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How Calculus Students at Successful Programs Talk About Their Instructors

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Motivation

- According to the PCAST report (2012) increasing the retention rate of the students who enter college intending to major in a STEM field has the potential to significantly decrease the gap between the number of STEM degrees produced and the projected number of STEM degrees needed to sustain the United States position in the global market.
- There is a growing body of research that suggests that intending STEM students are switching out of STEM fields due to experiences in their introductory mathematics courses (*Ellis, Kelton, & Rasmussen, 2014; PCAST, 2012; Rasmussen & Ellis, 2013*), including experiencing poor instruction (*Bressoud, Mesa, & Rasmussen, 2015; Seymour & Hewitt, 1997*).

Research Question

To this end, we seek to better understand student experiences in successful Calculus courses by answering the question:

How *do students in successful Calculus programs talk about their instructors?*

Project Background

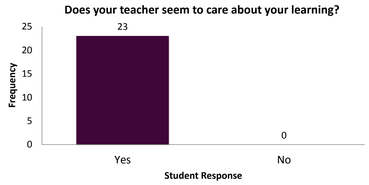
Characteristics of Successful Programs in College Calculus (CSPCC)

- Phase 1: National survey given to calculus students and their instructors at the beginning and end of the term (3,187 students; 231 instructors)
- Phase 2: Case studies at institutions deemed to have *successful* calculus programs (interviews with instructors, focus group interviews with students, collected class materials, observed classes)

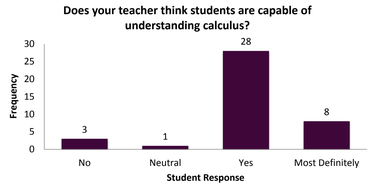
Indicators of *Successful* programs: student persistence onto Calculus II, change in student confidence, interest, and enjoyment in mathematics

Relevant Student Focus Group Questions

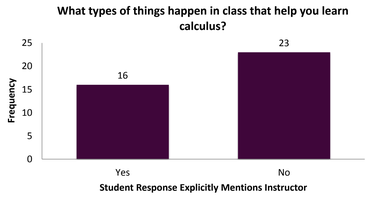
We chose to focus on a subset of interview questions as we found most references to instructors in students responses to the following questions:

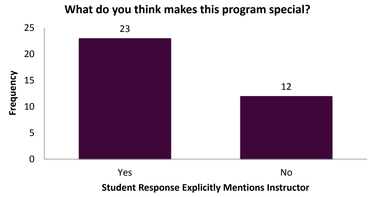


Overwhelming, students in successful Calculus programs felt their teachers cared about their learning.



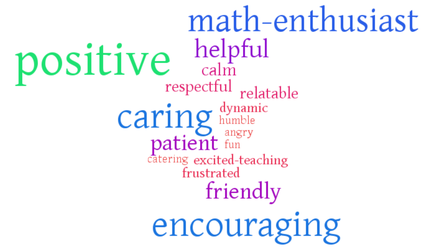
The majority of students in successful calculus programs identified that their teachers think they are capable of understanding calculus.





Sixteen students identified their instructors as an aspect of their Calculus class that helped them learn calculus and 23 students felt that the instructor was an aspect of the Calculus program that made it special.

<u>What would you say is your instructor's attitude towards students?</u>



"He's really energetic about it. And he gets really excited." B

"He's really helpful actually. Yeah, I really like that. He's really helpful. He likes taking time and he doesn't really, he doesn't get mad really and he doesn't get aggravated." D

"I mean I think her enthusiasm really helps to get people engaged get me interested." 2Y

"Depending on how good your question is, like he seems a little angry at first and then the more you make him understand your question the more he helps you and understands where you're coming from and it's like 'Oh, okay.' Like when he understand you, he loves your questions." B

"Yeah he genuinely cares about, I can tell, even though he goes off sometimes on tangents and intimidates me like crazy cause he's really into what he does, he definitely cares, he genuinely wants to see you do well and understand the concept rather then get the answer." M

How students are talking about their instructors

Conceptually driven

Students often spoke of their instructor's concern for their understanding of foundational concepts in calculus. These sorts of comments often alluded to a concern superseding that of simply completing the course with a passing grade.

(no codes issued at doctoral level)

"Nope, it's really just how much she cares and how much she wants you to understand it, she doesn't really care about your grade, she doesn't focus on that. She just wants you to get the concepts and be able to apply them in real life situations." M

"He wants us to understand. I think that makes him different than other teachers. I mean he wants us to understand what we're doing. I think whether my grade is worse in his class, I think I'm going to learn more than if I took another teacher, even if my grade is a little bit lower. I feel like I'm going to know more than kids in the other class." B

"If you ask him a question he will always make sure you understand before he moves on." B

"She wants you to study and do well and take something out of the class instead of just getting a C and passing." 2Y

Available & Timely

Students often perceived their instructors as accessible, available, and approachable both inside of class and out. Communication outside of class is encouraged; students at all institution types commented that their instructors were often available and responded in a timely manner.

"I like how he's really open about his office hours. like he keeps us up to date about when his office hours are, so that if any of us did need help, we would know when we can go in and just get some help with it. And he sits down and takes the time with us too, so it's really cool." D

"Yeah I think going to office hours is like really great and also you can just email whenever and like they're pretty, they respond pretty quickly." M

"I don't think he would spend all this time to be there for us for questions and everything and then try and explain everything as detailed as he can and then through the notes, like how detailed he gets with the notes. I don't think he would spend all that time if he didn't care." B

"What I kind of see it's like people actually taking the time to know that you know the extra time to explain things out. That's very important." 2Y

Mathematically Diverse

One way in which students speak of their instructors as being helpful, is in offering multiple strategies to a single problem. Whether it is an alternative way to think about the problem or an alternative approach in problem solving, students often mention diversity in their instructors' mathematical approaches.

"There are people struggling in the class and like he'll- when they're struggling he'll break it down with you even further. He'll try to relate it to something else that will make it simpler." B

"If she sees somebody struggling she'll try and explain it a different way or figure out how to say it so everybody can understand it the same." D

"I would say the fact that she teaches us several ways to do the same problem. It's not one specific way that she teaches us and then moves onto the next she will spend, she doesn't mind spending fifteen to twenty minutes on just one problem alone because she just wants to make sure that it gets in our minds that there is more than one way to find the same answer. So we always have another way to fall back on just in case we don't know the others." M

"We go through each problem and we all talk about how we approached it, which is really helpful because when you hear how other kids approached the problem too" D

Creating an atmosphere

Students reported on a kind of positive atmosphere fostered by their instructors where students feel comfortable doing mathematics. They even go further to suggest that this type of learning community not only increases their enjoyment, but it can even have a positive effect on their attitude and behavior.

"He tries to keep the mood very light hearted and he's always smiling and he's he's trying to make sure that you're not like agh calculus, but you're like oh, calculus." M

"When you see a teacher putting effort into the student, in a sense they don't want to let the professor down, so they do want to work harder, they do want to study better." M

"It's just like I just love the way he teaches. It's his energy that where you know this isn't going to be one of those classes that I want to sleep through it. You want to pay attention." D

"He creates a very comfortable environment." B

"Like you know it's almost like a coffee shop atmosphere like everyone's relaxed and everyone's enjoying being there." 2Y

Findings

Students in successful Calculus programs express their perceptions of instructors in an overwhelmingly positive way. Students speak positively about their instructor's character, methods, and the learning environment the instructor creates. The data referring negatively to an instructor is present. However, the lack of negative remarks in this study is significant enough to warrant the conclusion that students in successful Calculus programs talk about their instructors in a positive way.

Questions

Now that we have analyzed the data we would like to conduct further investigations regarding:

- How do the results compare across institution levels?
- How do the students talk about the teaching and learning of calculus?
- What do students think is the purpose of calculus?
- How are calculus instructors at successful institutions talking about their students?
- How are instructors and students talking about each other? Do they share a common vision of calculus in their classrooms?

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