two focus group interviews were conducted in the Spring 2023 semester and six in the Fall 2023 semester with 20 total participants (4 were student moderators). All participants were assigned a pseudonym for anonymity and identifying information was removed from the data to protect the identities of participants.

Data Collection

Peer-led focus group interviews were used to collect data while providing an environment where participants felt comfortable and open to discussing sensitive or "taboo" topics. The interviews lasted between 40-90 minutes and were carried out using an unstructured interview protocol where student moderators focused on major themes (Appendix A). This format allowed for follow-up questions if participants' responses sparked additional interest and to let the conversation flow naturally. The interview themes targeted current supports and resources (social and academic), current attitudes towards degrees, science capital, belonging in science, needed changes, and needs to succeed. The interviews were audio- and video-recorded, transcribed using Otter.ai, and cleaned for accuracy.

Data Analysis

MAXQDA qualitative analysis software was used with a phenomenographic approach to identify reoccurring patterns and themes for each transcript. For this project, only the transcripts of students who identified themselves as pre-health (14 students) were used. The thematic code book was drafted by the research team and emergent themes were identified by coders throughout the coding process. Throughout the process, researchers co-coded the transcripts or met post-independent coding and reviewed the transcripts until a consensus was reached. The emergent themes were discussed for clarity amongst the research group until a consensus was reached and resulted in the revised code book (Appendix B). A phenomenographic approach was utilized in the analysis process to allow for researchers' immersion into the participants' experiences to derive their details and meanings without objectivity or any preconceived notions (Han & Ellis, 2019).

Results and Discussion

The goal of analyzing the interview transcripts was to understand the experiences and the way that pre-health students think about their own science identity, the factors that result in them changing programs or tracks, the resources that they are currently utilizing, and the resources that they would like to see implemented or furthered at UofL.

Defining and Describing Science Identity (RQ1)

The way that students think about and describe their science identity is influenced by their own science capital (the sum of all science-related knowledge), upbringing, and previous/background experiences.

Science Capital and Identity

Students exhibited a strong science identity due to their frequent encounters with scientific scenarios. For example, Maya felt a strong and deep-rooted connection to science because it is something that she encounters daily.

"All my life revolves around science... It is interesting things that I feel add to my interest of science and trying to understand the world around us."

(Maya)

Throughout daily tasks, Maya is applying her knowledge in a variety of contexts to try and understand why different phenomena are occurring. She is developing a deeper understanding through application outside of the classroom, which furthers her feelings of being a "science person," and exhibiting routine tendencies of fueling her connection to science.

Upbringing

Many students had already been exposed to rigorous STEM curriculum before enrolling at UofL. One example of this is Athena discussing a program she had been involved in from a young age.

"I grew up in an MST (mathematics, science, and technology) program my entire life in the JCPS (Jefferson County Public School) system."

(Athena)

This program played a huge role in Athena's life while she was growing up, and her constant exposure to STEM led her to pursue a career in healthcare that would use and build upon her knowledge. The MST program was a constant throughout her educational journey and her continuing to pursue a path heavily centered around science is indicative of the impact it had on her. Her upbringing emphasized to her that science is important, and this can be seen within her possession of a strong science identity.

Previous/Background Experiences

There are various opportunities for involvement available to students before they reach college. Maya participated in a residential STEM program (The Gatton Academy) on a college campus in her last 2 years of high school. This allowed her to receive dual credit and be involved in campus organizations. While in this program, Maya also gained a variety of research experiences.

> *"I did public health research, I did physics research, I did research on black holes, and I also did micro-bio research... I did research at Icahn School of Medicine, which is up in Manhattan, so I spent a whole summer there doing research. Then I went to ISEF (International Science and Engineering Fair) with that."*
>
> (Maya)

Maya's involvement in this program provided her with the necessary tools to become involved on campus at UofL. It allowed her to explore the variety of options available to her and determine where she fit best. By having experiences such as Maya's, pre-health students will feel a stronger connection to their program or track due to developing a sense of belonging early on in their journeys.

Factors Causing Changes of Programs or Tracks (RQ2)

Students identified several factors including competitiveness, peer disconnect, club involvement, on/off-campus employment, and unmet expectations that caused them to experiences urges to change their programs or tracks.

Competitiveness

Competitiveness was identified as being highly prevalent amongst pre-health students with many students reporting it being present in their classroom interactions with peers. An example of this is Athena experiencing competitive behavior during a classroom activity.

> *"I asked this dude next to me for the answer to this quiz... and I kind of had a feeling it wasn't the right answer. So, when the answer came up, he told me the wrong answer on purpose."*
>
> (Athena)

Even though this was a group activity, the student felt the need to give Athena the wrong answer so that he would be at an advantage. This resulted in the alienation of Athena from her classmate and drove a wedge between their future interactions. This behavior is commonly seen amongst pre-health students to make themselves stand out. If they are doing better than their peers, they will be more desirable to an admissions board. This environment results in many students feeling discouraged and switching their program or track to get away from that mentality.

<u>Difficulty Connecting with Peers</u>

Although pre-health students are constantly surrounded by other pre-health students in their classes, many report a feeling of disconnect. It is difficult for students to develop relationships with their peers when they are prioritizing different things. Some students prefer to focus solely on academics, while others prefer to have more balance in their life or have outside responsibilities. For example, Selene struggles to interact with her peers because she feels that her lifestyle structure is very different.

> *"I definitely find myself not really talking to other people in my classes. I can't spend 10 hours studying every day. I have more things to do, and I just feel like my lifestyle,*

compared to other people who are fully devoted to this all the time, is just too different. It's just not someone I can be friends with."

(Selene)

Selene felt disconnected from her peers because of their differences in priorities, and this led to her avoiding conversations with them altogether. Without developing relationships with those around you, it becomes easy for isolation to occur. A lack of support may result in students discontinuing their studies because they do not feel a sense of belonging in their program or track.

Club Involvement

Many professional schools look for involvement in extracurriculars in their applicants. To make themselves stand out, pre-health students seek out and join multiple different organizations. An example of this is Penelope's involvement on campus.

"I'm in Chi Omega sorority, I'm the co-director for animal welfare for the student service project board, and in the neuroscience collegiate society."

(Penelope)

When students become involved in multiple organizations, it takes up a large portion of their time. This results in students not having as much time to study or devote to their coursework. Being involved in several different organizations can become overwhelming and has the potential for students to discontinue their program or track for one that does not involve as many "hidden" expectations.

On/Off Campus Employment

Due to UofL being a largely commuter campus, many students have jobs to pay their monthly bills and necessities. While some students choose to have a job for extra money, some students, like Adonis, do not have an option:

> *"At the end of the day, I need a job to pay for school and stuff because not everything is covered. I mean it is now because of RA[ing], but I still need the money for other things."*
>
> (Adonis)

Adonis does not have the option of focusing solely on his academics. In addition to being an RA, he has a second job working at the Student Recreation Center on campus. It is very stressful and time consuming for students to work and be enrolled as a full-time student. It is common for students grades to begin dropping when they are juggling several outside responsibilities. Students may decide to withdrawal from their program or track if they do not have the time necessary to devote to their studies.

Unmet Expectations (Classes)

Several students were met with different experiences than they anticipated when they began at UofL. Unmet class expectations regarding class structure and labs were identified by students. An example of this is Demeter's experience in her lab courses.

> *"Something I've noticed about UofL, because I've been to a few universities at this point, is that I feel like their lectures and their labs are very disjointed. I don't know why it is, and I don't think it's helping students that are in these programs."*
>
> (Demeter)

Having disjointed labs makes it difficult for students to apply the concepts they are learning in lectures. The application aspect of lab is missing when students are completing labs over material they have not yet learned or will never learn.

Another unmet expectation students have faced is active learning/flipped classrooms. Since these types of classrooms involve completing readings or watching videos prior to lecture, students feel that it is a lot to juggle alongside their other responsibilities. For Demeter, this type of classroom style would have been difficult for her to manage the first time she attended college. Before withdrawing for financial reasons, she was working two jobs to pay for her education.

> *"I can't imagine being in a situation I was in when I first started going to school. Working two jobs, going to school full time, and having the time to do these flipped course structures."*
>
> (Demeter)

Demeter was under a lot of stress trying to juggle both her work and school responsibilities and did not have much excess time outside of class. With this schedule, she would not have had enough time before class to learn and digest the content. This is the reality for many students in similar situations today. This format deters students from excelling in their classes, which may prevent them from remaining in their programs or tracks.

<u>Unmet Expectations (Advising)</u>

Communication with advisors has been very difficult for some students. For example, Rhea experienced frustration from a lack of urgency in response from her advisor.

> *"My advisor, I can't ever get her to respond to me. I will send an email and it is two weeks before I hear back and [she] never tells me 'I think this would be good for you.' It's just like, 'you need these to graduate', but there's no input on them."*
>
> (Rhea)

Advisors play an important role in students' academic journeys by providing them guidance and resources. It can become difficult for students to succeed if they are unable to communicate with their advisor in a timely manner, or if they do not feel a sense of support from them. This may result in students falling behind in their timeline or making misinformed decisions without proper guidance.

Available and Needed Resources (RQ3)

Regarding utilized resources, students reported that support from professors, REACH/PAL, and online resources were beneficial to their success. In addition to these resources, students expressed a desire for tutoring to be made available for upper-level courses.

Support from Professors and TAs

Many students reported that they felt a strong sense of support from their professors and TAs. Rhea discussed this support when talking about her experience with a professor ensuring that she understood the course concepts.

> *"[My professor] was so oriented on making sure that I understood things and talking me through it. That totally changed my perspective of what professors can be like because I hadn't had that experience before."*
>
> (Rhea)

Another student, Maya, found this type of support from her professors and her TA.

> *"All my STEM professors are very good, as well as Gaia (pseudonym), my chem TA. She's amazing. I'm just lucky to have a really good experience overall."*
>
> (Maya)

One of students' first interactions in the classroom is between them and their course instructors. A positive experience results in students feeling supported inside the classroom,

which allows them to feel comfortable asking questions and for further clarification. This comfort is necessary for students to maintain the confidence to continue pursuing their programs or tracks.

REACH/PAL

UofL offers students the ability to attend REACH and PAL sessions to receive additional support and supplemental materials to aid in their learning. This resource is available for large enrollment introductory courses. One student, Iris, mentioned how she found the review sessions helpful for further clarification.

> *"I really like the PAL sessions for a lot of the STEM courses, specifically chemistry, because I feel like it's easier to understand the material. Especially with the worksheets that REACH provides."*
>
> (Iris)

These review sessions are vital to students' understanding and are a frequently used resource. Many students learn at different pacing levels and with different learning styles. By providing an opportunity for students to review course content with a peer, who students may find easier to approach than an authoritative figure, it allows students to develop a more thorough understanding of course content and feel comfortable in their programs and tracks.

Online Resources

For many students, using outside resources is necessary for them to understand course content. For example, Demeter talked about how she has used YouTube videos to further understand course content.

"I've definitely gone to a YouTube source and been like 'let's see if this person breaks it down a little better'... now I can understand the concept because they walked me through it."

(Demeter)

YouTube videos are particularly useful to students because they can be viewed as many times as necessary and can be slowed down or sped up to a speed that is most convenient for the student's learning style. This is also true for supplemental Panopto recordings that are provided by some UofL instructors. These types of resources allow students to develop a deeper understanding of course content in a way that is convenient for their schedules. While online resources are beneficial to the student and act as an aid to their learning, they pose additional questions. Does the seeking out of these resources imply that UofL courses do not provide the necessary information to understand course content? Or do students just need a variety of resources available to them to figure out what works best for their learning style? This will need to be further investigated to fully understand students' reasonings for seeking out this type of resource.

Tutoring Desire for Upper-level Courses

While UofL provides various academic resources to aid in students' success, many of these resources are not available for upper-level courses. Many students expressed a desire for these resources to be made available for additional courses. An example of this is Maya discussing how vital her REACH tutor is to her success and how she wishes that she would continue to have this support as she continues her education.

"I don't know what I would do without my REACH tutor, like my PAL tutor. I really liked that. I don't know how that works regarding the higher-level ups because I think a lot of

them go away. I guess that's a downside. I guess… that I wish it would continue."

(Maya)

Although students continue to build on their knowledge from their introductory courses, there are still many concepts that students struggle to understand. This becomes more apparent as they enter upper-level courses. With students feeling this way, it can be inferred that the tutoring sessions are targeting students' knowledge and course content without teaching the study skills necessary for breaking down difficult topics. Students become accustomed to having these tutoring sessions available to them, and they begin to feel lost in their upper-level courses without them. This may result in students becoming discouraged and feeling that they are not capable of completing the course requirements necessary for their programs or tracks.

Conclusions

This study investigated pre-health students' science identity and the factors that influence them to change programs or tracks with the use of peer-led focus group interviews. While other studies have investigated retention problems of pre-health students intended on applying to medical school, this study opened the investigation to a variety of pre-health students to obtain different perspectives and experiences and understand why each of these impacts their decisions to change programs or tracks. Student responses identified that a strong sense of science identity stems from their upbringing and previous/background experiences, competitiveness and difficulty connecting with peers leads to feelings of not belonging and a lack of support, "hidden curricula" such as extensive campus involvement deters students from pursuing pre-health programs or tracks, necessary employment creates time restraints for studies, unmet class and advising expectations results in failed applications of knowledge and a lack of guidance, professor and TA support instills confidence in students' abilities, REACH/PAL sessions and

online resources are beneficial to students' success, and there is a desire for REACH/PAL sessions for upper-level courses. These findings suggest that UofL provides successful resources to aid in the retention of pre-health students, but there is need for expansion upon these resources for students to feel fully supported.

Limitations

The findings from this study are constrained to the participants of the collected data, namely students in pre-health programs or tracks. The participants interviewed during the focus groups are current undergraduate students who are still in pre-health programs; therefore, they fall into the retained category. For students no longer pursuing a pre-health program, similar experiences and obstacles may have been faced in their academic journeys. Before withdrawing from their programs, these students could have been enrolled the same prerequisite classes, interacting with the same peers, and participating in the same extracurricular activities as students who are still in their pre-health programs. While they have likely encountered similar experiences, assumptions cannot be made regarding those students.

Implications and Future Research

As seen with this study and other research, it is very important for students to have a strong science identity, feel supported, and have resources readily available to them as they pursue their pre-health programs and tracks. All these factors influence students' perceptions of their ability to continue and succeed. Bad experiences or interactions make it easy for students to become discouraged and have the potential to result in the changing of programs or tracks.

Throughout the interview process, students identified both areas of success and areas that need improvement on UofL's campus. Now that students' voices have been collected, the next step is implementing their concerns. Importance lies in implementation to support student

retention, feelings of belonging, and to provide resources they feel are necessary for their success. Working with university stakeholders, students' responses from this study will be used to strengthen and provide additional resources that are necessary for their support.

To develop a deeper understanding of the perceptions that impact the success of pre-health students and capture the perspectives of students who may have left their pre-health or STEM program altogether, this research will be continued through the collection and analysis of additional peer-led focus groups targeting students who have left their STEM or pre-health program, but who have remained students at UofL. These additional focus groups will recruit students in upper-level courses to introduce new perspectives and suggestions for improvement and will recruit pre-health students who have left their program through flyers placed around campus. These flyers will use targeted language inviting these students to share their experiences and reasonings for deciding to pursue a different career path. These interviews will dive deeper into why students aren't feeling supported, how the factors influencing them to change programs or tracks are influencing their science identity, and how changes in motivation and passion alter their goals. Specific solutions will be determined from students' responses to address their concerns.

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Appendix A – Focus Group Interview Guide

- Points to emphasize at the beginning:
    - Anonymity and a place for open dialogue
    - Conversation you're all having together
    - Participants can ask other members questions
    - Moderators are participants too
- Warm-up questions
    - What major are you?
    - What's been your favorite class at UofL and why?
- Possible follow-up questions:
    - What are some positive experiences you have had as a science student?
    - What are some negative experiences you have had as a science student?
    - So you mentioned "…" and I was just curious about that…
    - Can you tell me more about…

<u>Themes to present:</u>

I. Current supports and resources (social and academic)
    a. Living situation, extracurriculars, etc.
    b. Barriers to supports and resources
    c. Outside of school responsibilities
    d. Are there any challenges that you face day-to-day that impact your ability to fully participate in your coursework or lab work?
II. Current attitudes toward degrees
    a. Perceived value in courses
    b. Have you thought of changing your major?
        i. Why? If so, why did you decide to stay?
        ii. If not, why?
III. Science Capital
    a. Motivation to pursue science
        i. External or internal factors?
    b. Previous science experiences
    c. Science extracurriculars/university sponsored science activities?
    d. Who have you received support from to pursue science?
IV. Belonging in Science
    a. Science identity (do you think of yourself as a scientist?)
        i. Why or why not?
        ii. How/why do you think you came to see yourself as a scientist?
    b. Do you feel like it is easy to connect with your classmates or peers?
    c. Do you feel like your goals are similar to your peers?
    d. Do you feel like your struggles are similar to your peers?
V. What needs to change?
VI. What do you need to succeed?

Appendix B – Thematic Code Book

Code	Description
Science identity	
First-generation	Identifying as a first-generation college student.
Upbringing	Contributions to the student's science identity by the way they were raised.
Previous/Background Experiences	Previous/background science experiences that contributed to the student's science identity.
Science capital	
Background	Contributions to the student's science capital through background information the student possesses.
Upbringing	Contributions to the student's science capital by the way they were raised.
Previous/Background Experiences	Previous/ background experiences that contributed to the student's science capital.
Matrix	
Feeling supported	Feeling a sense of support - paired with an individual (professor, TA, tutor, advisor, or peer) that caused the feeling and the component (ability, identity, and belonging) that was impacted.
Feeling attacked	Feeling that they are experiencing an attack - paired with an individual (professor, TA, tutor, advisor, or peer) that caused the feeling and the component (ability, identity, and belonging) that was impacted.
No sense of belonging	Feeling no sense of belonging - paired with an individual (professor, TA, tutor, advisor, or peer) that caused the feeling and the component (ability, identity, and belonging) that was impacted.
Grit	Displaying perseverance - paired with an individual (professor, TA, tutor, advisor, or peer) that caused the feeling and the component (ability, identity, and belonging) that was impacted.
Ability	A student's academic ability - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and an individual (professor, TA, tutor, advisor, or peer) that caused the feeling.
Identity	A student's identity - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and an individual (professor, TA, tutor, advisor, or peer) that caused the feeling.

Belonging	A student's sense of belonging - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and an individual (professor, TA, tutor, advisor, or peer) that caused the feeling.
Professor	A professor impacted the student - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and the component (ability, identity, and belonging) that was impacted.
TA	A TA impacted the student - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and the component (ability, identity, and belonging) that was impacted.
Tutor	A tutor impacted the student - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and the component (ability, identity, and belonging) that was impacted.
Advisor	An advisor impacted the student - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and the component (ability, identity, and belonging) that was impacted.
Peers	A peer impacted the student - paired with a feeling (feeling supported, feeling attacked, no sense of belonging, or grit) and the component (ability, identity, and belonging) that was impacted.
Unmet Expectations	
Major	Unmet expectations within the structure of the student's major.
Health sciences	Unmet expectations within the health science classes and requirements.
Advising	Unmet expectations in the student's advising experience.
Community	Unmet expectations within the campus community.
Classes	Unmet expectations in class structure.
Support structure	Unmet expectations in the support provided to the student.
Resistance to accommodations	
Family emergencies	Experiencing a resistance in accommodations following a family emergency.
Competitiveness	Experiencing competition amongst peers.
Pre-health track	Involvement in a pre-health track intending to attend a health professional school.
On-campus employment	Employment that occurs on-campus.
Off-campus employment	Employment that occurs off-campus.
Difficulty connecting with peers	Experiencing a disconnect amongst peers.

Tutor/REACH	Identifying an experience with a tutor or REACH services.
Chemistry is the problem	A negative experience with the chemistry department (class, lab, TA, or professor).
Housing/living accommodations	Experiencing problems or issues surround the student's housing/living situation.
Discrimination based on gender	Experiencing discrimination due to the gender the student presents as or identifies with.
Diversity of Classes	A desire for various classes in both the STEM and humanities fields.
Extracurriculars	Involvement in organizations or experiences outside of the classroom.
Outside/online resources	Using outside or online resources as supplements for course content.
Outside responsibilities	Possessing responsibilities outside or off-campus.
Non-traditional student	A student with a non-traditional education journey.
Commuter	A student that commutes to campus.
Low performance	A student that exhibits low performance in their classes.
High-Stakes Course Structure	A course structure where students experience high-stakes due to limited graded components.
Test Anxiety	Experiencing anxiety surrounding or during tests.
Roommate Issues	Experiences problems or issues amongst roommates.