

STUDENT-TEACHER RELATIONSHIPS DRIVE HELP-SEEKING FOR MATH LEARNING CHALLENGES

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INTRODUCTION

- Social and academic integration key to college success (Tinto, 2012)
- Seeking and receiving help from others, particularly teachers, after academic challenges promotes academic success (Sebesta & Speth, 2017)
- Positive student-teacher interactions promote integration and help-seeking (Newman, 2002)

What kind of student-teacher interactions promote student help-seeking to overcome learning challenges?

RESEARCH QUESTIONS

RQ1: What interactions in student-teacher relationships do students describe as positive or negative?



RQ2: How do those interactions motivate student help-seeking decisions after math learning challenges?



METHODS

- Participants
 - N = 25 undergraduate and graduate students and recent alumni (<2 years post-degree) of Eastern US unis
 - Affiliated with identity-based affinity groups/orgs
- Design
 - 8 focus group sessions via Zoom
 - Semi-structured interviews w/5 questions asked of all participants



PRIMARY INTERVIEW QUESTIONS

1. What challenges have you specifically had learning math that you think other people may not have had?
2. How did these challenges affect your sense of belonging in math classes, school, organizations?
3. How did you overcome these challenges to experience success?
4. How have your personal experiences influenced the way you faced new challenges while learning math?
5. What advice do you have for learners experiencing similar challenges?

DATA PREPARATION – DEDUCTIVE CODES

- Experiences and resource use
- Student self-perceptions
 - Motivation/Effort/Interest, Performance/Grades, Emotions, Confidence, Understanding math concepts
- School
 - Teacher relationships, Teacher methods/instruction, School environment
- People vs. materials as resources
- Positive and negative valence of experiences and resource use

DATA ANALYSES II – CODE MAPS

Code Co-Occurrence Frequency Maps

Codes talked about more frequently together form clusters

3 themes with self-efficacy closely clustered with positive valence



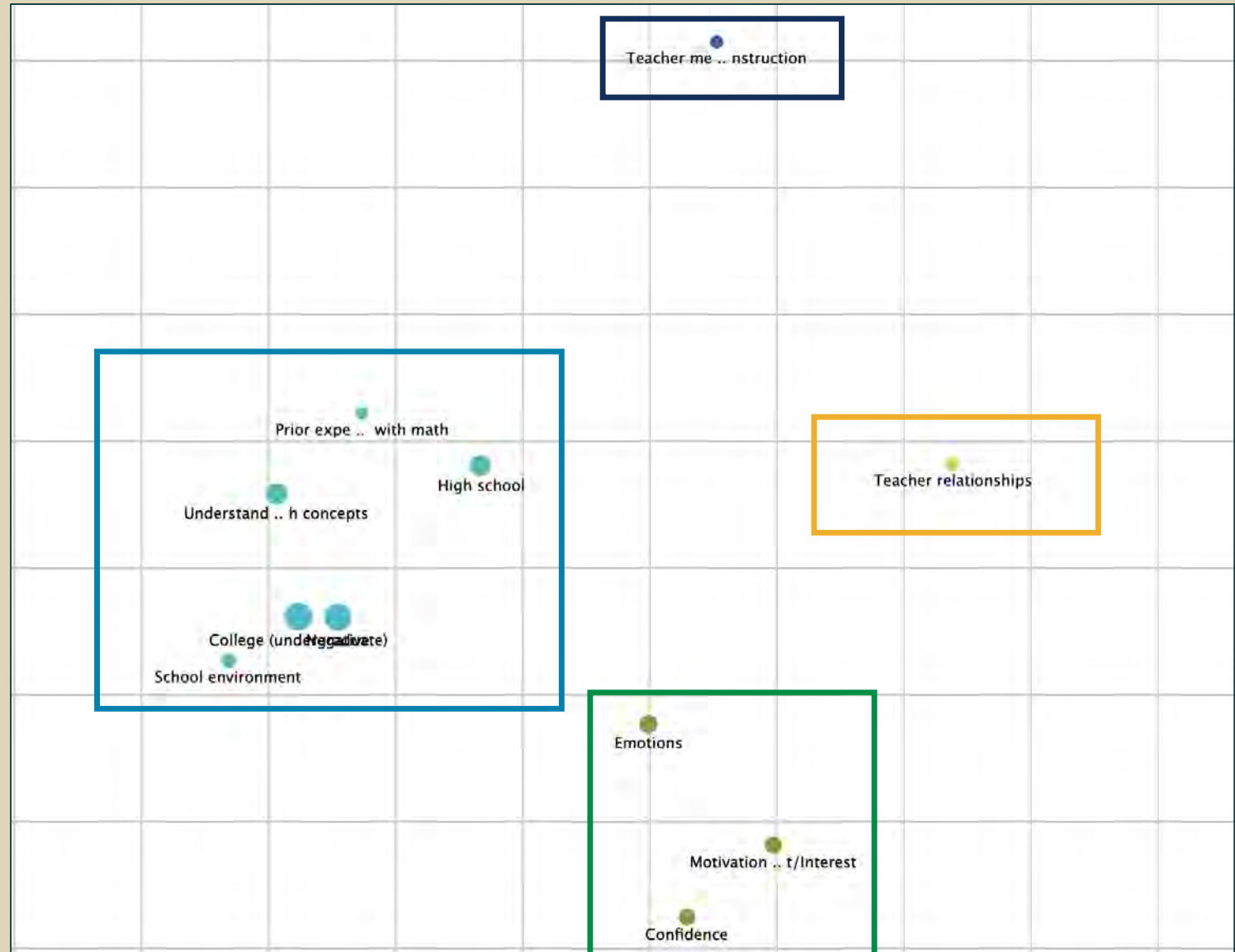
DATA ANALYSES II – CODE MAPS

4 themes emerged with negative valence code

Math learning context discussed most often

Self-efficacy clustered separately from teacher interaction codes

Teacher instruction and relationships discussed alone



DATA ANALYSES III – THEMATIC ANALYSIS: POSITIVE THEMES

Positive	Teacher influence on self-efficacy	Motivation/Effort/Interest (19)
		Performance/Grades (12)
		Emotions (11)
		Major/minor (11)
		Confidence (10)
		Teacher relationships (9)
	Instructional environment	College/undergraduate (14)
		High school (13)
		Teacher methods/instruction (7)
		School environment (6)
	Interpersonal and structural support	Understanding math concepts (5)
		Peer relationships (4)
		Support structures (4)
		Parental guidance (2)

DATA ANALYSES III – THEMATIC ANALYSIS: NEGATIVE THEMES

Negative	Math learning context	Understanding math concepts (37)
		College/undergraduate (37)
		High school (22)
		School environment (18)
		Prior experiences with math (13)
	Sense of self-efficacy	Emotions (23)
		Confidence (20)
		Motivation/Effort/Interest (12)
	Teacher methods/instruction	Teacher methods/instruction (14)
	Teacher relationships	Teacher relationships (13)

FINDINGS I – STUDENT-TEACHER INTERACTION VALENCE (RQ1)

“...[my math teacher] had recommended me for honors geometry and... she recognized that it took me longer to understand what was happening. ... [B]ut if I was willing to put in the work, she believed that I could do it. ... **it was nice to have someone that believed that I could do it. [which] kind of forced me to work harder and then appreciate it later.**” – Tia (Black, female)

Theme: Teacher influence on self-efficacy (positive)

FINDINGS I – STUDENT-TEACHER INTERACTION VALENCE (RQ1)

“[I]t was almost like [the teacher] was teaching for the students that had a strong math background... and he expected everyone [to] just to catch up... **I think the disappointing thing for me in that experience comes from him just outright denying the fact that he was teaching to that level, and it was really discouraging for me to think that I was trying to do the right thing and trying to learn this material that I knew I was struggling with, and I was outright being denied the opportunity to be able to catch up to that level.**” – Lucia (Latina, female)

Theme: Teacher relationships (negative)

FINDINGS III – POST-INTERACTION STUDENT BEHAVIOR (RQ2)

“Mostly, people that influenced my path in STEM [are] pretty much... teachers in my high school... Cause before that... I **don't even know what I was going to do... or if I [would even] go to college at all. [Teachers] influenced me to apply, and not just that, but pursue the path I'm on,** which is chemical engineering, and I've enjoyed it ever since. And I still consider them mentors...” – Joe (no demographic information)

Theme: Teacher influence on self-efficacy (positive)

FINDINGS III – POST-INTERACTION STUDENT BEHAVIOR (RQ2)

“[I]t's algebra, but still something I heavily struggled with and still struggle with, I'll say. She looked me in the face and just said, "I don't think I have the ability to teach you what you should already know by now." **A week later, I withdrew from her class. It was just so discouraging to think that I'm so far behind at a point that I can't be helped. ... I can't even go to the professor.**” – Drew (no demographic information)

Theme: Teacher relationships (negative)

SUMMARY AND DISCUSSION

- Student-teacher interactions impact student perceptions and help-seeking decisions



CONCLUSION AND FUTURE WORK

- Student-teacher interactions may impact trust
- What teacher behaviors cue help-seeking trustworthiness to students?
- Trust interventions might boost academic integration and success

THANK YOU, EVERYONE!!

Student-Teacher Relationships Drive Student Help-Seeking from Teachers for Math Learning Challenges

Abstract

Overcoming past adversity can inform strategies for facing future challenges. To address math learning difficulties, students use structural and interpersonal resources to pursue math learning goals. How a student perceives and appraises prior math learning experiences may influence which resources they use and how they approach new obstacles. During focus group discussions, students reflected on past struggles learning math and how they overcame challenges toward math-related goals. Students shared positive and negative prior experiences that subsequently impacted their strategies for achieving success in math. We first examined clusters of co-occurring segment codes to identify common prior math learning experiences related to using resources to facilitate math learning success. Next, we conducted a thematic analysis on segments where students discussed experiences and resources used to more fully characterize links between student experiences and their future math learning approaches. Using this approach, we identified several themes related to student perceptions of their math learning environment and resources. We focus on two key findings showing that interactions with math instructors were critical in 1) positive perceptions of prior math learning experiences that boosted students' sense of self-efficacy and help-seeking and 2) negative perceptions that diminished students' willingness to persist in math, admit math learning struggles, and seek help. Our findings elucidate how students make meaning of social interactions with math instructors that influence students' approach toward, or avoidance of, interpersonal forms of support to achieve math learning success. The findings also highlight ways instructors can better support student math learning endeavors.

Introduction

Overcoming barriers to reaching educational goals influences the resources we rely on to face future obstacles. How people perceive experiences with such challenges may differentially drive approach toward, or avoidance of, resources that can help them achieve success. For instance, a student may seek help during office hours, which carries the benefits of enrichment with course material and building rapport with professors. However, a student might avoid office hours if they are concerned with a professor's potentially negative perceptions of their intelligence, competence, or dependency (Johnson & Safavian, 2016). Critically, in choosing to seek help with math learning goals, whether a student perceives prior experiences with a prospective resource as positive or negative might impact their decision to approach or avoid that resource. When students feel positive about their learning experiences, they may be more motivated to engage with resources that promote learning success (Fan & Williams, 2018). With this study, we seek to understand how students perceive their past math learning experiences to inform future strategies toward using math learning resources. Specifically, we set out to understand: RQ1) How do students describe prior experiences learning math? and RQ2) How do students connect these experiences with related resources?

Methods

Design and Participants

We conducted eight focus group sessions virtually ($n = 25$) with pre-scripted questions related to students' struggles learning math and how they overcame them. Participants shared positive and negative experiences with learning math, as well as the resources they used to support their math learning success. We recruited undergraduate and graduate students affiliated with identity-based affinity groups at local schools (eastern United States) and recent alumni (<2 years post-degree).

Data Preparation and Analysis

We developed a codebook to capture math learning experiences and challenges shared by participants with attention to the math learning resources they used. Two researchers independently coded each focus group transcript and met to discuss coding discrepancies (IRR 80%) and reconcile coding to 100% agreement. We used the Code Map feature in MAXQDA (VERBI Software, 2019) to produce clusters of co-occurring codes by frequency for segments where students described either positive or negative math learning experiences. This allowed us to extract seven themes (Table 1) based on code clustering distances and to visualize differences between students' descriptions of positive and negative experiences (Figure 1). Next, we identified and summarized segments where students also described using math learning resources and conducted a thematic analysis to explain the relationship between experiences and resource use from each student's perspective. These factors characterized students' approach toward, or avoidance of, a given resource.

Findings

Clustering co-occurring codes yielded common themes across focus groups for both positive and negative experiences (RQ1). Due to space constraints, we focus here on one key theme: Teacher relationships. Interestingly, teacher relationship codes clustered differently between positive and negative experiences. To further understand these differences, we used our thematic analysis to identify factors that link students' relationships with teachers to their motivation to use various resources (RQ2). All quotes (using pseudonyms) are presented in Table 2.

Students discussed positive teacher interactions as boosting their sense of self-efficacy or supporting their math-related goals. Reflecting on a time when a teacher recommended that she take honors geometry despite struggling in algebra, Tia appreciated that someone believed in her, which motivated her to work harder in class (Quote 1). Tia later shared a goal of going to college with a teacher and he offered to meet her before and after school for SAT prep (Quote 2). Joe recalled that teachers were the biggest influencers in his choice to apply to college (Quote 3). Positive teacher interactions made these students feel more comfortable seeking and getting help from those teachers, translating to students' math learning persistence and success.

When discussing negative teacher relationships, which clustered alone (Figure 1, right panel), students described openly disparaging teachers who discouraged educational pursuits and help-seeking. For instance, Leslie mentioned a teacher who discouraged her from taking an AP course. This made Leslie doubt her math ability and further decreased her willingness to seek help from that teacher (Quote 4). Following negative teacher interactions, students were dejected and demoralized, speaking of how teachers undermined their trust in them to facilitate math learning. Lucia recalled a professor who she felt was not teaching at an appropriate level and catered to students with stronger math backgrounds. Though Lucia consistently attended office hours and advocated for herself, the professor refused to adjust his teaching methods, leaving Lucia feeling that she was denied the chance to catch up to other students (Quote 5). A teacher so unwilling to teach at a student's level of math understanding left one student, Drew, feeling that no one could help them at all (Quote 6). Overall, negative experiences deterred students from seeking help from those teachers and even incited feelings of learned helplessness.

Discussion and Contributions

By using code co-occurrences and thematic analysis to focus on student-teacher relationships, we found that positive interactions boosted students' sense of self-efficacy and facilitated math learning persistence, while negative interactions demoralized students and undermined trust, steering them away from teachers for help. Consistent with recent work showing positive relationships are conducive to learning (García-Moya et al., 2020), our findings may help explain how motivating effective goal-approach strategies, like seeking help from trusted teachers, increases math self-efficacy, persistence, and success. Trust building interventions to foster student-teacher relationships may be a fruitful research endeavor.

Selected References

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- García-Moya, I., Brooks, F., & Moreno, C. (2020). Humanizing and conducive to learning: an adolescent students' perspective on the central attributes of positive relationships with teachers. *European Journal of Psychology of Education, 35*(1), 1-20.
- Johnson, M. L., & Safavian, N. (2016). What is cost and is it always a bad thing? Furthering the discussion concerning college-aged students' perceived costs for their academic studies. *Journal of Cognitive Education and Psychology, 15*(3), 368-390.

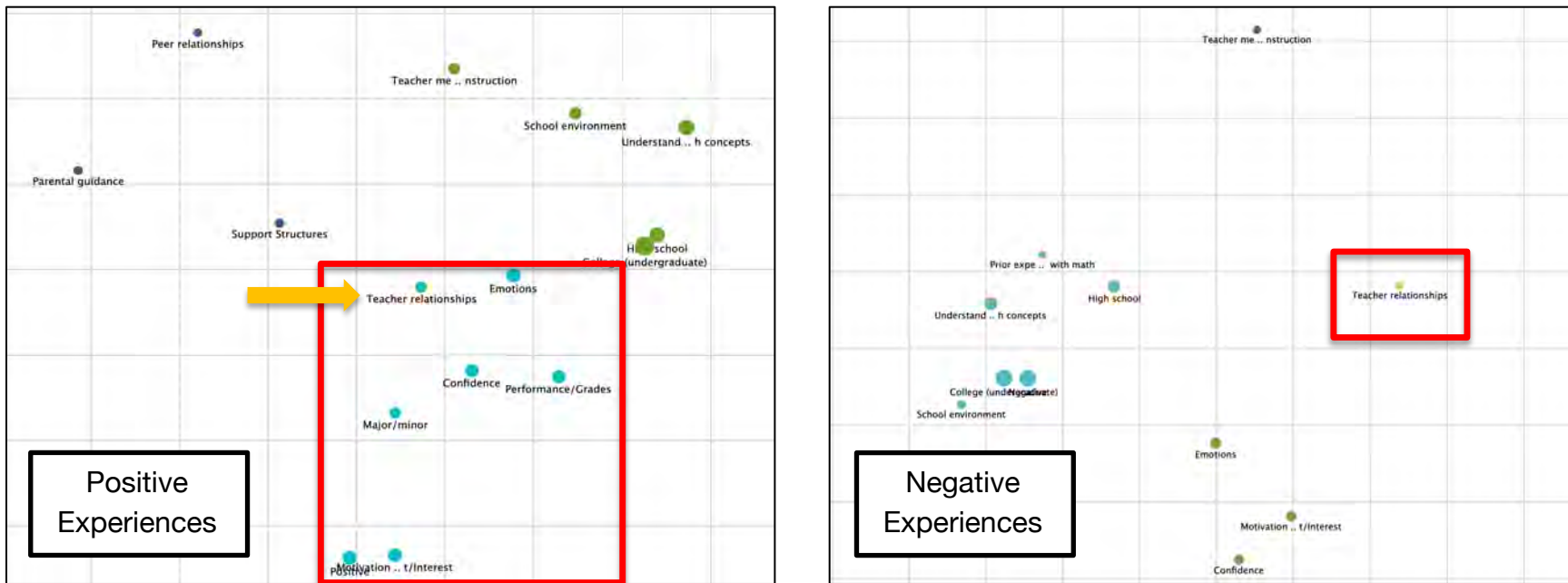


Figure 1 Code co-occurrence maps for positive (left panel) and negative (right panel) math learning experiences. Aspects of students' math learning experiences were clustered based on the frequency with which they intersected either with our negative or positive valence codes. Codes that co-occurred more frequently appear closer on the maps indicating that these aspects were discussed together more frequently in the same segments within and across focus groups. Distinct clusters are represented by different colors. Clusters were used to generate seven (three positive, four negative) overarching themes. Red boxes highlight our key finding that the teacher relationships code clusters with codes related to self-efficacy in positive math learning experiences, whereas it clusters alone in negative experiences. The orange arrow points to the mapping location of the teacher relationships code within the cluster.

Table 1*Codes and Themes for Experiences and Resources*

Experience Valence	Primary Themes from Clusters	Codes (co-occurrence frequency)	Theme Definitions
Positive	Teacher influence on self-efficacy	Motivation/Effort/Interest (19), Performance/Grades (12), Emotions (11), Major/minor (11), Confidence (10), Teacher relationships (9)	A teacher, or other instructor, engaged with a student in a supportive way that encouraged or inspired the student to view themselves as capable of overcoming math challenges and/or pursuing a math-relevant field.
	Instructional environment	College/undergraduate (14), High school (13), Teacher methods/ instruction (7), School environment (6), Understanding math concepts (5)	Institutional aspects of math education (e.g., teaching methods and instruction, learning support programs, college and STEM exposure initiatives) that developed competency and/or interest in math or math-relevant fields.
	Interpersonal and structural support	Peer relationships (4), Support structures (4), Parental guidance (2)	Interactions with individuals other than teachers that provided guidance, instructional and/or emotional support for students.
Negative	Math learning context	Understanding math concepts (37), College/undergraduate (37), High school (22), School environment (18), Prior experiences with math (13)	An experience in a classroom or campus setting that was not conducive to students learning math concepts that were necessary for success in a math or math-related course or field.
	Sense of self-efficacy	Emotions (23), Confidence (20), Motivation/ Effort/Interest (12)	Experiences that resulted in negative emotions (e.g., sadness), decreases or loss of confidence in math ability/performance, or a loss of motivation or interest in persisting in math or math-related field.
	Teacher methods/ instruction	Teacher methods/instruction (14)	Teaching methods or instruction that student found unhelpful or detrimental to math success.
	Teacher relationships	Teacher relationships (13)	Interactions with teachers or other instructions that students found unhelpful, denigrating, or demotivating.

Table 2*Cited Quotes from Coded Segments*

#	Quotes and Theme Based on Co-Occurrence Clustering
1	<p>“...[my math teacher] had recommended me for honors geometry and... she recognized that it took me longer to understand what was happening. ... [B]ut if I was willing to put in the work, she believed that I could do it. ... it was nice to have someone that believed that I could do it. [which] kind of forced me to work harder and then appreciate it later.” – Tia (Black, female) Theme: Teacher influence on self-efficacy (positive)</p>
2	<p>“[my physics teacher and I] had like a pretty good relationship... So, it made it pretty easy to just say, ‘Oh yeah, I’m trying to get into [current university]...[a]nd one of the things I need to do is take the physics SAT’ and... I don’t even think I asked... he was like, ‘Oh, well, I’d be willing to help you study for that and help prepare you.’” – Tia (Black, female) Theme: Teacher influence on self-efficacy (positive)</p>
3	<p>“Mostly, people that influenced my path in STEM [are] pretty much... teachers in my high school... Cause before that... I don’t even know what I was going to do... or if I [would even] go to college at all. [Teachers] influenced me to apply, and not just that, but pursue the path I’m on, which is chemical engineering, and I’ve enjoyed it ever since. And I still consider them mentors...” – Joe (no demographic information) Theme: Teacher influence on self-efficacy (positive)</p>
4	<p>“... [my AP Calculus teacher] kind of discouraged me from taking AP Calc. And that made me feel like I wasn’t good enough to take AP Calc, and then I took it anyways. I was afraid to ask for help because I knew he didn’t want me in the class anyways. So, I kind of just struggled through everything and did extra problems on my own.” – Leslie (Asian, female) Theme: Teacher relationships (negative)</p>
5	<p>“When I was taking [Calc 3], it was almost like he was teaching for the students that had a strong math background and had already taken the course in some way, shape, or form coming out of high school... I would try to ask questions and keep up as much as possible with the class and go to office hours and really do everything I was so supposed to, but it was so hard to follow along because he was starting at level C and I was at level A, and he expected everyone at levels A and B just to catch up and jump to the spot where he was starting to teach, so, again, not starting from that ground zero. ... I think the disappointing thing for me in that experience comes from him just outright denying the fact that he was teaching to that level, and it was really discouraging for me to think that I was trying to do the right thing and trying to learn this material that I knew I was struggling with and I was outright being denied the opportunity to be able to catch up to that level.” – Lucia (Latina, female) Theme: Teacher relationships (negative)</p>
6	<p>“I asked my freshman chemistry professor if she could reexplain thermodynamics to me which is heavily in calculating. Pretty much it’s algebra, but still something I heavily struggled with and still struggle with, I’ll say. She looked me in the face and just said, “I don’t think I have the ability to teach you what you should already know by now.” A week later, I withdrew from her class. It was just so discouraging to think that I’m so far behind at a point that I can’t be helped. ... I can’t even go to the professor.” – Drew (no demographic information) Theme: Teacher relationships (negative)</p>