

Exploring Teens' Enjoyment of Math Class, Their Math Mindsets, and Experiences Studying Math

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Introduction

Research shows that achievement in math contributes to upward mobility in the U.S. and globally. However, both international and national studies demonstrate that teens in the U.S. struggle with math. The 2018 Program for International Student Assessment study found that the U.S. trails 30 other education systems in student performance in math (PISA, 2018). In addition, the 2019 National Assessment of Education Progress Mathematics Assessment study found that less than one-quarter of 12th graders reached the proficient level in math. Moreover, only 8% of Black and 11% of Latino 12th graders reached the proficient level (NAEP, 2019).

Among the many factors that may influence teens' math achievement, the role of motivation is key. School achievement over time benefits from sustained motivation and a mindset in which learning is seen as enjoyable and personally rewarding (Souders, 2020). In such a setting, learning involves active student engagement – a combination of concentration, interest, and enjoyment derived from the process of learning itself (Shernoff, et al., 2003).

To better understand the factors that may influence math achievement and, ideally, help address achievement gaps, we studied the relationship between teens' enjoyment of math class and four key factors:

- ❖ Classroom climate (teacher and peer interactions in math class),

- ❖ Math identities and beliefs about math (teens' views of their math ability, how math ability develops and the importance of studying math),
- ❖ Support from parents around math learning (parental expectations and providing help), and
- ❖ Taking honors and/or Advanced Placement (AP) math courses.

This analysis is part of a larger study NORC conducted to explore how teens view math (math mindset), their own math abilities (math identity), and their experiences studying math (instructional contexts). The data was collected through a survey of a nationally representative sample of teens ages 13-17, administered in the fall of 2021. Below is a summary of the findings.

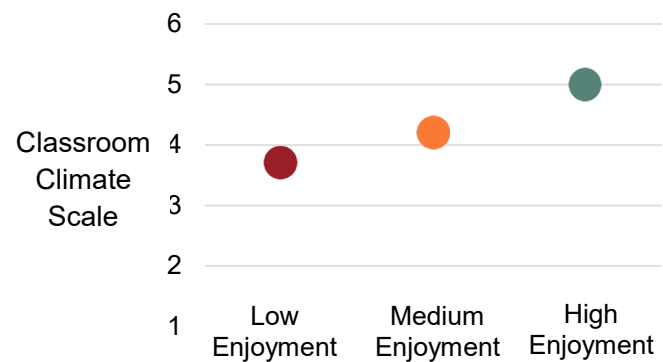
Findings

Was there a relationship between teens' enjoyment of math and the climate in their math class?¹

Research shows that the way students perceive their school climate influences their interest in math and views of their math skills (Stack, 2021). We further explored whether there was a relationship between teens' enjoyment of math class and their views of the climate in their math class (such as whether they felt supported in class and had positive interactions with their teacher and peers).²

As Figure 1 shows, teens who reported a low level of enjoyment of math also had a less positive view of the climate in their math class. The teens who reported medium enjoyment in math class had a more positive view of their math classroom climate. Those reporting a high enjoyment in math class had the most positive view of the climate in their math class. Thus, we found a relationship between teens' enjoyment of math and the quality of the climate in their math class.

FIGURE 1. TEENS' ENJOYMENT OF MATH & CLASSROOM CLIMATE*



*Results from a one-way ANOVA show that the mean differences on classroom climate scores are statistically significant across enjoyment categories CLASS, $F(2, 1789) = 338.368, p = .000$

¹ The level of enjoyment variable collapses responses to our survey item, "I enjoy learning math," from a six-point agreement scale to an ordinal scale with three categories: "Low" enjoyment = Strongly Disagree and Disagree, "Medium" enjoyment = Somewhat Disagree and Somewhat Agree, and "High" enjoyment = Agree and Strongly Agree.

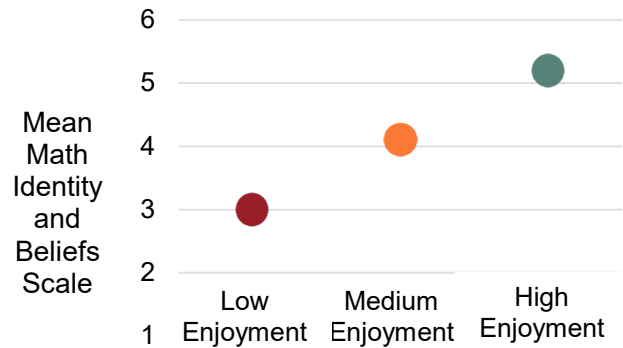
² We conducted an exploratory factor analysis (EFA) and calculated Cronbach's alpha scores to determine whether the survey questions form reliable scales that measure underlying constructs related to math mindset and identity. Our EFA yielded a three-factor solution that accounted for 62% of the variance. The three factors (Classroom Climate, Math Identity/Beliefs, and Parental Involvement) were used to determine mean scale scores.

Was there a relationship between teens' enjoyment of math and their math identities and beliefs?

Educators expect that when students enjoy a subject, they are more likely to view it positively and have confidence in their own abilities in that subject. We explored whether there was relationship between teens' enjoyment of math class and their math identity (views of their own math ability) and their beliefs about math (its importance and whether working hard can improve math ability).

As Figure 2 shows, we found that teens who reported a low level of enjoyment of math also had less positive views of math and less belief in their math abilities. Teens with medium levels of enjoyment of math had more positive views of math and a stronger belief in their math abilities, and those with high levels of enjoyment of math had the most positive views of math and the strongest belief in their math abilities. Thus, we found a relationship between teens' enjoyment of math and their math identities and beliefs.

FIGURE 2. TEENS' ENJOYMENT OF MATH & THEIR MATH IDENTITY AND BELIEFS*



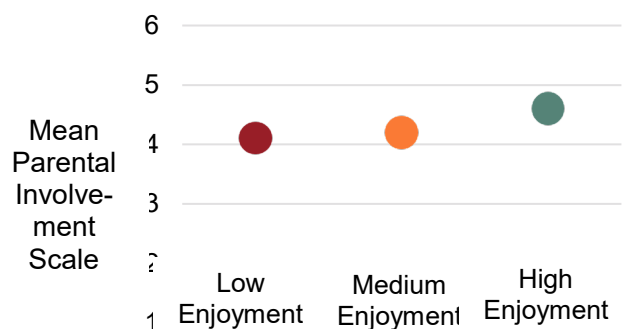
*Results from a one-way ANOVA show that the mean differences on math identity and beliefs scores are statistically significant across enjoyment categories, $MIB, F(2, 1789) = 1487.461, p = .000$.

Was there a relationship between teens' enjoyment of math and parental involvement around math learning?

Research shows that parental involvement can positively influence student motivation and academic achievement (Zedan, 2021). We further explored whether there was a relationship between teens' enjoyment of math class and parental involvement around their math learning (such as providing help with homework and selecting math courses, as well as parental expectations that teens do well in math).

As Figure 3 shows, we found that teens at all three levels of enjoyment reported relatively high levels of parental involvement (level 4 or above). Those with low or medium

FIGURE 3. TEENS' ENJOYMENT OF MATH & PARENTAL INVOLVEMENT*



*Results from a one-way ANOVA show that the mean differences on parent involvement scores are statistically significant, $PI, F(2, 1788) = 36.574, p = .000$. Post-hoc tests revealed that there were no statistically significant differences in mean PI scores between low and medium enjoyment categories.

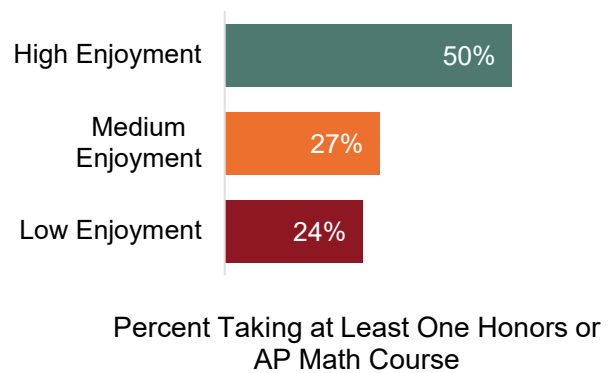
enjoyment of math reported similar levels of parental involvement, and teens with high enjoyment of math reported slightly higher levels of parental involvement. Thus, we found a modest relationship between teens' enjoyment of math and parental involvement.

Was there a relationship between teens' enjoyment of math and their honors/Advanced Placement (AP) course taking?

Research has found that students who take advanced coursework are better prepared for college than their peers who do not take advanced coursework (Barnard-Brak, et al., 2011; Long, et al., 2012; Roderick & Stoker, 2010). We explored the relationship between teens' enjoyment of math class and whether they reported previously or currently taking an honors or AP math class.

We found that almost twice as many teens with high enjoyment of math class (50%) were taking or had taken at least one honors/AP course compared to teens with low enjoyment (24%) and medium enjoyment (27%) in math class. Thus, we found a relationship between teens' enjoyment of math class and their taking of honors/AP math courses.

FIGURE 4. TEENS' ENJOYMENT OF MATH & HONORS/AP COURSE-TAKING



*The relationship between enjoyment in math class and taking an honors/AP math class was statistically significant $\chi^2(2, N=1789) = 103.964, p = .000$.

Conclusion

Our exploration revealed a consistent relationship between teens' enjoyment of math and classroom climate, as well as their math identities and beliefs. Teens with a medium level of enjoyment had more positive views of classroom climate and math identities and beliefs compared to those with a low level of enjoyment. Likewise, teens with a high level of enjoyment had more positive views of classroom climate and math identities and beliefs compared to those with medium and low levels of enjoyment.

When it came to parental involvement or participation in at least one honors/AP course, teens in the high enjoyment level were different than other teens, reporting more parent involvement and more experience taking honors/AP courses than teens in the medium or low levels of enjoyment.

Based on these findings, policies and programs that help teens feel supported and enhance their in-class interactions, help them understand the importance of math, and promote the idea that their math ability can improve through hard work may increase their enjoyment of math, their motivation to study math, and, ultimately, their math achievement.

More research is needed to explore how teens' motivation, math identity, beliefs about math, and experiences in math class (climate and contexts) play a role in their decisions about studying math in the future and pursuing STEM careers. Potential topics for further investigation include:

- how to establish a supportive classroom environment for all teens in math class,
- how interactions between teens, teachers, and their peers may influence teens' views about their own math ability and how these views change over time, and
- the nature and impact of parental involvement in teens' math learning across the teen years.

In particular, the math journeys of traditionally underserved groups, such as Black and Latino teens, should be studied to identify the key challenges these groups face in pursuing education and careers in STEM and the kinds of support they need to succeed in STEM fields.

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