FACTORS THAT INFLUENCE STUDENT MATHEMATICAL DISPOSITIONS

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The Problem

In 2011, 42% of 4th graders nationwide reported that they like math 'Always or almost always.' Four years later, only 18% of this group responded similarly in 8th grade.

Therefore, we ask: *Why do secondary students in the US consistently and increasingly report a lack of interest in mathematics? What factors influence secondary students' relationship with the discipline?*

Research Goals and Methods

In order to positively impact student attitudes towards mathematics, it is important to understand factors that may influence secondary students' relationship with the discipline.

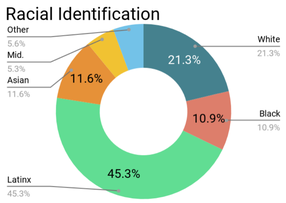
We designed an online survey to learn about students' relationship with mathematics, including experiences and settings that contribute to both positive and negative feelings about the subject. We surveyed 275 students in 11 classes in three schools in three New England districts. Though not randomly chosen, this sample allows us to examine student attitudes across a variety of contexts.

We asked students about their feelings towards mathematics over the years, as well as which aspects of class they most enjoyed or disliked. Finally, we included items from the TRIPOD survey (Wallace et al., 2016) and the 2015 TIMSS survey, which allows us to compare our sample with the national sample.

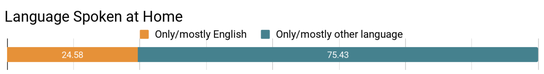
Student Participants

Students are in grades 9-12, studying math in both honors and non-honors tracks.

Students' racial identification varied widely by school. For example, the percentage of students who identified as Hispanic or Latinx ranged from 15% to 80%.

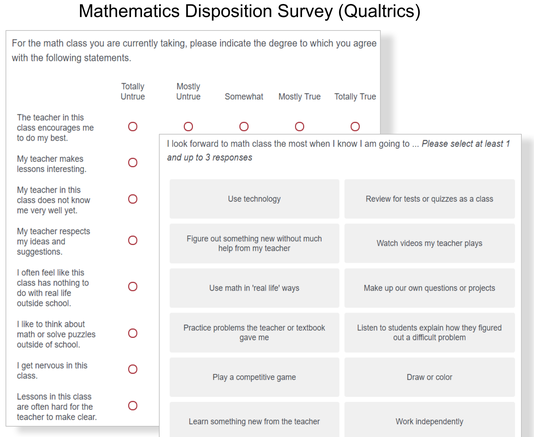


Grade Distribution	
9th grade	108 students
10th grade	132 students
11th grade	18 students
12th grade	45 students



Sample Survey Questions

Mathematics Disposition Survey (Qualtrics)



State of the Students: Overall Feelings about Math

Disposition toward math/class (items from TIMSS):

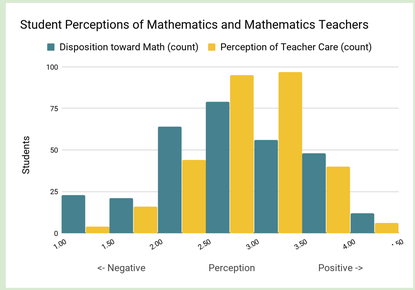
For example, "I like to solve mathematics problems."
Disagree a lot = 1; Agree a lot = 4

Significantly varies by teacher and school (p<0.001), but not by gender (p=0.6223) or language spoken at home (p=0.0809).

Perception of teachers' caring (items from TRIPOD):

For example, "My teacher seems to know if something is bothering me."
Totally untrue = 1; Totally true = 4

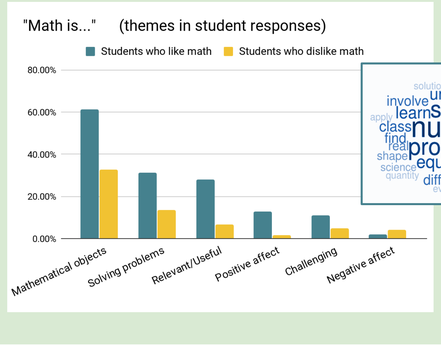
Significantly varies by teacher and school (p<0.001) but not by gender (p=0.3631) or language spoken at home (p=0.8172).



Other student attitudes (items from TIMSS):

Statement about mathematics	Percentage of students who selected 'Disagree a little' or 'Disagree a lot'	Percentage of students who selected 'Agree a little' or 'Agree a lot'	Average response (4 = Agree a lot; 1 = Disagree a lot)	Standard deviation
I like mathematics.	31.4%	68.6%	2.83	0.96
Mathematics is one of my favorite classes.	49%	51%	2.57	1.03
Mathematics is boring.	58%	42%	2.33	0.90

What is math?



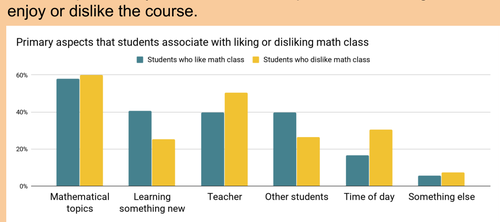
Preferred Student Activities

Favorite and least favorite math lesson activities:
Students' reported favorite class activities vary depending on how much they report liking math.

"I like mathematics"	Number of students	Most common responses to "I look forward to math class the most when I know I am going to…"
Agree a lot	80	Work in groups (33%), Solve puzzles (33%)
Agree a little	125	Work in groups (48%), Play a competitive game (31%), Do a hands on activity (29%)
Disagree a little	56	Work in groups (54%), Play a competitive game (45%), Do a hands on activity (32%)
Disagree a lot	36	Work in groups (33%), Do a hands on activity (33%)

"I like mathematics"	Number of students	Most common responses to "I dislike going to math class the most when I know I am going to…"
Agree a lot	80	Take a test (41%), Listen to a lecture (36%)
Agree a little	125	Take a test (58%), Listen to a lecture (37%)
Disagree a little	56	Take a test (63%), Listen to a lecture (36%)
Disagree a lot	36	Take a test (42%), Share work with the class (39%)

Attracting and repelling aspects of math courses:
Students were asked which aspects of the math courses they had taken in previous years were most impactful in causing them to enjoy or dislike the course.

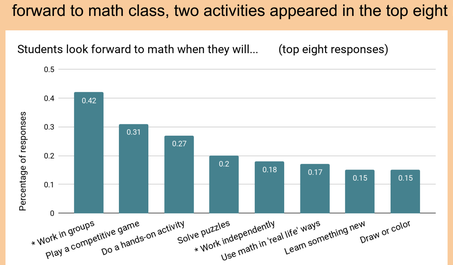


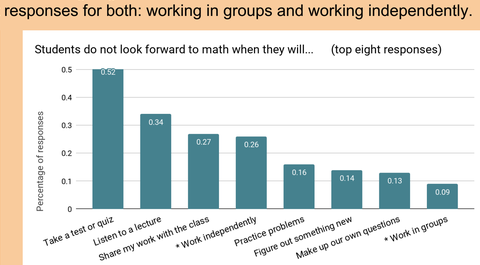
Students who selected 'something else' for reasons they enjoyed math listed reasons such as: "I was good at it and understood it."

Students who selected 'something else' for reasons they dislike math listed reasons such as: "how confusing everything was."

Overall trends in favorite and least favorite activities:

When students named the three activities made them look forward to going to math class and three that made them not look forward to math class, two activities appeared in the top eight responses for both: working in groups and working independently.





Significant factors/correlations

Gender

Only three TIMSS or Tripod items differ significantly by gender *(female N = 150; male N = 138; non-binary N = 5)*:

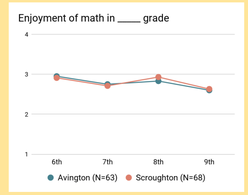
1. **I like to think about math or solve puzzles outside of school.** *(p=0.01; female: 2.15; male: 2.39; non-binary: 2.95)*
2. **Mathematics is one of my favorite classes.** *(p=0.01; female: 2.41; male: 2.78; non-binary: 2.60)*
3. **I have pushed myself hard to understand my lessons in this class.** *(p=0.01; female: 3.18; male: 2.97; non-binary: 3.55)*

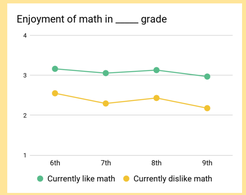
No statistically significant relationships between the interaction between student and teacher gender and a students' composite TIMSS score or Teacher Care score were found.

Age

Students were asked how much they liked mathematics class in each year since 6th grade. The different level of enjoyment for each year was significantly different.

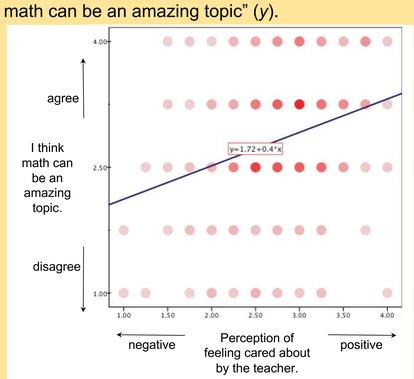
The pattern of lowered enjoyment of 7th and 9th grade was evident for students in both schools at which a sizeable amount students in 10th, 11th, and 12th grades were surveyed, and for both students who report currently liking math and currently disliking math.





Feeling cared for by teachers

The is a weak but statistically significant (p<0.001) correlation between how much student report feeling cared for by their teachers (*x*) and how much they agree with the statement "I think math can be an amazing topic" (*y*).



Career expectations

Students who report that they like mathematics also report that they expect to use math in their careers. *(Significantly different; p<0.001)*

Do you expect to use math in your career?	Number of Responses	Mean TIMSS Composite (Scale: 1 - 4)	Standard Deviation
Yes	227.0	2.9	0.7
No	70.0	2.2	0.7

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Why do secondary students in the US consistently and increasingly report a lack of interest in mathematics? Lack of interest in mathematics has been well documented by the TIMSS studies; students' dissatisfaction with mathematics more than doubled by 2011, when 40% of 8th graders reported not liking math, up from 18% as 4th graders in 2007. And, sadly, the trend appears to be worsening. In 2015, 47% of 8th graders indicated not liking math, up from 22% as 4th graders. In order to positively impact student attitudes towards mathematics, it is important to understand factors that may influence secondary students' relationship with the discipline. This poster presents findings from an exploratory study of student disposition toward mathematics.

We designed an online survey to learn about students' relationship with mathematics, including experiences and settings that contribute to both positive and negative feelings about the subject. We surveyed 275 students, grades 9 to 12, in 11 classes in three schools in three New England districts. Though not randomly chosen, this sample allows us to examine student attitudes across a variety of contexts. We asked students about their feelings towards mathematics over the years, as well as which aspects of class they most enjoyed or disliked. Finally, we included items from the TRIPOD survey (Wallace et al., 2016) and the 2015 NAEP survey, which allows us to compare our sample with the national sample.

Initial results indicate that student view their teachers and the topics of study as the central factors influencing their enjoyment of mathematics class. We found a correlation between responses that math is boring and that it is not relevant. Students who like math and those who do not reported different class activity preferences. For example, students who like math reported disliking watching a video in class, while students who dislike math reported disliking learning something new. Both groups of students (those who like math and those who do not) dislike math class when they have to present work to classmates, but hold positive views of solving puzzles and working with other students. Technology seems to appeal equally to both groups. Students who reported disliking math also look forward to playing competitive games. We saw no evidence that gender or race corresponded to students' level of appreciation math. Finally, students reported liking math class less in high school than in middle school.

Identifying factors that influence secondary student mathematical dispositions can inform curriculum designers seeking to improve mathematical attitudes. Future studies can learn if new curricular designs can change student relationships with mathematics to reverse recent trends.

References

Wallace, T. L., Kelcey, B., & Ruzek, E. (2016). What Can Student Perception Surveys Tell Us About Teaching? Empirically Testing the Underlying Structure of the Tripod Student Perception Survey. American Educational Research Journal, 53(6), 1834–1868.