NORC

Youth and Teen Math Mindset Study: An Exploration of Students' Beliefs about Math and Experiences Learning Math
February 2024

Executive Summary

STUDY CONTEXT: Educators and researchers highlight the important role that math plays in providing opportunities for upward mobility in the United States (and globally). Many students from underrepresented communities, including Black, Hispanic/Latinx, and low-income students, often do not get the support they need to develop a positive math mindset, sense of self-efficacy, and sense of belonging due to racial bias, negative instructional experiences, and lack of cultural relevancy in math classrooms. To ensure that all students can achieve proficiency in math, schools, districts, and communities must prioritize students' needs and experiences. This involves learning more from students about their attitudes and mindsets towards math and their experiences studying math.

STUDY PURPOSE: This study had two main purposes. The first was to develop surveys to gather information about the math mindsets, identities, experiences studying math, and course-taking behaviors of youth and teens (upper elementary school through high school). The second was to test whether the survey questions worked well as indicators of constructs to measure progress in math mindsets and course-taking behaviors for youth and teens.

STUDY DESIGN: NORC developed a survey, in close collaboration with the Bill & Melinda Gates Foundation's Measurement, Learning, and Evaluation (MLE) team, and administered it to a representative sample of youth and teens, ages 10-17, using NORC's AmeriSpeak® Teen Panel. Given the special interest in the experiences of subgroups that are underrepresented in honors and advanced placement (AP) coursework and in STEM majors and careers, we oversampled for individuals identifying as Black and Hispanic/Latinx. Additionally, because the Foundation is especially interested in math education efforts in targeted locations (California, Florida, New York, Texas, and Washington), we oversampled youth and teens from these states. To further enhance our understanding of youth and teens' math mindsets and experiences, we also surveyed a subsample of parents of the youth and teens who responded to the survey to explore the role parents' beliefs about math may have on their children.

STUDY METHODS: To make the survey applicable to both youth and teen respondents, NORC revised the teen survey it previously developed and administered in the 2022 pilot study. NORC also revised the 2022 parent survey to align it with the revised survey for youth and teens. We enlisted the help of an expert advisory panel which included math education researchers, STEM learning educators, teacher training program educators, curriculum developers, and other related professionals, and incorporated their feedback into the youth and teen survey. The final versions were reviewed by a panel of youth and teens and NORC survey specialists for clarity, validity, and utility. See Figure 1 for key survey topics.

Figure 1. Key Survey Topics

DATA COLLECTION AND ANALYSIS: During the spring and summer of 2023, AmeriSpeak® fielded the survey to its panels and invited parents of the youth and teen panel respondents to complete the parent survey. Data collection methods adhered to strict guidelines for maintaining respondent confidentiality and assurance of parent consent for youth and teens to participate. Figure 2 summarizes how we analyzed the survey responses.

Table 1. Analysis Methods

Analysis Methods	Purpose
Descriptive Analysis	To examine basic patterns in how students and their parents view and experience math, overall and by gender and race subgroups.
Group Comparisons	To explore the relationship between math identity, math mindset, and course-taking by covariates such as gender, race, grade level, SES, and state.
Cross-Year Analysis	To compare the mean response rates between the first and second survey administrations in 2022 and 2023.
Regression Analysis	To investigate whether student demographic variables and math mindset scales predict students' self-reported grades from 2022 and 2023.

SUMMARY OF FINDINGS: Below we summarize some of the key findings by types of analyses (descriptive, cross-year, and regression). Appendix A presents more details about these findings. Also, to further explore the findings, we produced three research briefs that focus on the experiences of Black students, Hispanic/Latinx students, and a case study of the use of the study's surveys by a suburban school district (see: https://www.norc.org/research/projects/youth-teen-math-mindset-study.html).

1. DESCRIPTIVE ANALYSES: YOUTH/TEEN SURVEY

Students' Experiences Studying Math and Access to Resources

- The majority of youth (78%) and teens (60%) reported feeling supported by their teachers but less than half feel comfortable in math class (47% youth, 41% teens) or supported by their peers (46% youth, 37% teens).
- The majority of youth (61%) and teens (54%) reported having access to extra help with math from peers, teachers, and other adults.
- Almost all the youth (93%) and teens (90%) agreed they were in the right level of mathematics, but somewhat fewer Hispanic youth (86%) agreed that the level of their math class was appropriate.

Students' Views on Math and Math Mindset

- Almost half of youth (47%) and teens (40%) reported enjoying learning math but over half of both youth and teens (59%) reported persisting when math is hard.
- The majority of youth (63%) and about half of teens (52%) reported being good at math and a majority also believe that math is important for their future studies and careers (69% youth, 58% teens).
- The majority of youth (72%) and teens (62%) believe that they can get better at math if they work hard. But more youth (81%) and teens (75%) believe that some people are born good at math.

Students' Views on Instructional Activities

- The majority of youth (60%) and teens (50%) reported that their math teachers connect math to the world at least weekly.
- About half of youth (52%) and teens (50%) reported that their math teachers use collaborative learning activities (such as students working together to solve problems), at least weekly.
- About half of youth (51%) and teens (52%) reported that being asked challenging questions and using diverse materials helped them learn math.
- Many youth (43%) and about half of teens (52%) reported that being able to use a language other than English helps them learn math.

- About half of youth (56%) and one-third of teens (31%) reported spending most of their time in math doing worksheets. About half of youth (51%) and many teens (46%) reported engaging in hands-on activities at least once a week.

Students' Views on Parental Support and Future Plans/Grades

- The majority of youth (65%) and teens (53%) reported having strong support from their parents (help with homework, interest in their math work, high expectations).
- Only about one-fifth of youth (19%) and one-third of teens (31%) reported planning to take higher level math classes (such as statistics, pre-calculus, calculus), while the majority (80% of youth and teens) reported getting a B or higher in math; 53% of youth and 39% of teens reported getting an A in math.

2. DESCRIPTIVE ANALYSIS: PARENT SURVEY

Children's Experiences with Math, Access to Resources, and Child's Math Abilities

- A majority of parents believe their child is good at math (58%) and that their child has access to help with math at school and after school (58%).
- A majority of parents (58%) believe their child's teacher is supportive/helpful.
- A majority of parents believe both that some students are naturally good at math (75%) and that through hard work their child can do well in math (72%), and that math is important for their child's future success (73%).

Engagement with Child Around Math and Engagement with School

- About half of parents (52%) report helping their child with math, being able to find help when needed, from family, school, or tutoring services (69%), but most (59%) do not pay for extra math help for their child (math camp or tutoring).
- A majority of parents (54%) reported that their child's math teacher is responsive and supportive and about half (51%) that they have access to information in their home language.

3. GROUP COMPARISONS

- ***Gender.*** More male than female youth and teens agreed that their classroom math experiences were positive (62% versus 52%) and reported higher math motivation (55% versus 42%).
- ***Race/ethnicity.*** Fewer Hispanic youth and teens agreed that their classroom math experiences were positive compared to the other groups (61% versus 72%), and AAPI students reported less access to resources (59% versus 63%).
- ***Grade level.*** Students perceived their parents as being less supportive with math as their grade level increased.

4. CROSS-YEAR ANALYSIS

- Overall, a comparison of students' and parents' responses to questions from years 2022 and 2023 shows that attitudes about math beliefs and classroom experiences are similar across the two years.
- When comparing responses from teens in 2022 to teens in 2023, more teens in 2023 reported understanding math even when it is hard and believing that they are good at math, with fewer teens in 2023 reporting that parents check in to see how they are doing in math.
- When comparing responses from parents of teens in 2022 to parents of teens in 2023, fewer parents in 2023 found their child's math teacher to be supportive, and fewer believed that if their child works hard, they can do well in math, while more reporting helping their child with math homework.

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5. REGRESSION ANALYSES:

- Positive math experiences, experiencing more frequent positive math instructional practices, and parental support were found to be associated with higher grades for students.
- Overall, math motivation was the strongest factor in predicting grades.

APPENDIX A: DETAILS ON STUDY FINDINGS

KEY FINDINGS: DESCRIPTIVE ANALYSES: After analyzing responses from the youth and teen survey and parent survey, certain significant patterns were observed. Findings from the youth and teen survey are presented in Tables 2-5. Findings from the parent survey are presented in Tables 6-7.

Table 2. Key findings: Students' Experiences Studying Math and Access to Resources

Experiences Studying Math	**Teacher support.** The majority of youth (78%) and teens (60%) feel supported by their teachers, believe their teacher cares about them and expects them to do well in math class, and that they can count on their teacher to help them with math.
	Peer Support. Almost half of youth (46%) and teens (37%) feel supported by classmates but more youth (50%) than teens (40%) feel they can get help from peers and like working with peers.
	Feeling comfortable in math class. Less than half of youth (47%) and teens (41%) feel comfortable doing math in school. More males (50%) than females (33%) feel comfortable in math class and feel comfortable asking questions when math is confusing while more AAPI youth and teens (78%) feel comfortable in math class.
	Access to extra help. A majority of youth (61%) and teens (54%) have access to extra help with math from fellow students, teachers, and other adults.
Access to Resources	**Math club at school.** Less than half of the youth (22%) and teens (38%) have access to a math club at school. More AAPI youth (67%) reported having access to a math club, while more AAPI (51%) and White (49%) teens reported having access to a math club.
	Tutoring at school. The majority of youth (61%) and teens (67%) have access to tutoring at school, with more teens reporting having access to tutoring than youth, and fewer Hispanic youth (41%) and AAPI teens (63%) reporting having access than other race/ethnicity groups.
	Tutoring outside of school. The majority of youth (50%) and teens (62%) have access to math tutoring outside of school, with more teens reporting having access than youth, and fewer Hispanic youth (38%) reporting having access to tutoring outside of school.

Table 3. Key Findings: Students' Views on Math and Math Mindset

Views of Math	**Finding math engaging.** When asked if math was a subject where they did not really learn much, few youth (8%) and teens (14%) reported **not** learning very much in math class. Also, few youth (16%) and teens (18%) reported engaging in math for fun outside of school, with more Black (28%) and AAPI youth (33%) reporting doing math for fun after school than other groups.
	Motivation. Almost half of youth (47%) and teens (40%) reported enjoying learning math. More male than female youth and teens (52% vs. 40%) reported enjoying learning math, and fewer Black youth (45%) reported enjoying math. Over half of all students (59%) reported persisting even when math is hard.
	Belief in math abilities. About one-half of youth (53%) and teens (45%) reported being good at math. More male than female youth (56% vs. 46%) believe they are good at math, and more AAPI youth (67%) than other groups believe they are good at math.
	Math helps future success. Most youth (69%) and teens (58%) believe math will help them be successful in school and future careers, while fewer teens (47%) than youth (60%) believe math helps them in everyday life.
Math Mindset	**Math ability can be improved.** More youth (47%) than teens (38%) believe they can change how good they are at math.
	Hard work matters. A majority of youth (72%) and teens (62%) believe they can be good at math if they work hard, with more male than female youth and teens (74% vs. 64%) believing they can be good at math through hard work.
	Math ability is natural. A majority of youth (81%) and teens (75%) believe that some people are naturally good at math.
	Hard work may not be enough. Less than one-third of youth and teens (27%) believe that hard work may not be enough to help them do well in math, with more female than male youth (31% vs. 21%) and no AAPI youth believing that hard work may not be enough.

Table 4. Key Findings: Students' Views on Instructional Activities

General Instructional Activities	**Connecting math to the world and personal interests.** Over half of youth (60%) and teens (50%) reported that their teachers connect math to the real world weekly and almost three-fourths (76% youth, 72% teens) connect math to students' interests at least monthly.
	Collaborative learning. Almost half of youth (52%) and teens (50%) reported that their teachers have them engage in different types of

	collaborative learning at least weekly (such as working together to solve problems, talking with each other, sharing ideas about math, and explaining their thinking).
	Quality of teaching. Over two-thirds of youth (76%) and teens (67%) reported that the quality of teaching is high, with more Black (88%), Hispanic (74%), and AAPI (100%) youth reporting that their teacher helps them learn from their mistakes in math.
	Worksheets vs hands-on activities. About half of youth (56%) and one-third of teens (31%) report spending most of their time in math doing worksheets. About half of youth (51%) and teens (46%) report engaging in hands-on activities at least once a week.
Instructional Practices that Support Equity	**Question Difficulty.** More youth (56%) and teens (54%) reported that being asked challenging questions helps them learn math than being asked easy questions (36% youth, 42% teens).
	Diverse materials. A majority of youth (53%) and teens (52%) reported that having diverse instructional materials and diverse examples used in math class helps them learn math. More Black (93%)and Hispanic (55%) youth than White (44%) and AAPI (33%) youth found using diverse examples helpful.
	Language. A majority of youth (43%) and teens (52%) reported that being able to use a language other than English helps them learn math.

Table 5. Findings: Students' Views on Parental Support and Future Plans

Parental Support	**Expectations.** A majority of youth (74%) and teens (67%) reported that their parents expect them to do well in math.
	Active support. About two-fifths of the youth (62%) and half of teens (49%) reported that their parents and/or family members help them with homework, check to see how they're doing in math, and help them select which math class to take.
	Math outside of school. About one-third of youth (29%) and teens (32%) reported that their parents encourage them to engage with math outside of school.
	Language other than English. Over one-third of youth (42%) and less than one-third of teens (30%) reported that their parents help them with math in a language other than English.
Future Plans and Grades	**Taking Honors or AP courses.** One-third or less of youth (19%) and teens (31%) reported taking an honors or AP math course this year, with more AAPI teens (51%) reporting taking honors/AP courses than other race/ethnicity groups.

	Right Course Level. Students were asked if they believed that they were currently assigned to the appropriate level of math class. Almost all of the youth (93%) and teens (90%) agreed they were in the right level, with fewer Hispanic youth (86%) and fewer Hispanic teens (91%) agreeing the level of their math class is appropriate.
	Course-taking plans. More teens (51%) than youth (42%) reported planning to take higher order math classes.
	Grades. About half of youth (53%) and two-fifths of teens (39%) reported getting an A this year and last year in mathematics.

Table 6. Parent Survey: Findings on Children's Experiences with Math, Access to Resources, and Child's Math Abilities

Children's experiences with math	**Child's enjoyment of math.** While few parents reported that their child does math for fun outside of school (15%), the majority believe their child is good at math (58%) and 37% believe their child enjoys learning math, with more AAPI parents (65%) reporting that their child is good at math and enjoys learning math.
	Trust in child's teacher. The majority of parents believe that their child's math teacher is someone they can rely on for help (53%) and that the teacher expects their child to do well in math (62%), with fewer Hispanic parents (44%) believing they can count on their child's teacher for help.
	Diverse classroom materials. About one-third (34%) of parents reported that their child's math curriculum includes diverse examples.
	Access to extra help. Many parents reported that their child has access to math help through school (61%) and over half reported that their child has access to help after school from a non-family member (54%).
Access to resources	**Math club at school.** While fewer than one-third of parents (30%) said their child has access to a math club through school, many were not sure (44%).
	Tutoring through school. While the majority of parents reported their child having access to math tutoring through their child's school (57%), some were not sure (24%), and fewer AAPI parents reported access to tutoring (45%).
	Tutoring outside of school. While the majority of parents reported having access to math tutoring outside of school (55%), some (23%) were not sure.

Child's math abilities	**Belief in math abilities.** Most parents believe that some students are naturally good at math (75%) and that through hard work their child can do well in math (72%).
	Math helps future success. The majority of parents believe that math helps their child be successful in everyday life, school, and their future careers (73%). More parents of male (77%) and AAPI (79%) students believe that math helps their child's future success.

Table 7. Parent Survey Findings: Engagement with Child Around Math and Engagement with School

Parental engagement with child around math	**Personally helping their child with math.** The majority of parents (59%) reported checking in with their child about math, helping their child with math homework, and feeling able to help their child with math. But few engage in fun math activities with their child (35%) or help their child with homework in a language other than English (17%).
	Investing in supplemental math assistance. Most parents reported that they do not pay for their child to attend math camp or receive math tutoring (61%), nor do they plan to enroll their child in extra math education programs (58%).
	Finding math help for child. Most parents reported being able to find their child help when they need it (69%), and many (39%) reported having another family member who can help their child with math.
Parent engagement with school around math	**Parent-teacher relationship.** The majority of parents (59%) reported having a positive relationship with their child's math teacher, that the teacher responds to their concerns and is open to hearing their perspective. Many parents reported that they are treated like a partner in their child's math learning (60%), with more Black parents (58%) and AAPI parents (58%) having positive experiences than Hispanic (52%). On the other hand, few teachers send home fun activities that parents can do with their child (33%).
	Communication with teachers and school. Most parents (51%) have access to school information and communication in their home language and agreed that their voice is heard by the staff and administration but fewer (10%) reported that their child's teacher has a forum for regular communication, and more AAPI parents (19%) reported that their voice is not being heard by school administrators.

KEY FINDINGS: GROUP COMPARISONS: To explore group differences in youth/teens' math experiences, mindsets, perceptions of instructional practices, and perceived supports, we examined differences in their responses by gender,

race/ethnicity, and grade level groups. We also explored these group differences within the parent survey as well. These findings are outlined in Tables 8 and 9.

Table 8: Youth and Teen Survey: Findings from Group Comparisons of Youth and Teen Responses

By Gender	• More male than female youth (69% male, 56% female) and teens (62% male, 52% female) agreed that their classroom math experiences were positive. • Male youth and teens reported higher math motivation than female youth and teens (55% male youth, 42% female youth) (54% male teens, 46% female teens). • There was no difference by gender in youth and teens' rating of their parental support.
By Race/Ethnicity	• There were no significant differences in youth and teens' math motivation by race. • Hispanic youth reported less positive math experiences than other groups (61% Hispanic youth, 72% other groups youth). • AAPI teens reported lower access to resources compared to their Black and White peers (59% AAPI teens, 63% White teens, 62% Black teens).
By Grade Level	• Middle and high school students reported experiencing typical instructional practices (such as engaging in collaborative learning) and perceived these practices to be less useful than younger students. • Students perceived their parents as being less supportive with math as their grade level increased.

Table 9. Parent Survey: Findings from Descriptive Analyses of Parents' Responses

By Gender	• There were no differences on parents' ratings of their child's math experiences by parent gender. • Male parents reported more positive views on math than female parents (83% male parents, 65% female parents). • There was no difference in male and female parental engagement with their child or their child's teacher and school around math.
By Race/Ethnicity	• AAPI parents rated their child's math experiences and their own views on math more positively than other groups (73%), while Hispanic parents reported lower scores than other groups (44%). • Black parents (55%) reported engaging with their child around math more than other groups.

	• There was no difference in parents' engagement with their child's teacher and school or their child's access to resources by race.
By Grade Level	• Parents of high school students reported lower scores for views on math than parents of children in younger grades. • Parents of 11th and 12th graders also reported lower scores for engagement with their child and their child's teacher and school.

KEY FINDINGS: CROSS-YEAR ANALYSIS: To compare how teens and parents responded to common survey questions in 2022 (year 1) and 2023 (year 2), cross-year analyses were performed. Interesting patterns appeared, detailed in Tables 10 and 11 below.

Table 10: Teen Survey: Findings from Cross-Year Analyses of Teens' Responses

Overall	• More students in year 2 than in year 1 reported understanding math even when it's hard (a statistically significant positive mean difference of 0.15). • More teens in year 2 than in year 1 reported believing they are good at math (a statistically significant positive mean difference of 0.13). • Fewer students in year 2 than in year 1 reported that their parents check with them to see how they're doing in math (a statistically significant negative mean difference of -0.10).
By Gender	• More male students in year 2 than in year 1 reported understanding math even when it's hard (a statistically significant positive mean difference of 0.14). The same pattern was found for female students. • Fewer male students in year 2 than in year 1 reported believing they are good at math (a statistically significant negative mean difference of -0.24).
By Race/Ethnicity	• More Hispanic teens in year 2 than in year 1 reported that they understand math even when it's hard (a statistically significant positive mean difference of 0.41).
By Grade Level	• Fewer 7th graders in year 2 than in year 1 reported that their parents check with them to see how they are doing in math (a statistically significant negative mean difference of -0.27). • More 12th graders in year 2 than in year 1 reported that they understand math, even when it's hard (a statistically significant positive mean difference of 0.31).

	• Fewer 7th graders in year 2 than in year 1 reported that their parents check to see how they are doing in math (a statistically significant negative mean difference of -0.27.)

Table 11: Parent Survey: Findings from Cross-Year Analyses Parents' Findings

Overall	• Fewer parents in year 2 than year 1 reported that their child's math teacher is someone they can count on to help them (a statistically significant negative mean difference of -0.16.) • Fewer parents in year 2 than in year 1 reported that if their child works hard, they can do well in math class (a statistically significant negative mean difference of -0.07.) • More parents in year 2 than in year 1 reported that they help their child with their math homework (a statistically significant positive mean difference of 0.35).
By Gender	• Fewer male parents and female parents in year 2 than year 1 reported that their child's math teacher was someone they can count on to help them (a statistically significant negative mean difference of -0.18 and -0.14 respectively). • Fewer female parents in year 2 than in year 1 agreed that If their child works hard, they can do well in math class (a statistically significant negative mean difference of -0.15.)
By Race/Ethnicity	• Fewer Hispanic parents in year 2 than in year 1 reported that their child's math teacher was someone they can count on to help them (a statistically significant negative mean difference of -0.39.) • Fewer White parents in year 2 than in year 1 reported that if their child works hard, they can do well in math class (a statistically significant negative mean difference of -0.16). • More Hispanic parents and multiracial parents in year 2 than in year 1 reported helping their child with their math homework (a statistically significant positive mean difference of 0.37 and 0.87 respectively).
By SES	• Fewer lower SES parents in year 2 than in year 1 reported that their child's math teacher being someone they can count on to help them (a statistically significant negative mean difference of -0.29.) • More parents in the upper middle SES group in year 2 than in year 1 reported that when their child needs help in math, they can provide them with the help they need (a statistically significant positive mean difference of 0.41.)

Overall, the documentation of statistically significant mean changes between years shows that attitudes among about math beliefs and classroom experiences among our youth and teen and parent samples are stable. The combination of these data with school-level, district-level, or community-level data would enable us to triangulate other factors that are tied to these small changes. However, the absence of these additional datasets for this study precludes us from making any inferences about what these changes may mean.

KEY FINDINGS: REGRESSION ANALYSES: To examine how well youth and teen covariates, scale scores, and parent scale scores predict various dependent variables, regression analyses were performed, and several key patterns of note emerged.

- Individually, positive math experiences, more frequent perceptions of positive math instructional practices, and parental support were found to be correlated with higher grades for students.
- In combination with one another – math motivation, perceptions of instruction support, and parental support were found to be significant predictors of students' grades.
- Overall, math motivation was the strongest factor in predicting grades. Students who responded positively to questions about whether they enjoy learning math, are good at math, keep trying even when it's hard, and believe math is important to their everyday life, schooling and future careers also reported getting higher grades.
- Age, gender and parent education were all strong predictors of grades for students. Male students and older students were more likely to have poorer grades. Also, parents with a bachelor's degree and higher have children with better grades.
- Being a Black student was more associated with lower grades, in comparison to being a White student. Because students are self-reporting on grades, we urge caution in interpreting this finding. Moreover, while race itself is not inherently meaningful, it acts as a proxy for structural and systemic inequality, which shows up in our models.
- Children were found to have better grades in households with parents who have bachelor's degrees than in households with parents with less than a high school degree.

For more information about this study, please visit:
https://www.norc.org/research/projects/youth-teen-math-mindset-study.html

This work was conducted by researchers NORC at the University of Chicago (Claudia Gentile, Will Fisher, Abrea Greene, Cristina Carrazza, Susan Pachikara, Eric Brown, Ji Eun Park, Kimberly Shaw, Jenny Seelig, Elizabeth Klein, and Emily Lenning)

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