TEEN MATH MINDSET STUDY: AN EXPLORATION OF TEENS' MATH BELIEFS AND EXPERIENCES STUDYING MATH

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Executive Summary

STUDY CONTEXT: Educators and researchers highlight the important role that math plays as a consequential gateway to upward mobility in the United States (and globally). Black students and Hispanic/Latinx students, as well as students from low-income communities, 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 advance goals in math proficiency for all students, schools, districts, and surrounding communities must focus on students' needs and experiences. To accomplish this, we need to learn more from students about their attitudes and mindset towards math and their experiences studying math.

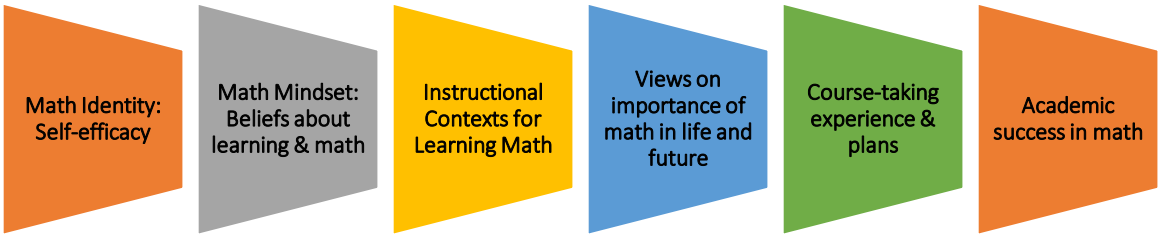
STUDY PURPOSE: The purpose of this study was to develop a survey for teens in middle school and high school, to capture information about their math mindsets, identities, experiences studying math, and course-taking behaviors. Additionally, the study explored whether the survey questions worked well as indicators or constructs and could serve as a tool for monitoring changes in teen math mindsets and course-taking behaviors.

STUDY DESIGN: NORC and AmeriSpeak® staff developed a survey and administered it to a representative sample of teens, ages 13-17, using AmeriSpeak® Teen Panel. In view of special interest in the experiences of subgroups who are underrepresented in honors and advanced placement (AP) coursework and in STEM majors and careers, we oversampled for teens identifying as Black and Hispanic/Latinx. In addition, to explore math education efforts in separate states as well as the U.S. overall, we oversampled teens from California, Florida, New York, Texas, and Washington (often referred to below as priority states). To further expand the information about teens' math mindsets and experiences and explore the role parents' beliefs about math may have on their

children, we surveyed a subsample of parents of the teens who responded to the survey.

STUDY METHODS: We developed a teen survey and parent survey, following best practices in survey research. We worked closely with AmeriSpeak® to plan specifications, reviewed existing surveys, and tested our newly created surveys for the study using cognitive interviews with teens and parents. The final versions were reviewed for clarity, validity, and utility. See Figure 1 for key survey topics.

Figure 1. Key Survey Topics



DATA COLLECTION AND ANALYSIS: During fall of 2021, AmeriSpeak® fielded the survey to its Teen Panel and invited parents of the Teen Panel respondents to take the parent survey. Data collection methods followed strict guidelines for maintaining respondent confidentiality and assurance of parental permission for teens to participate. We analyzed survey data in four ways, as described in Figure 2.

Figure 2. Analysis Methods

Analysis Methods	Purpose
Descriptive analyses	Examine basic patterns in teens and parents' responses, overall and by subgroups of interest
Group comparisons	Explore the relationship between math identity, math mindset and course-taking items by covariates such as gender, race, grade level, priority state status and socioeconomic status
Factor analysis and scale reliability	Explore the degree to which the survey items formed constructs of interest to the study and test reliability of those constructs
Regression analyses	Model students' math achievement using the math mindset and math identity constructs as predictors

KEY FINDINGS: DESCRIPTIVE ANALYSES: In looking at responses to the teen and parent surveys, several key patterns emerged, as described in Figures 3 and 4.

Figure 3. Teen Survey: Findings from Descriptive Analyses of Teens' Responses

Overall	• Teens agreed to some extent with each statement in the survey. • The fewest percentage of teens agreed that math ability is inherent (39%), that they enjoy learning math (34%) and that they understand difficult work in math class (39%). • Most teens agreed with statements about being good at math if they work hard at it (93%), about parent math expectations (93%), and about parents checking to see how they are doing in math (89%).
By Gender	• Male and female teens' responses were very similar for most survey questions. • More female than male teens reported collaborating with classmates in math class (77% vs. 74%). • More male than female teens reported being comfortable asking questions in math class (81% vs. 74%). • More male teens than female teens have confidence in their math ability (80% vs. 76%).
By Race/Ethnicity	• When asked about positive math viewpoints, experiences, and classroom environments, more Asian, White, and Black teens agreed with these statements than did Hispanic/Latinx, Other, and multiracial teens.
By Grade Level	• Agreement with the survey statements was higher in the middle school grade levels and declined through the high school grade levels.

Figure 4. Parent Survey: Findings from Descriptive Analyses of Parents' Responses

Overall	Overall, most parents agreed with most statements in the survey. • The statement the parents agreed with the least was about their child's math ability being inherent (37%). • The statements that the parents agreed with the most was that math is important for their child's future (95%) and that their child can do well if they work hard in math class (92%).
By Gender	• A higher percentage of male parents than female parents agreed with almost every statement, including being good at math (83% vs 65%).

	• A higher percentage of female parents than male parents reported checking in on their child (93% vs 90%) and engaging in extra math activities with them (60% vs 55%).
By Race/Ethnicity	• Compared to other groups, a higher percentage of Asian parents agreed with statements about their child getting help in math through school (96%), from parents themselves (79%), and by parents finding help (93%) for their children. • A higher percentage of Black parents (79%) agreed that they can get help outside of school for their child compared to other groups. • Compared to other groups, a higher percentage of Black (20%) and Hispanic/Latinx (21%) parents disagreed that their child is good at math.

KEY FINDINGS: GROUP COMPARISONS: When we conducted group comparisons within the teen survey, several key patterns emerged by gender, race/ethnicity, grade level, priority state status, and socioeconomic status around teens' academic success: taking higher-level courses and passing math last year, described in Figure 5.

Figure 5. Teen Survey: Findings from Group Comparisons on Academic Success

By Gender	• More female (98%) than male teens (92%) reported passing last year's math course and the differences were statistically significant.
By Race/Ethnicity	• White teens (96%) reported passing their math course this year at higher rates compared to Asian (93%), Black (91%), and Hispanic/Latinx teens (92%). • More Asian teens (53%) reported taking an Advanced Placement (AP)/honors course than Black (31%) and Hispanic/Latinx teens (26%) and the differences were statistically significant. • More White teens (39%) reported taking an AP/honors course than Hispanic/Latinx teens (26%) and the differences were statistically significant.
By Priority State	• More teens in New York (99%), Texas (97%), and Florida (98%) reported passing math class last year than teens in California (89%). The differences were statistically significant. • More teens from Florida (53%) reported taking AP/honors courses than teens from Washington (33%), California (31%), New York (30%), and the rest of the national sample (35%). The differences were statistically significant.

By SES	• More teens in the High-SES group (96%) reported passing math last year than teens in the Lower (26%) and Medium-Low SES (27%) groups. The differences were statistically significant. • More teens in the High-SES group (58%) reported taking an AP/honors course than teens in all other SES groups (Low-26%, Lower-Middle 27% and Upper-Middle 32%). The differences were statistically significant.

Likewise, group comparisons within the teen survey revealed several key patterns in teens' math mindsets and experiences in math class by gender, race/ethnicity, grade level, priority state status, and socioeconomic status, as described in Figure 6.

Figure 6. Teen Survey: Findings from Group Comparisons on Math Mindset and Experiences

By Gender	• Male teens agreed more than female teens that they are good at math (4.40 vs 4.17), that they can be good at math if they work hard (4.96 vs 4.86), that they can count on their math teacher for help (4.64 vs 4.51), and that they feel comfortable asking questions in class (4.35 vs 4.23). These differences were statistically significant. • Female teens agreed more than male teens that they can get help outside of school (4.08 vs 3.94) and that students collaborated in math classrooms (4.29 vs 4.13). These differences were statistically significant.
By Race/Ethnicity	• In general, White and Asian teens agreed more with positive statements about math class than Black and Hispanic/Latinx teens. • White teens agreed more than Hispanic/Latinx teens that their parents expect them to do well in math (4.99 vs 4.80), help them decide which math courses to take (4.22 vs 3.86), and check on how they are doing in math class (4.95 vs 4.69). These differences were statistically significant.
By Grade Level	• Seventh graders agreed more than all high schoolers that their parents help them with math homework (4.83) and check to see how they are doing in math (5.27). These differences were statistically significant. • Ninth graders agreed more than twelfth graders that math was important for their future (4.69 vs 4.37), that math is important for everyone to learn (4.86 vs 4.57), and that their parents expect them to do well in math (5.03 vs 4.77). These differences were statistically significant.
By Priority State	• Teens from priority states agreed more than teens from non-priority states that math is an important subject for their futures

	(4.56 vs 4.43) and that they can get help with math outside of school (4.13 vs 3.94). These differences were statistically significant. • Teens in New York (NY) agreed more than teens in Washington (WA) and California (CA) that they feel engaged in math class (NY-4.45, WA-3.94 and CA-3.90) and feel like they belong in math class (NY-4.42, WA-3.92 and CA-3.89). These differences were statistically significant.
By SES	• Teens in High-SES families experience math class and home support differently than teens in the other SES categories, hold somewhat stronger views about math, and take advanced courses in math more often. • More teens in the High-SES group agreed with multiple statements across the survey questions when compared to all other SES groups.

KEY FINDINGS: FACTOR ANALYSES: The analyses yielded three viable factors for the teen survey: classroom contexts, math identity and beliefs, and parental involvement. This suggests a good degree of reliability in the survey questions and indicates that the questions measure key constructs of interest for this study. Thus, the teen survey items may be a useful measure of change in students' classroom contexts, math identify and beliefs and parental involvement and thus useful to explore impacts on teens' mindsets, course-taking behaviors, and performance.

Figure 7. Three Factors from Teen Surveys

Classroom contexts	9 statements	Teacher and peer interactions in math class.
Math identity and beliefs	8 statements	Teens' views of math and their math ability.
Parental involvement	3 statements	Support from parents around math learning.

The analyses also yielded three viable factors for the parent survey: parental engagement and math confidence, parental beliefs, and supporting/accessing help. Again, this suggests a good degree of reliability in the survey questions and indicates that the questions measure key constructs of interest for this study and may be useful as a measure of change in parents' views on these constructs.

Figure 8. Three Factors from Parent Surveys

Parental engagement and confidence	4 statements	Parents supporting their child with math assignments and confidence in their own math ability.
Parental beliefs	4 statements	Parents' beliefs of their child's math ability, and importance of math for their child's future.
Parental support and accessing help	4 statements	Parents' perceptions of the help they can provide to their child, the help the child received in school, and monitoring their child's progress in math.

KEY FINDINGS: REGRESSION ANALYSES: When we conducted regression analyses of the teen surveys, several key patterns of note emerged.

- All three student factors (classroom context, math identity and beliefs, and parental involvement) predicted whether teens passed math class last year.
- Socioeconomic status predicted whether teens passed math class last year.
- Identifying as Hispanic/Latinx predicted whether teens passed math class last year.

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