Math Follow-Up Study

September 2021 Progress Update

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Official Analysis Sample

- There were 771 students in our database from the Pre-K study.
- We re-consented 519 students in 5th grade.

- **Timepoints from the Middle School Follow-Up Study (funded by IES & HSF):**
    - Year 1 (5th grade): 517 students assessed
    - Year 2 (6th grade): 513 students assessed
    - Year 3 (7th grade): 503 students assessed
    - Year 4 (8th grade): 496 students assessed
        - *Note.* 4 students have partial data at this timepoint.
    - Year 5 (9th grade): 486 students assessed
        - *Note.* 1 student has partial data at this timepoint, and we dropped all data for 1 student who was ill during testing. So, 484 students have complete data at this timepoint, and 1 additional student has partial data.
- **Timepoints from the Current Study (funded by NSF):**
    - Year 1 (10th grade): 457 students assessed
        - *Note.* 457 students were assessed, but we dropped data for 2 students with changes in guardianship. So, 455 students have data at this timepoint.
    - Year 2 (11th grade): 357 students assessed either fully or partially
        - *Note.* 357 students were assessed, but we kept 354 students in our analytical sample for this timepoint. Data were dropped for 3 students because:
            - Student indicated that he/she had a guardianship change, and we were unable to obtain a consent form from the new guardian (1 student).
            - Significant technology issues/disruptions (1 student).
            - Student's glasses were broken, and she expressed difficulty reading the questions (1 student).
    - Year 3 (12th grade): 279 students assessed either fully or partially
        - *Note.* 262 students (94% of those assessed) completed the full assessment battery, and 2 students (1% of those assessed) started the direct assessments but refused to finish all of the measures.
        - *Note.* 15 students (5% of those assessed) completed at least part of the online student surveys only (i.e., they did not complete the math direct assessment measures).

Data Collection Timeline

The following chart provides an overview of the student direct assessment data collection timepoints for the original study ("Scaling Up TRIAD"), as well as the two follow-up studies.

OVERVIEW OF STUDENT DIRECT ASSESMENT DATA COLLECTION				
Project Title	**Funding Source**	**School Year**	**Grade Level***	**Data Collection Timepoints**
Scaling Up TRIAD: Teaching Early Mathematics for Understanding with Trajectories and Technologies	Institute of Education Sciences	2007-2008	Pre-K	Fall Pre-K
				Spring Pre-K
		2008-2009	Kindergarten	Spring K*
		2009-2010	1st	Spring 1st Grade*
"Between Study Years"	*N/A*	*2010-2011*	*2nd*	*N/A*
		2011-2012	*3rd*	*N/A*
		2012-2013	*4th*	*N/A*
Contributions to Mathematics Competency of At-Risk Students: The Impact of Executive Function, Approximate Number System and Early Mathematics Skills	Heising-Simons Foundation & Institute of Education Sciences	2013-2014	5th	Spring 5th Grade*
		2014-2015	6th	Spring 6th Grade*
		2015-2016	7th	Spring 7th Grade*
		2016-2017	8th	Spring 8th Grade*
		2017-2018	9th	Spring 9th Grade*
A Longitudinal Study Predicting Postsecondary STEM Readiness Among Low-Income Minority Students	National Science Foundation	2018-2019	10th	Spring 10th Grade*
		2019-2020	11th	Spring 11th Grade*
		2020-2021	12th	Spring 12th Grade*

*Grade level if not retained.

Consort Chart: From the Original Study through the Follow-Up Studies

Note. Original official analysis sample of 771 was defined as those assessed at the beginning of pre-k; official analysis sample of 519 for the follow-up study was defined as those re-consented (whether assessed in Spring 2014 or not).

945 Original Possible Participants

153 Excluded
Parental Consent not obtained (153)

792 In Randomized Schools in PK (2007-2008)

463 In Building Blocks Treatment

329 In Control Condition

Time 1

11 Not Assessed
Withdrew from study (1),
Repeated absences (1),
Withdrew from school (9)

10 Not Assessed
Repeated absences (1),
Consented too late (4),
Withdrew from school (5)

Time 1

452 Assessed Fall 2007 (Beginning PK*)

319 Assessed Fall 2007 (Beginning PK*)

Time 5

135 Not Re-Consented
Withdrew from study in 1st grade (8),
Parents refused reconsent (20),
Out of state in 5th grade (14),
Not found in 5th grade (26),
Out of Davidson County in 5th grade (27),
Never returned consent (40)

117 Not Re-Consented
Withdrew from study in 1st grade (8),
Parents refused reconsent (14),
Out of state in 5th grade (15),
Not found in 5th grade (19),
Out of Davidson County in 5th grade (26),
Never returned consent (35)

Time 5

1 Not Assessed
Repeated absences

1 Not Assessed
Consented too late for assessments this year

316 Assessed Spring 2014

201 Assessed Spring 2014

Time 6

3 Not Assessed
Withdrew from study in 6th grade (1),
Out of region/state in 6th grade (2)

3 Not Assessed
Out of region/state in 6th grade (3)

Time 6

1 back at T6

314 Assessed Spring 2015

199 Assessed Spring 2015

1 back at T6

Time 7

5 Not Assessed
Withdrew from study in 7th grade (2),
Out of region/state in 7th grade (3)

5 Not Assessed
Out of region/state in 7th grade (4),
Not found in 7th grade (1)

Time 7

309 Assessed Spring 2016

194 Assessed Spring 2016

1 Partial
KM, part of EP

Time 8

4 Not Assessed
Withdrew from study in 8th grade (1),
Out of region/state in 8th grade (3)

7 Not Assessed
Withdrew from study in 8th grade (1),
Out of region/state in 8th grade (5),
Unable to assess in 8th grade (1)

Time 8

3 Partial
EP only (1),
KM only (2)

1 back at T8

306 Assessed Spring 2017

190 Assessed Spring 2017

3 back at T8

Time 9

10 Not Assessed
Withdrew from study in 9th grade (1),
Out of region/state in 9th grade (4),
Unable to assess in 9th grade (2),
Not found in 9th grade (3)

7 Not Assessed
Withdrew from study in 9th grade (1),
Out of region/state in 9th grade (3),
Unable to assess in 9th grade (1),
Not found in 9th grade (2)

Time 9

1 Partial
Interview & KM

1 Dropped
Ill during test

2 back at T9

298 Assessed Spring 2018

188 Assessed Spring 2018

5 back at T9

Time 10

21 Not Assessed
Withdrew from study in 10th grade (2),
Out of region/state in 10th grade (10),
Unable to locate and/or assess (9)

13 Not Assessed
Out of region/state in 10th grade (3),
Unable to located and/or assess (10)

Time 10

1 Dropped
Guardian change

1 Dropped
Guardian change

4 back at T10

281 Assessed Spring 2019

176 Assessed Spring 2019

1 back at T10

Time 11

68 Not Assessed
Withdrew from study in 11th grade (2),
Out of region/state in 11th grade (6),
Attempted dropout interview (2),
Unable to locate and/or assess (58)

40 Not Assessed
Withdrew from study in 11th grade (1),
Out of region/state in 11th grade (3),
Attempted dropout interview (4),
Unable to locate and/or assess (32)

Time 11

3 Dropped
Tech issues (1),
Broken glasses (1),
Guardianship (1)

6 back at T11

219 Assessed Spring 2020

138 Assessed Spring 2020

2 back at T11

Time 12

78 Not Assessed
Graduated early (16),
Withdrew from study in 12th grade (3),
Out of region/state in 12th grade (1),
Attempted dropout interview (1),
Unable to locate and/or assess (57)

58 Not Assessed
Graduated early (7),
Withdrew from study in 12th grade (2),
Attempted dropout interview (5),
Unable to locate and/or assess (44)

Time 12

4 Partial
QC & PS (1),
Partial surveys (1),
QC (1),
CMAT & partial surveys (1)

7

42 back at T12

183 Assessed Spring 2021

96 Assessed Spring 2021

16 back at T12

Demographic Information (Assessed Sample for Grade 12)

Age at Time of Testing (Years)	N	Min	Max	Mean	SD
Entire Assessed Sample	279	17.4	18.8	18.0	0.33
Completed on a Computer or Tablet	147	17.4	18.6	17.9	0.33
Completed on a Cell Phone	128	17.4	18.8	18.0	0.32
Used Multiple Devices	3	17.5	18.6	18.0	0.55
Device Type Missing	1	17.6	17.6	17.6	---

Note. 3 students used multiple devices during their assessment (e.g., computer for visual and cell phone for audio).

Student Demographics (Assessed Sample for Grade 12 vs. Overall Study Sample)

	Entire Assessed Sample (N=279)		Overall Sample (N=519)	
	Freq	Pct	Freq	Pct
Ethnicity				
Black	225	80.6	410	79.0
White	20	7.2	45	8.7
Hispanic	22	7.9	42	8.1
Other	12	4.3	22	4.2
Gender				
Male	117	41.9	227	43.7
Female	162	58.1	292	56.3
Pre-K Condition				
Building Blocks (Tx)	183	65.6	317	61.1
Control	96	34.4	202	38.9
Pre-K ELL Designation[1]				
ELL	25	9.0	47	9.1
Not ELL	253	90.7	471	90.8

Note[1]. 1 student is missing a pre-k ELL designation.

Note. Assessed students were spread across 48 schools, and 1 student was homeschooled. Most schools were located in Davidson County, but because assessments were conducted virtually this year, we also tried to assess students who would have been classified as out-of-region (i.e., not living in Davidson County or in a contiguous county) in previous years of the study.

Student Demographics by Type of Device Used During Grade 12 Session

	Completed on a Computer or Tablet (N = 147)		Completed on a Cell Phone (N = 128)		Used Multiple Devices (N = 3)		Device Type Missing (N = 1)		Not Assessed in Grade 12 (N = 240)	
	Freq	Pct	Freq	Pct	Freq	Pct	Freq	Pct	Freq	Pct
Ethnicity										
Black	115	78.2	107	83.6	3	100.0	0	0.0	185	77.1
White	6	4.1	13	10.2	0	0.0	1	100.0	25	10.4
Hispanic	17	11.6	5	3.9	0	0.0	0	0.0	20	8.3
Other	9	6.1	3	2.3	0	0.0	0	0.0	10	4.2
Gender										
Male	64	43.5	51	39.8	1	33.3	1	100.0	110	45.8
Female	83	56.5	77	60.2	2	66.7	0	0.0	130	54.2
Pre-K Condition										
Building Blocks (Tx)	98	66.7	82	64.1	2	66.7	1	100.0	134	55.8
Control	49	33.3	46	35.9	1	33.3	0	0.0	106	44.2
Pre-K ELL Designation[1]										
ELL	20	13.6	5	3.9	0	0.0	0	0.0	22	9.2
Not ELL	126	85.7	123	96.1	3	100.0	1	100.0	218	90.8

Note[1]. One student is missing a pre-k ELL designation.

Tracking Data Completion

Data Completion from Grade 11 to Grade 12

In grade 11 (SY 2019-2020), we collected at least partial assessment data on 353 students, and in grade 12 (SY 2020-2021), we collected at least partial assessment data on 279 students.

- Of the 353 students assessed in grade 11, we have complete Woodcock-Johnson (Quantitative Concepts subtest) and CMAT (Problem Solving, Algebra, and Geometry subtests) data on 311.
- Of the 279 students assessed in grade 12, we have complete Woodcock-Johnson (Quantitative Concepts subtest) and CMAT (Problem Solving, Algebra, and Geometry subtests) data on 262.

A total of 198 students have complete 11th and 12th grade Woodcock-Johnson and CMAT data (all subtests).

In grade 11, some students were assessed in-person, but we began to test students virtually after COVID-19 caused schools to switch to remote instruction in mid-March 2020. The table below shows the type of session that those 262 students who have complete Woodcock-Johnson and CMAT data for this year completed during 11th grade data collection.

Year 11 Session Type	Freq	Pct
In-Person Assessment	148	56.5
Full Virtual Assessment[1]	27	10.3
Modified Virtual Assessment[2]	26	9.9
Completed Survey & Partial Interview Only	20	7.6
Not Assessed	41	15.6

Note[1]. Students completed all assessment measures virtually via Zoom.

Note[2]. Students were assessed virtually, but the technology used (e.g., Chromebook, cell phone, etc.) prevented them from being able to take control of the screen and input their own answers. The experimenter entered answers for the students. Also, the student could not complete the interview sorting task.

Student Outcomes: CMAT

The following table includes information about all of the students who completed the CMAT subtests this year (N=264).

CMAT Subtest/Score	Entire Assessed Sample[1]			Used a Computer or Tablet			Used a Cell Phone			Used Multiple Devices			Device Type Missing		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
CMAT: Problem Solving															
Age-Based Standard Score	264	7.77	3.42	147	8.75	3.11	113	6.58	3.45	3	5.33	1.53	1	5.00	-
Age-Equivalent Score	264	13.80	3.60	147	14.69	3.29	113	12.75	3.70	3	10.83	1.46	1	10.25	--
Grade Equivalent Score	264	8.68	3.52	147	9.54	3.21	113	7.65	3.65	3	5.77	1.44	1	5.20	--
CMAT: Algebra															
Age-Based Standard Score	263	7.21	3.62	147	8.24	3.54	112	5.94	3.29	3	5.33	3.21	1	2.00	--
Age-Equivalent Score	263	13.92	3.24	147	14.80	2.99	112	12.86	3.22	3	12.08	3.41	1	9.25	--
Grade Equivalent Score	263	8.77	3.11	147	9.61	2.83	112	7.74	3.12	3	7.03	3.45	1	4.20	--
CMAT: Geometry															
Age-Based Standard Score	263	6.21	3.49	147	6.82	3.76	112	5.48	2.99	3	4.33	1.53	1	3.00	--
Age-Equivalent Score	263	13.35	2.97	147	13.86	3.10	112	12.75	2.69	3	11.67	1.66	1	10.25	--
Grade Equivalent Score	263	8.18	2.79	147	8.66	2.91	112	7.61	2.53	3	6.60	1.64	1	5.20	--

Note[1]. Does not include those students who only provided survey data (N=15).

Note. One student only completed the Problem Solving subtest this year.

CMAT Scores Across Years

Students completed three CMAT subtests (Problem Solving, Algebra, and Geometry) in the spring of 10th, 11th, and 12th grades. The table below shows the scores over time for those 196 students who have complete CMAT data at all possible timepoints.

CMAT Subtest/Score	N	Min	Max	Mean	Median	SD	Actual - Expected Mean
CMAT: Problem Solving							
Age-Based Standard Score (Year 10)	196	1.00	15.00	8.01	8.00	3.09	-1.99
Age-Based Standard Score (Year 11)	196	1.00	16.00	8.21	9.00	3.06	-1.79
Age-Based Standard Score (Year 12)	196	1.00	15.00	7.74	8.00	3.30	-2.26
Age Equivalent Score (Year 10)	196	6.75	18.00	13.22	12.50	3.35	-2.69
Age Equivalent Score (Year 11)	196	6.25	18.00	13.60	13.50	3.32	-3.32
Age Equivalent Score (Year 12)	196	6.25	18.00	13.78	13.50	3.51	-4.15
Grade Equivalent Score (Year 10)	196	1.70	12.70	8.11	7.40	3.29	-2.59
Grade Equivalent Score (Year 11)	196	1.20	12.70	8.48	8.40	3.25	-3.32
Grade Equivalent Score (Year 12)	196	1.20	12.70	8.66	8.40	3.44	-4.14
CMAT: Algebra							
Age-Based Standard Score (Year 10)	196	1.00	17.00	7.41	7.50	3.34	-2.59
Age-Based Standard Score (Year 11)	196	1.00	17.00	7.28	7.00	3.55	-2.72
Age-Based Standard Score (Year 12)	196	1.00	18.00	7.40	7.50	3.68	-2.60
Age Equivalent Score (Year 10)	196	8.25	18.25	13.38	13.38	3.26	-2.53
Age Equivalent Score (Year 11)	196	8.25	18.25	13.46	13.75	3.30	-3.46
Age Equivalent Score (Year 12)	196	8.25	18.25	14.11	14.13	3.25	-3.83
Grade Equivalent Score (Year 10)	196	3.20	12.70	8.24	8.35	3.14	-2.46
Grade Equivalent Score (Year 11)	196	3.20	12.70	8.31	8.70	3.17	-3.49
Grade Equivalent Score (Year 12)	196	3.20	12.70	8.95	9.05	3.11	-3.85
CMAT: Geometry							
Age-Based Standard Score (Year 10)	196	1.00	16.00	7.37	7.00	3.01	-2.63
Age-Based Standard Score (Year 11)	196	1.00	16.00	6.71	6.00	3.48	-3.29
Age-Based Standard Score (Year 12)	196	1.00	16.00	6.13	5.00	3.51	-3.87
Age Equivalent Score (Year 10)	196	8.75	18.25	13.08	12.50	2.71	-2.83
Age Equivalent Score (Year 11)	196	8.75	18.25	13.30	12.50	2.91	-3.62
Age Equivalent Score (Year 12)	196	8.75	18.25	13.29	12.50	2.99	-4.65
Grade Equivalent Score (Year 10)	196	3.70	12.70	7.93	7.40	2.57	-2.77
Grade Equivalent Score (Year 11)	196	3.70	12.70	8.13	7.40	2.75	-3.67
Grade Equivalent Score (Year 12)	196	3.70	12.70	8.11	7.40	2.81	-4.69

Note. The average age of the students was 15.9 years at 10th grade testing, 16.9 years at 11th grade testing, and 17.9 years at 12th grade testing.

Note. The average grade level of the students was 10.7 at 10th grade testing, 11.8 at 11th grade testing, and 12.8 at 12th grade testing. For 11th grade, the average uses the dates for the full intended school year (vs. the date that MNPS closed due to COVID-19).

CMAT Scores Across Years by Type of Device Used During Grade 12 Session

The table below shows students' CMAT scores over time when broken apart by the type of device used during their grade 12 assessment session.

- For all categories except for the "Not Assessed in Grade 12" category, only students with complete data at all timepoints (10th – 12th) are included (N=196).
- For comparison, we also included 10th and 11th grade CMAT data for all students who were assessed the past two years but who were not assessed this year (N=101).

CMAT Subtest/Score	Used a Computer or Tablet			Used a Cell Phone			Used Multiple Devices			Device Type Missing			Not Assessed in Year 12		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
CMAT: Problem Solving															
Age-Based Standard Score (Year 10)	107	8.79	2.90	85	7.09	3.12	3	6.67	2.08	1	6.00	--	101	7.19	2.65
Age-Based Standard Score (Year 11)	107	8.87	2.79	85	7.52	3.24	3	5.33	0.58	1	5.00	--	101	7.37	2.56
Age-Based Standard Score (Year 12)	107	8.60	3.08	85	6.79	3.32	3	5.33	1.53	1	5.00	--	--	--	--
Age Equivalent Score (Year 10)	107	13.98	3.26	85	12.35	3.30	3	11.50	1.75	1	10.75	--	101	12.39	2.97
Age Equivalent Score (Year 11)	107	14.20	3.12	85	12.98	3.47	3	10.58	0.29	1	10.25	--	101	12.58	2.80
Age Equivalent Score (Year 12)	107	14.56	3.32	85	12.95	3.57	3	10.83	1.46	1	10.25	--	--	--	--
CMAT: Algebra															
Age-Based Standard Score (Year 10)	107	8.06	3.28	85	6.76	3.26	3	5.00	1.00	1	1.00	--	101	6.59	2.89
Age-Based Standard Score (Year 11)	107	7.78	3.67	85	6.79	3.34	3	4.33	1.15	1	4.00	--	101	6.44	3.11
Age-Based Standard Score (Year 12)	107	8.45	3.64	85	6.22	3.34	3	5.33	3.21	1	2.00	--	--	--	--
Age Equivalent Score (Year 10)	107	14.01	3.21	85	12.74	3.19	3	10.67	1.01	1	8.25	--	101	12.58	2.73
Age Equivalent Score (Year 11)	107	13.88	3.36	85	13.09	3.20	3	10.25	0.43	1	9.75	--	101	12.78	2.80
Age Equivalent Score (Year 12)	107	14.98	2.99	85	13.14	3.25	3	12.08	3.41	1	9.25	--	--	--	--
CMAT: Geometry															
Age-Based Standard Score (Year 10)	107	7.92	3.19	85	6.75	2.71	3	6.00	1.00	1	5.00	--	101	6.38	2.38
Age-Based Standard Score (Year 11)	107	7.39	3.72	85	5.91	3.07	3	5.33	0.58	1	6.00	--	101	5.91	2.76
Age-Based Standard Score (Year 12)	107	6.81	3.84	85	5.36	2.92	3	4.33	1.53	1	3.00	--	--	--	--
Age Equivalent Score (Year 10)	107	13.53	2.83	85	12.60	2.50	3	11.67	1.66	1	10.25	--	101	12.20	2.21
Age Equivalent Score (Year 11)	107	13.83	3.07	85	12.68	2.64	3	12.00	1.30	1	12.50	--	101	12.70	2.48
Age Equivalent Score (Year 12)	107	13.86	3.17	85	12.66	2.63	3	11.67	1.66	1	10.25	--	--	--	--

Student Outcomes: Woodcock-Johnson Subtests

The following table includes information about all of the students who completed the Woodcock-Johnson subtests this year (N=263). One additional student was assessed this year, but he is not included in the table below because his Quantitative Concepts B data was accidentally deleted due to assessor error.

Quantitative Concepts Score	N	Min	Max	Mean	Median	SD
Entire Assessed Sample[1]						
W-Score	263	456.00	566.00	519.70	518.00	16.51
Standard Score	263	30.00	123.00	85.40	84.00	14.35
Used a Computer or Tablet						
W-Score	147	457.00	566.00	523.64	524.00	15.32
Standard Score	147	30.00	123.00	88.86	89.00	13.25
Used a Cell Phone						
W-Score	113	456.00	549.00	514.85	514.00	16.89
Standard Score	113	30.00	110.00	81.14	80.00	14.73
Used Multiple Devices						
W-Score	3	508.00	512.00	509.67	509.00	2.08
Standard Score	3	75.00	79.00	76.67	76.00	2.08

Note[1]. Does not include those students who only provided survey data (N=15)

Comparing Students' 11th and 12th Grade Woodcock-Johnson Scores

The following table looks at the change in students' Woodcock-Johnson scores from 11th to 12th grade. Only students with complete data at both timepoints are included (N=202).

Quantitative Concepts Score	N	Min	Max	Mean	Median	SD
Entire Assessed Sample[1]						
W-Score (Year 11)	202	458.00	563.00	518.87	517.00	16.25
W-Score (Year 12)	202	456.00	566.00	519.45	518.00	16.81
Standard Score (Year 11)	202	31.00	122.00	85.13	84.00	14.23
Standard Score (Year 12)	202	30.00	123.00	85.20	84.00	14.61
Used a Computer or Tablet (Year 12)						
W-Score (Year 11)	112	479.00	563.00	522.33	518.00	15.33
W-Score (Year 12)	112	457.00	566.00	523.28	521.00	15.72
Standard Score (Year 11)	112	50.00	122.00	88.16	85.00	13.34
Standard Score (Year 12)	112	30.00	123.00	88.56	87.00	13.63
Used a Cell Phone (Year 12)						
W-Score (Year 11)	87	458.00	549.00	514.64	513.00	16.66
W-Score (Year 12)	87	456.00	549.00	514.86	512.00	17.26
Standard Score (Year 11)	87	31.00	111.00	81.43	79.00	14.69
Standard Score (Year 12)	87	30.00	110.00	81.17	79.00	15.02
Used Multiple Devices (Year 12)						
W-Score (Year 11)	3	504.00	518.00	512.33	515.00	7.37
W-Score (Year 12)	3	508.00	512.00	509.67	509.00	2.08
Standard Score (Year 11)	3	72.00	84.00	79.33	82.00	6.43
Standard Score (Year 12)	3	75.00	79.00	76.67	76.00	2.08

Woodcock-Johnson Scores Across Years

- From the original study through this year, there were 12 testing timepoints. They were: fall of PK, spring of PK, spring of K, spring of 1st grade, and spring of 5th, 6th, 7th, 8th, 9th, 10th, 11th and 12th grades.
- Letter-Word Identification was only given in fall of PK, spring of PK, spring of K, spring of 1st grade, and spring of 7th and 8th grades.
- The graphs below show the scores over time for those 184 students who were tested at all possible timepoints.

WJ W-Scores from the Beginning of PK through 11th Grade (N=184)

WJ Standard Scores from the Beginning of PK through 12th Grade (N=184)
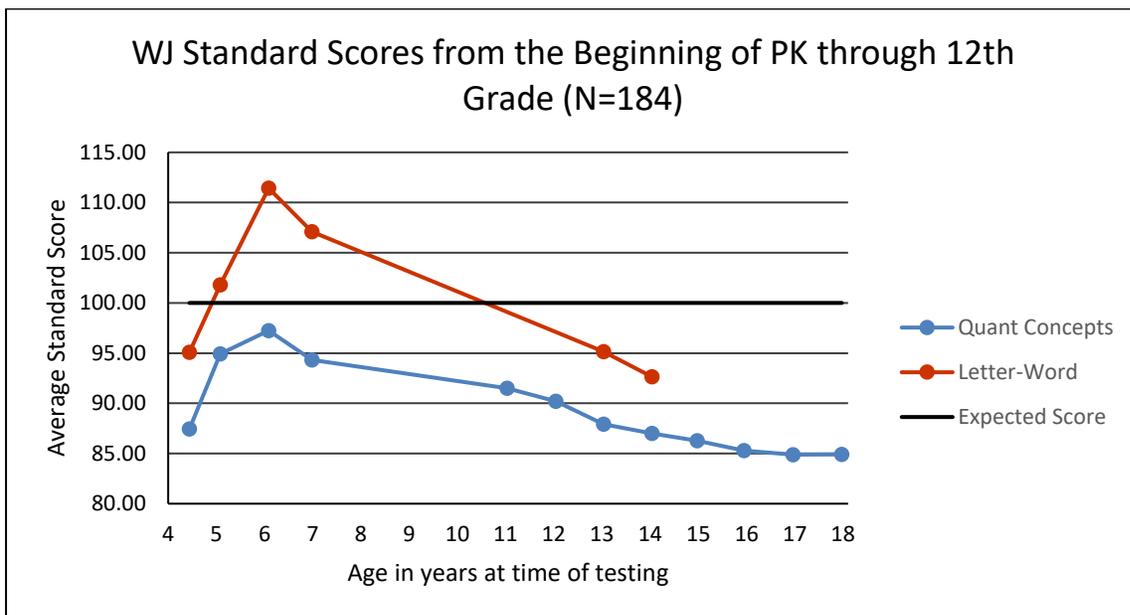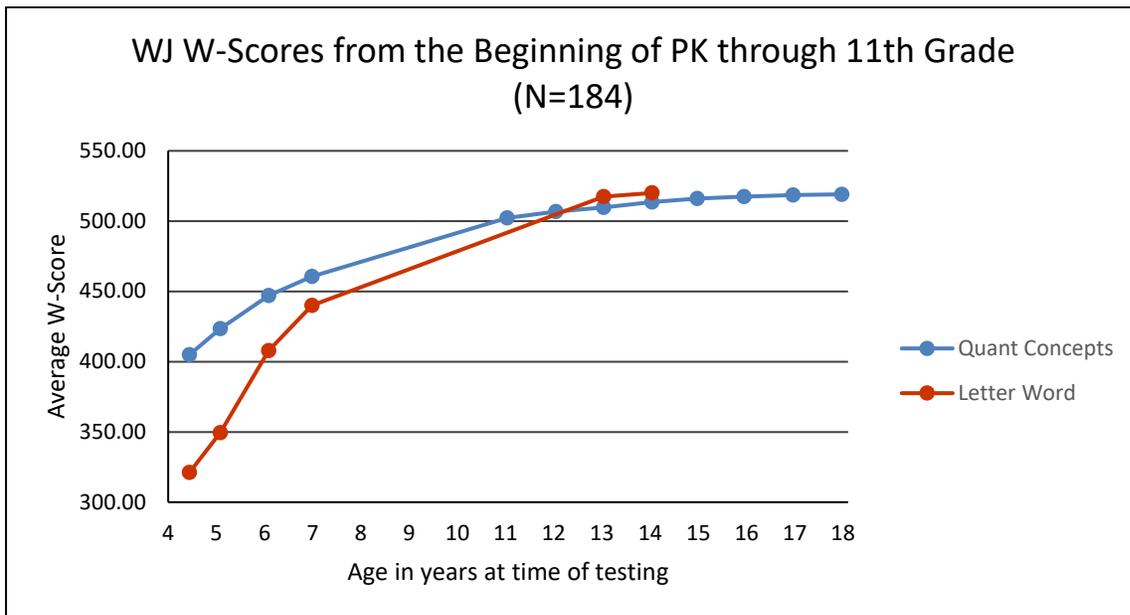
Woodcock-Johnson Scores by Type of Device Used During Grade 12 Session

The following graphs show students' Woodcock-Johnson scores over time when grouped by the type of device used during the 12th grade session. Of this year's assessed sample, we only included students who had complete data from pre-k through 11th grade: 106 students used a computer, 84 used a phone, and 2 used multiple devices. Only 1 student was missing a device type, so we excluded those data from the graphs. For comparison, we also included students who have complete data from pre-k to 11th grade, but who weren't assessed this year (N=92).

WJ Quant Concepts Standard Scores from the Beginning of PK through Grade 12 by Grade 12 Device Type (N=284)

WJ Letter-Word ID Standard Scores from the Beginning of PK through Grade 12 by Grade 12 DeviceType (N=284)
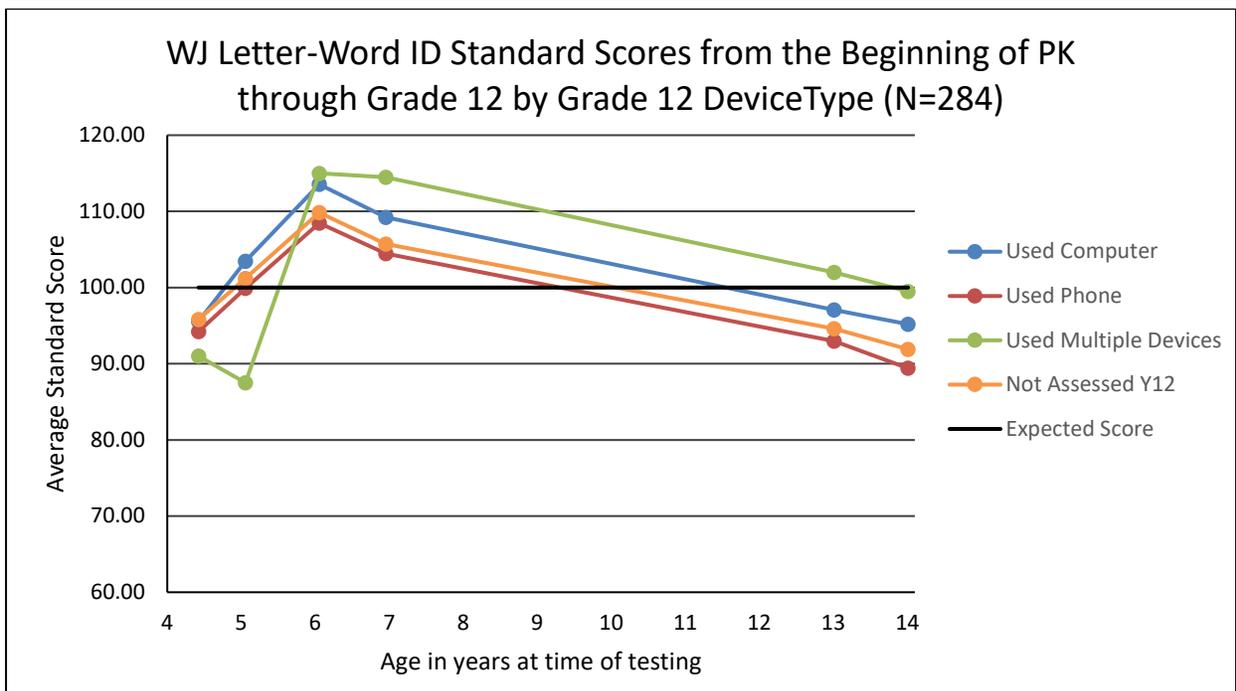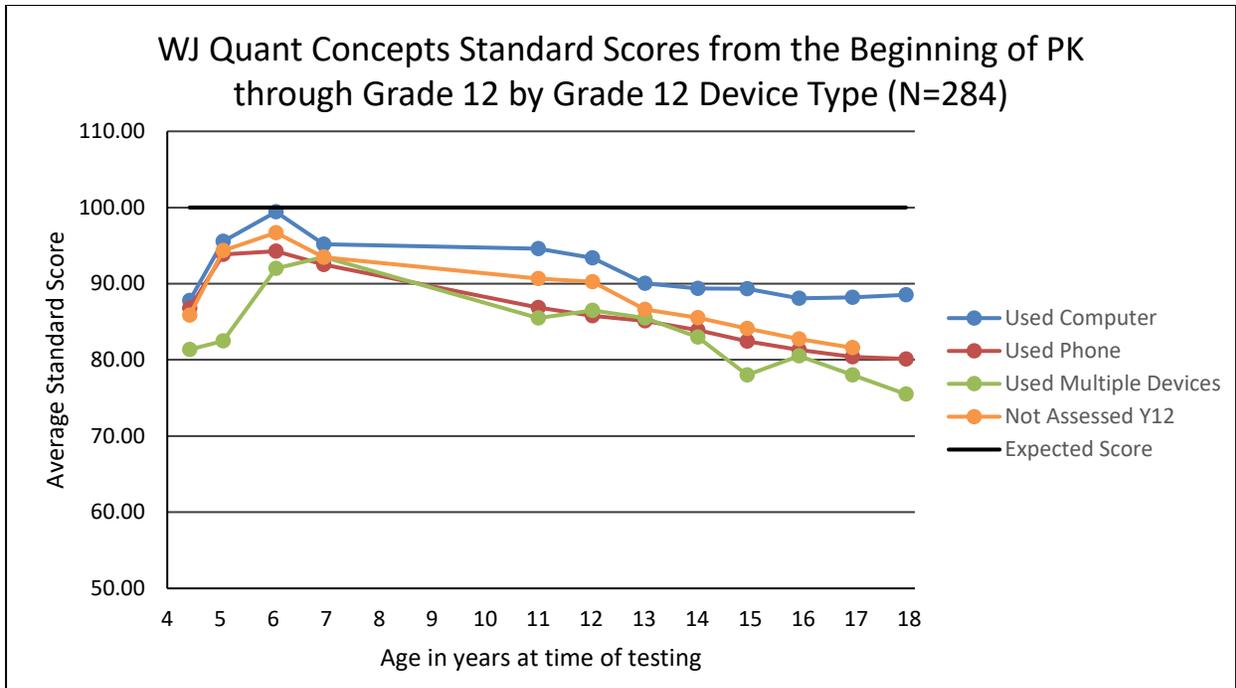
Student Survey Outcomes: TIMSS (Trends in International Mathematics and Science Study) Math

Each year since 6th grade, we have administered the TIMSS survey on math attitudes. Beginning in 10th grade, we added the Science Survey.

In previous years, assessors read each survey item, and students responded by circling their answer on paper. This year, students completed the surveys electronically via REDCap. Assessors read the items to students only if they had an IEP or were an English learner; otherwise, students completed the survey independently.

As a way to make sure that students were paying attention, we added attention check items such as "I select 'Agree a little' for this item" to the survey. If a student responded incorrectly to an attention check item, a message appeared in REDCap reminding him/her what the correct answer should have been and encouraging the student to read carefully. If the same answer was selected for every item on a page, REDCap also reminded the student to think carefully about his/her answers.

We decided to drop students' TIMSS Math data if either of the following criteria was true:

- Student missed 2 (out of 3) attention check items
- Student gave the same response for every TIMSS Math item

Of the students assessed this year, 12 did not meet the attention check criteria, so their data were dropped. Of the students whose data were dropped, 8 used a phone to complete the survey, and 4 used a computer or tablet.

	N	Min	Max	Mean	SD
Confidence Scale Average	**266**	**1.00**	**4.00**	**2.66**	**0.76**
I usually do well in mathematics (reverse coded)	266	1.00	4.00	3.12	0.87
Mathematics is more difficult for me than for many of my classmates	266	1.00	4.00	2.50	1.05
Mathematics is not one of my strengths	266	1.00	4.00	2.41	1.14
I learn things quickly in mathematics (reverse coded)	266	1.00	4.00	2.69	0.94
Mathematics makes me confused and nervous	266	1.00	4.00	2.47	1.00
I am good at working out difficult mathematics problems (reverse coded)	266	1.00	4.00	2.59	0.94
My teacher thinks I am good at working out difficult mathematics problems (reverse coded)	266	1.00	4.00	2.85	0.86
My teacher tells me I am good at mathematics (reverse coded)	266	1.00	4.00	2.82	0.96
Mathematics is harder for me than any other subject	266	1.00	4.00	2.48	1.16

	N	Min	Max	Mean	SD
Value Scale Average	**265**	**1.33**	**4.00**	**3.07**	**0.62**
It is important to do well in mathematics (reverse coded)	265	1.00	4.00	3.63	0.65
I think learning mathematics will help me in my daily life (reverse coded)	266	1.00	4.00	3.25	0.85
I need mathematics to learn other school subjects (reverse coded)	266	1.00	4.00	3.07	0.79
I need to do well in mathematics to get into the college or university of my choice (reverse coded)	266	1.00	4.00	3.22	0.87
I need to do well in mathematics to get the job I want (reverse coded)	266	1.00	4.00	2.95	1.00
I would like a job that involves using mathematics (reverse coded)	266	1.00	4.00	2.27	1.05
Like Learning Scale Average	**265**	**1.00**	**4.00**	**2.82**	**0.76**
I enjoy learning mathematics (reverse coded)	265	1.00	4.00	2.93	0.90
I wish I did not have to study mathematics	265	1.00	4.00	2.64	1.01
Mathematics is boring	265	1.00	4.00	2.62	0.97
I learn many interesting things in mathematics (reverse coded)	265	1.00	4.00	3.14	0.85
I like mathematics (reverse coded)	265	1.00	4.00	2.78	1.02
Engagement Scale Average	**266**	**1.00**	**4.00**	**2.85**	**0.62**
I know what my mathematics teacher expects me to do (reverse coded)	266	1.00	4.00	3.42	0.74
During math class, I think of things not related to the lesson	266	1.00	4.00	2.12	0.87
My mathematics teacher is easy to understand (reverse coded)	266	1.00	4.00	2.87	0.95
I am interested in what my mathematics teacher says (reverse coded)	266	1.00	4.00	2.99	0.86
My mathematics teacher gives me interesting things to do (reverse coded)	266	1.00	4.00	2.83	0.92
Researcher Developed Item (Not Part of Published TIMSS)					
My family thinks that I am good at mathematics (reverse coded)	266	1.00	4.00	3.09	0.92

Note. TIMSS items are on a scale of 1 (Agree a lot) to 4 (Disagree a lot). All positively worded items above were reverse coded (e.g., I usually do well in math) so that on all items higher scores mean more positive student ratings.

Note. Twelve students completed the TIMSS Math, but data were dropped because they did not meet the attention check criteria. One student who was assessed did not complete any of the survey items. Also, one student who was assessed started the TIMSS Math, but he did not complete all items.

Student Ratings for Math Subscales by Year (Entire Assessed Sample)

- The TIMSS Math was administered at 7 testing timepoints throughout the Math Follow-Up Study. They were: 6th, 7th, 8th, 9th, 10th, 11th and 12th grades.
- The table below shows the scores over time for those 219 students who completed the TIMSS Math at all possible timepoints.

Grade Level[1]	N	Confidence Scale Avg		Value Scale Avg		Like Learning Scale Avg		Engagement Scale Avg	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
6th Grade	219	3.11	0.68	3.52	0.44	3.42	0.61	3.31	0.53
7th Grade	219	2.95	0.70	3.52	0.43	3.25	0.68	3.20	0.53
8th Grade	219	2.96	0.70	3.47	0.40	3.16	0.70	3.08	0.58
9th Grade	219	2.86	0.76	3.36	0.49	3.06	0.71	3.00	0.58
10th Grade	219	2.90	0.74	3.30	0.56	3.04	0.69	3.01	0.59
11th Grade	219	2.84	0.73	3.25	0.54	3.01	0.72	2.83	0.69
12th Grade	219	2.65	0.74	3.07	0.61	2.83	0.76	2.84	0.62

Note[1]. Grade level if not retained.

Student Ratings for Math Subscales Across Years by Type of Device Used During 12th Grade Session

On average, the type of device that students used during their 12th grade assessment session did not appear to influence students' math beliefs. Please see the appendix for more detailed information about students' math beliefs when broken apart by the type of device used during the 12th grade assessment session.

Student Survey Outcomes: TIMSS Science

In 10th grade, we began administering the TIMSS Science. As with the TIMSS Math, students completed the survey on paper in previous years but completed electronically (via REDCap) this year. Also, due to time constraints, we intentionally did not ask the 5 TIMSS Science items that comprise the Science Engagement Subscale.

This year's survey included attention check items to make sure that students were paying attention, and REDCap also prompted students if they chose the same response to every item on a page.

We decided to drop students' TIMSS Science data if either of the following criteria was true:

- Student missed 2 (out of 2) attention check items
- Student gave the same response for every TIMSS Science item

Of the students assessed this year, 9 did not meet the attention check criteria, so their data were dropped. Of those students, 7 used a phone, and 2 used a computer or tablet.

	N	Min	Max	Mean	SD
Confidence Scale Average	**267**	**1.11**	**4.00**	**3.03**	**0.62**
I usually do well in science (reverse coded)	268	1.00	4.00	3.35	0.74
Science is more difficult for me than for many of my classmates	268	1.00	4.00	3.11	0.91
Science is not one of my strengths	268	1.00	4.00	2.74	0.98
I learn things quickly in science (reverse coded)	268	1.00	4.00	3.02	0.82
Science makes me confused and nervous	268	1.00	4.00	3.05	0.84
I am good at working out difficult science problems (reverse coded)	268	1.00	4.00	2.73	0.87
My teacher thinks I can do well in science classes with difficult materials (reverse coded)	267	1.00	4.00	3.13	0.85
My teacher tells me I am good at science (reverse coded)	267	1.00	4.00	2.98	0.93
Science is harder for me than any other subject	268	1.00	4.00	3.13	0.92
Value Scale Average	**268**	**1.00**	**4.00**	**2.74**	**0.71**
It is important to do well in science (reverse coded)	269	1.00	4.00	3.19	0.79
I think learning science will help me in my daily life (reverse coded)	268	1.00	4.00	2.91	0.90
I need science to learn other school subjects (reverse coded)	268	1.00	4.00	2.51	0.93
I need to do well in science to get into the college or university of my choice (reverse coded)	268	1.00	4.00	2.75	0.99
I need to do well in science to get the job I want (reverse coded)	268	1.00	4.00	2.61	1.06
I would like a job that uses science (reverse coded)	268	1.00	4.00	2.44	1.05

	N	Min	Max	Mean	SD
Like Learning Scale Average	**269**	**1.00**	**4.00**	**3.20**	**0.69**
I enjoy learning science (reverse coded)	269	1.00	4.00	3.10	0.91
I wish I did not have to study science	269	1.00	4.00	2.99	0.96
Science is boring	269	1.00	4.00	3.12	0.88
I learn many interesting things in science (reverse coded)	269	1.00	4.00	3.56	0.64
I like science (reverse coded)	269	1.00	4.00	3.23	0.85
Items That Are Not Part of the Published TIMSS Subscales					
I read about science in my spare time (reverse coded)	269	1.00	4.00	1.83	0.99
My family thinks that I am good at science (reverse coded)	268	1.00	4.00	3.07	0.88

Note. TIMSS items are on a scale of 1 (Agree a lot) to 4 (Disagree a lot). All positively worded items above were reverse coded (e.g., I usually do well in science) so that on all items higher scores mean more positive student ratings.

Note. Nine students completed the TIMSS Science, but data were dropped because they did not meet the attention check criteria. One student who was assessed did not complete any of the survey items. Also, one student started the TIMSS Science but did not complete all items. Lastly, one student reported that he did not take science this past year, so he intentionally left two items (the items about his science teacher) blank.

Student Ratings for Science Subscales by Year (Entire Assessed Sample)

- The TIMSS Science was administered at 3 testing timepoints throughout the Math Follow-Up Study. They were: 10th, 11th and 12th grades.
- The table below shows the scores over time for those 222 students who completed the TIMSS Math at all possible timepoints.

		Confidence Scale Avg		Value Scale Avg		Like Learning Scale Avg	
Grade Level[1]	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
10th Grade	222	2.98	0.68	2.80	0.73	3.07	0.76
11th Grade	222	3.09	0.65	2.79	0.70	3.21	0.70
12th Grade	222	3.06	0.60	2.71	0.70	3.22	0.69

Note[1]. Grade level if not retained.

Student Ratings for Math Subscales Across Years by Type of Device Used During 12th Grade Session

On average, the type of device that students used during their 12th grade assessment did not appear to influence students' beliefs about science. Please see the appendix for more detailed information about students' science beliefs when broken apart by the type of device used during the 12th grade assessment session.

Comparing Student Ratings on Math and Science Subscales by Year

The table below shows the scores over time for those 217 students who completed both the TIMSS Math and TIMSS Science at all possible timepoints. Note that:

1. While the TIMSS Math was collected beginning in Y6, the TIMSS Science was not administered until students' 10th grade year.
2. Due to time constraints, the TIMSS Science Engagement Scale items were not given during Y12 data collection.

Grade Level[1]	N	MATH Confidence Scale Avg		SCIENCE Confidence Scale Avg		MATH Value Scale Avg		SCIENCE Value Scale Avg		MATH Like Learning Scale Avg		SCIENCE Like Learning Scale Avg		MATH Engagement Scale Avg		SCIENCE Engagement Scale Avg	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
6th	217	3.11	0.68	*n/a*	*n/a*	3.53	0.41	*n/a*	*n/a*	3.43	0.60	*n/a*	*n/a*	3.33	0.51	*n/a*	*n/a*
7th	217	2.94	0.69	*n/a*	*n/a*	3.52	0.44	*n/a*	*n/a*	3.25	0.68	*n/a*	*n/a*	3.20	0.54	*n/a*	*n/a*
8th	217	2.96	0.70	*n/a*	*n/a*	3.48	0.40	*n/a*	*n/a*	3.16	0.70	*n/a*	*n/a*	3.08	0.57	*n/a*	*n/a*
9th	217	2.86	0.75	*n/a*	*n/a*	3.37	0.49	*n/a*	*n/a*	3.06	0.71	*n/a*	*n/a*	3.00	0.59	*n/a*	*n/a*
10th	217	2.90	0.73	2.98	0.68	3.31	0.55	2.80	0.74	3.04	0.69	3.07	0.76	3.02	0.59	3.00	0.63
11th	217	2.84	0.73	3.09	0.65	3.27	0.53	2.79	0.70	3.01	0.71	3.21	0.71	2.83	0.69	3.08	0.65
12th	217	2.66	0.74	3.06	0.60	3.08	0.61	2.70	0.70	2.84	0.75	3.23	0.69	2.85	0.62	*n/a*	*n/a*

Note1. Grade level if not retained.

Pearson Correlations among 12th Grade Measures

	I. WJ QC	II. CMAT PS	III. CMAT ALG	IV. CMAT GEO	V. TIMSS MATH TOTAL	Va. MATH CONF	Vb. MATH VAL	Vc. MATH LIKE	Vd. MATH ENG	VI. TIMSS SCI TOTAL	Va. SCI CONF	Vb. SCI VAL
I. WJ Quant Concepts (Std. Score)												
II. CMAT Problem Solving (Std. Score)	0.77**											
III. CMAT Algebra (Std. Score)	0.61**	0.58**										
IV. CMAT Geometry (Std. Score)	0.71**	0.66**	0.54**									
V. TIMSS Math (Total Score)	0.17**	0.15*	0.13*	0.11								
a. Confidence Scale (Avg. Score)	0.23**	0.24**	0.19**	0.20**	0.89**							
b. Value Scale (Avg. Score)	0.04	0.04	0.03	-0.04	0.73**	0.45**						
c. Like Learning Scale (Avg. Score)	0.19**	0.17**	0.14*	0.12*	0.87**	0.68**	0.63**					
d. Engagement Scale (Avg. Score)	-0.05	-0.09	-0.04	-0.05	0.72**	0.52**	0.45**	0.56**				
VI. TIMSS Science (Total Score)	0.13*	0.16**	0.06	0.14*	0.02	-0.05	0.14*	0.01	0.00			
a. Confidence Scale (Avg. Score)	0.06	0.12	0.08	0.10	-0.02	-0.03	0.04	-0.06	-0.05	0.88**		
b. Value Scale (Avg. Score)	0.14*	0.14*	0.04	0.11	0.11	-0.01	0.29**	0.10	0.07	0.76**	0.46**	
c. Like Learning Scale (Avg. Score)	0.10	0.13*	0.03	0.12	-0.03	-0.11	0.09	0.03	-0.01	0.85**	0.69**	0.51**

Note. Pairwise deletion was used to calculate these correlations, so some of the Ns are different across correlations.

**.Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Pearson Correlations among 11ᵗʰ & 12ᵗʰ Grade Measures

| | | 11th Grade Outcomes | | | | |
	QCS	CMAT PS (STD SCORE)	CMAT ALG (STD SCORE)	CMAT GEO (STD SCORE)	TIMSS MATH (TOTAL SCORE)	TIMSS SCIENCE (TOTAL SCORE)
12th Grade Outcomes						
QCS	0.888**	0.750**	0.664**	0.647**	0.205**	0.091
CMAT PS (STD SCORE)	0.757**	0.803**	0.640**	0.673**	0.161*	0.135*
CMAT ALG (STD SCORE)	0.550**	0.566**	0.616**	0.554**	0.137*	0.069
CMAT GEO (STD SCORE)	0.681**	0.623**	0.656**	0.839**	0.202**	0.135*
TIMSS MATH (TOTAL SCORE)	0.137*	0.191**	0.172*	0.102	0.734**	0.006
TIMSS SCIENCE (TOTAL SCORE)	0.092	0.090	-0.013	0.115	0.033	0.681**

Note. Pairwise deletion was used to calculate these correlations, so some of the Ns are different across correlations.

**.Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

STEM Interest Survey

Beginning this year, we asked students questions about their STEM career interest. Items were adapted items from the *Student Attitudes toward STEM Survey-Middle and High School Students*, which was developed by the Friday Institute for Educational Innovation (2012), and the survey was grouped into two main sections: (1) questions about students' interest in specific STEM disciplines, and (2) questions about students' knowledge of adults who work in STEM disciplines.

Students completed the items independently via REDCap unless they had an IEP and/or were classified by their school as an English Learner. We included an attention check item in order to make sure that students were reading carefully. If a student responded incorrectly to the attention check item, REDCap reminded him/her of the correct response and prompted the student to think carefully.

Of the students assessed this year, 29 did not meet the attention check criteria, so their data were dropped. Of those students, 19 used a phone, 9 used a computer or tablet, and 1 student used multiple devices.

Section I: Interest in STEM Disciplines

STEM Discipline	N	Min	Max	Mean	SD
Medicine	247	1.00	4.00	2.61	1.10
Engineering	247	1.00	4.00	2.26	1.01
Medical Science	247	1.00	4.00	2.26	1.07
Biology & Zoology	247	1.00	4.00	2.15	0.95
Earth Science	247	1.00	4.00	2.12	0.99
Veterinary Work	247	1.00	4.00	2.11	1.03
Environmental Work	247	1.00	4.00	2.06	0.95
Chemistry	247	1.00	4.00	2.00	0.96
Computer Science	247	1.00	4.00	1.98	0.93
Mathematics	247	1.00	4.00	1.96	0.95
Physics	247	1.00	4.00	1.91	0.87
Energy	247	1.00	4.00	1.90	0.87

Note. STEM items are on a scale of 1 (Not at all interested) to 4 (Very interested). On all items, higher scores mean a higher interest in the STEM discipline.

Note. Three students who have partial grade 12 data (on other measures) did not complete the STEM Survey.

Student Interest in STEM Disciplines by Grade 12 Device Type (N=247)
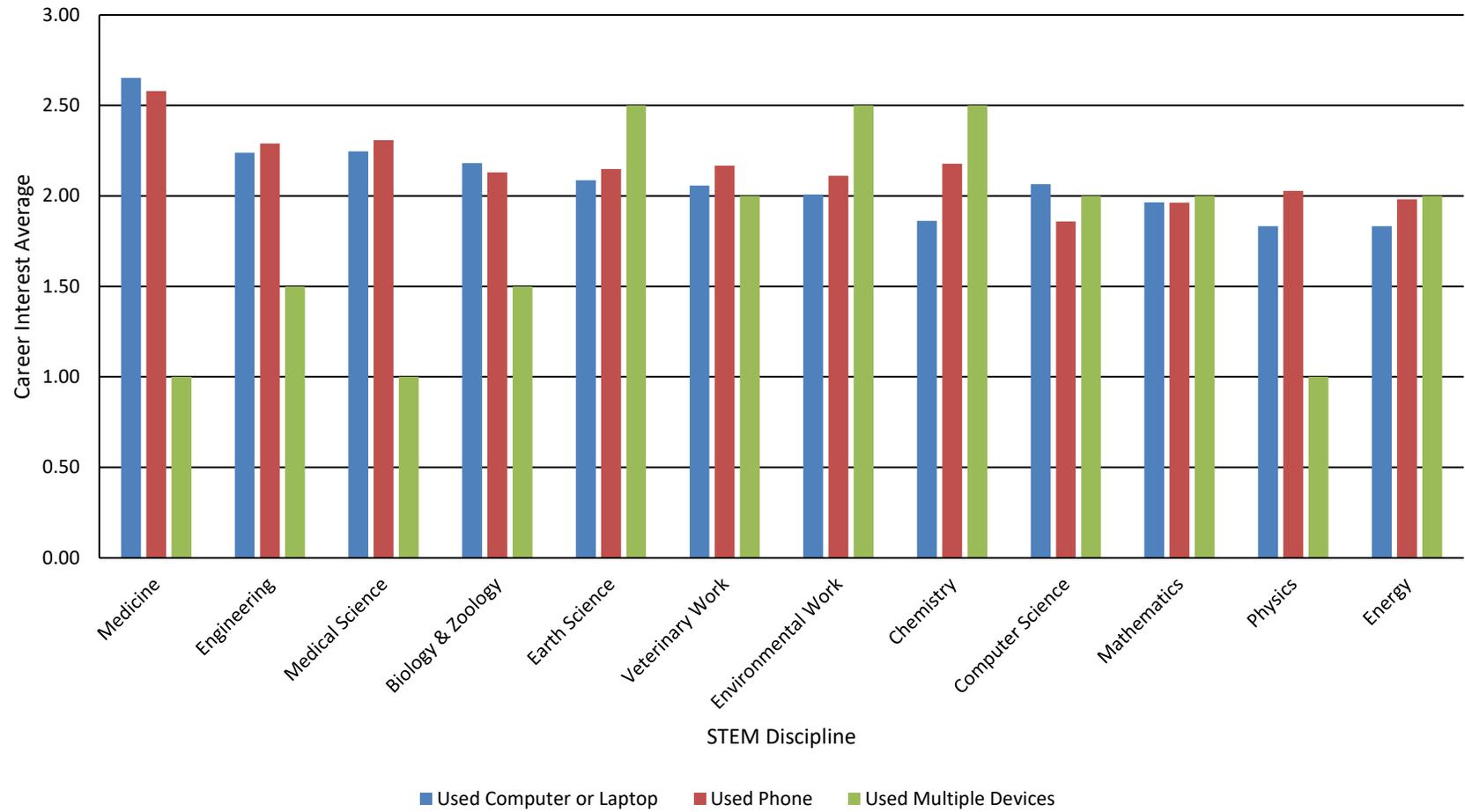
Section II: Knowledge of Adults Who Work in STEM Disciplines

- ## **Results for Entire Assessed Sample**

Does Student Know any Adults who Work in STEM Disciplines?

Y-axis: % of Survey Respondents (0.0 to 80.0)

X-axis: STEM Discipline — Scientists, Engineers, Mathematicians, Technologists, Medical Professions

Data labels:
- Scientists: Yes (N=41), No (N=171), Not Sure (N=35)
- Engineers: Yes (N=139), No (N=80), Not Sure (N=28)
- Mathematicians: Yes (N=85), No (N=136), Not Sure (N=26)
- Technologists: Yes (N=90), No (N=123), Not Sure (N=34)
- Medical Professions: Yes (N=186), No (N=42), Not Sure (N=19)

Legend: Yes, No, Not Sure

Post-High School Survey

Beginning in 10th grade, students were individually interviewed about their post-high school plans. We kept a subset of those original 10th grade interview questions this year and added additional questions (e.g., "Have you completed a college application?") to find out specific details about students' pursuits.

Unlike in previous years, this year students filled out the items independently using REDCap. Note that data were dropped for 3 students (all of whom used a cell phone) because they did not take the survey seriously. Also, 3 other students who have partial grade 12 data (on other measures) did not complete any of the Post-High School Survey items. Therefore, the N for this section is 273 students.

Q1: After high school, what are you most likely to do?

Student Response	Freq	Pct
Continue in School	193	70.7
Get a Job	115	42.1
Join the Military	9	3.3
Not Sure	29	10.6
Other	6	2.2

Note. These codes were not mutually exclusive.

Note. For "Other", students listed the following plans: become an actor (N=1), become an entrepreneur (N=1), pre-law internships (N=1), start business (N=2), and travel (N=1).
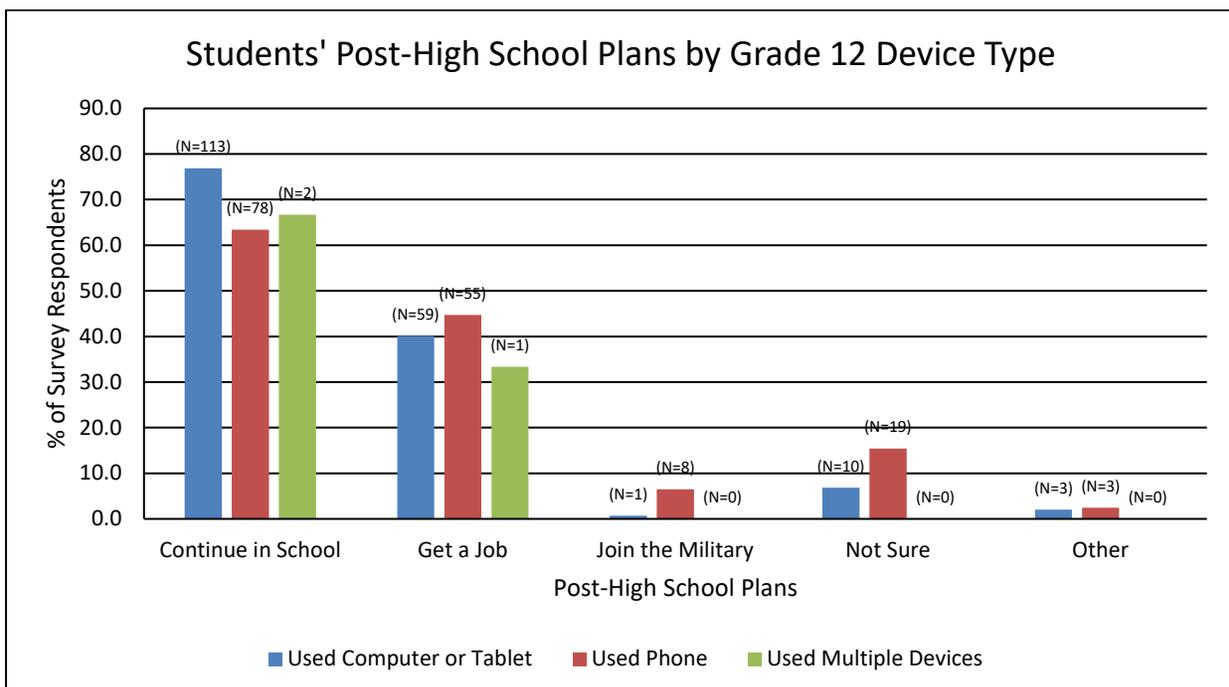
If Student Chose "Continue in School":

Student Response	Have you completed a college application?		Have you filled out a FAFSA application for help to pay for college?	
	Freq	Pct	Freq	Pct
Yes	142	73.6	152	79.2
No	51	26.4	40	20.8

Note. 80 students were not asked these questions because they did not select "Continue in School" for Q1.

Note. One student could not remember if she completed the FAFSA, so her data for this item are coded as "missing".
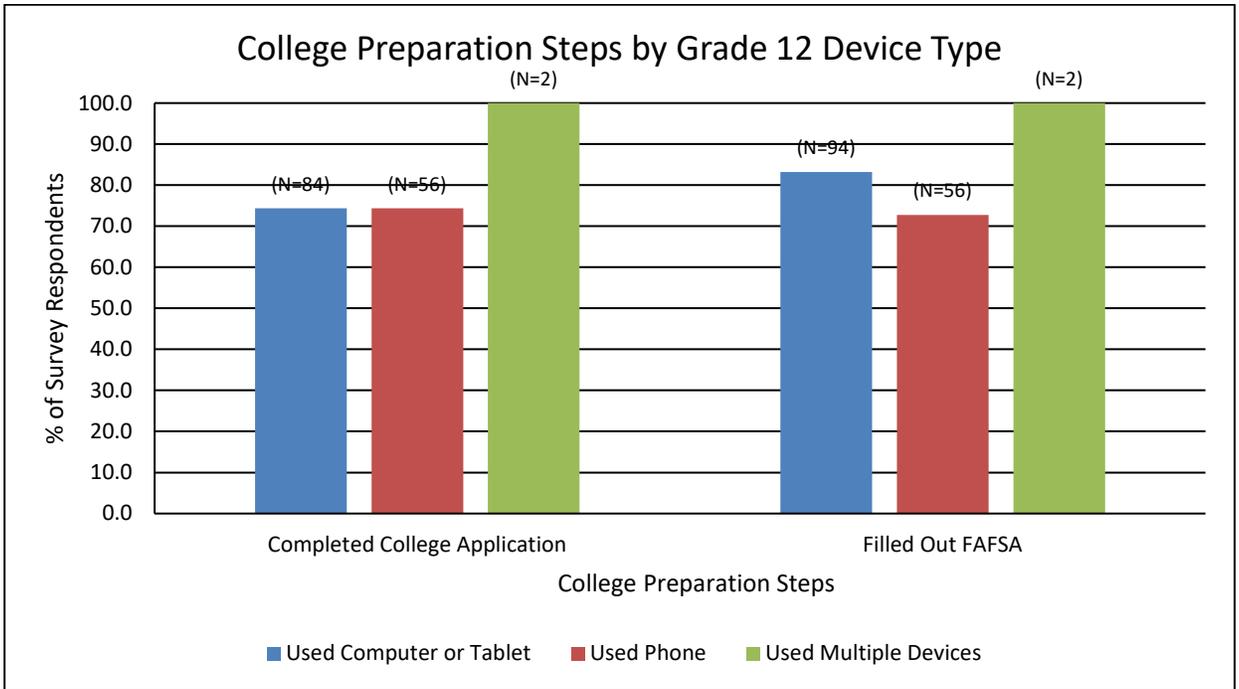
If Student Chose "Get a Job":

Student Response	Do you know how to apply for a job?		Do you have businesses in mind that you might apply to?	
	Freq	Pct	Freq	Pct
Yes	112	97.4	84	73.0
No	3	2.6	31	27.0

Note. 158 students were not asked these questions because they did not select "Get a Job" for Q1.

Job Preparation Steps by Grade 12 Device Type

% of Survey Respondents

Knows How to Apply for Job: (N=57), (N=54), (N=1)
Has Businesses in Mind to Apply to: (N=40), (N=43), (N=1)

Job Preparation Steps

■ Used Computer or Tablet   ■ Used Phone   ■ Used Multiple Devices
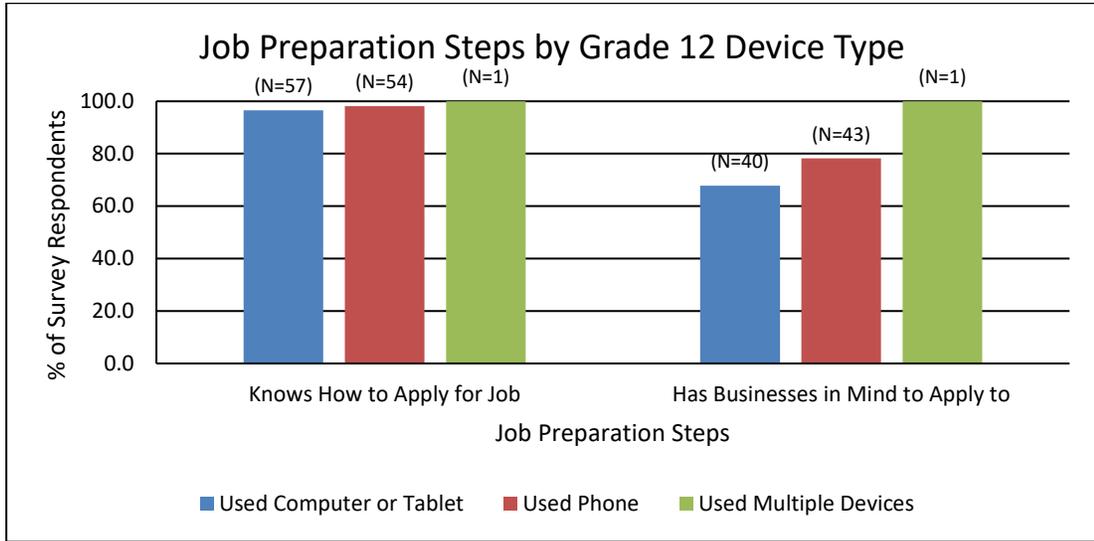
Student Response	Are you hoping to get a job that you might have short-term or long-term?	
	Freq	Pct
Short-Term	43	37.4
Long-Term	72	62.6

Note. 158 students were not asked this question because they did not select "Get a Job" for Q1.

Planned Type of Job by Grade 12 Device Type

% of Survey Respondents

Short-Term: (N=25), (N=18), (N=0)
Long-Term: (N=34), (N=37), (N=1)

Planned Type of Job

■ Used Computer or Tablet   ■ Used Phone   ■ Used Multiple Devices
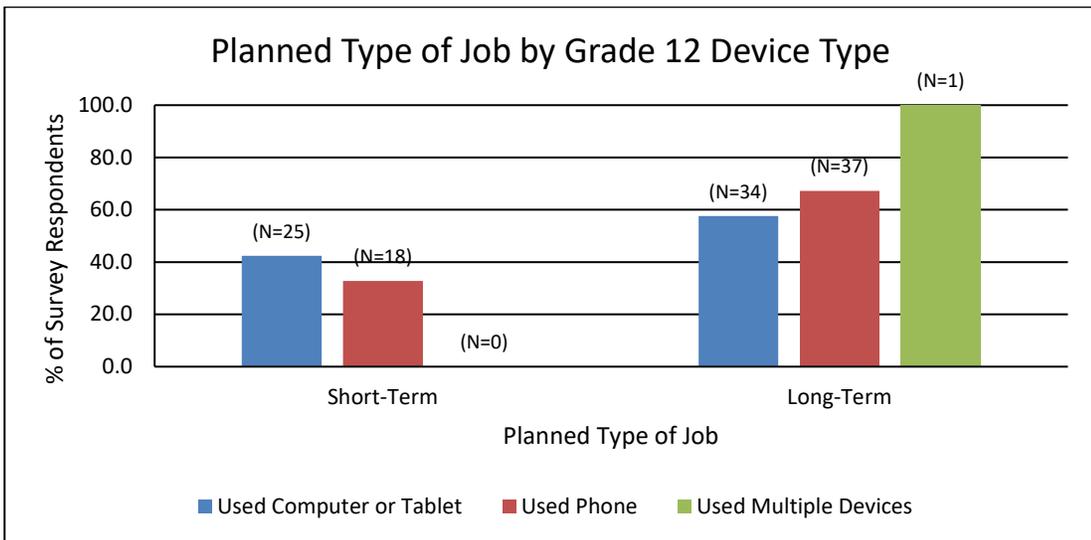
If Student Chose "Join the Military":

Student Response	Have you talked to a recruiter?		Have you learned anything about the tests you'll need to take to join the military?	
	Freq	Pct	Freq	Pct
Yes	7	77.8	7	77.8
No	2	22.2	2	22.2

Note. 264 students were not asked these questions because they did not select "Join the Military" for Q1.
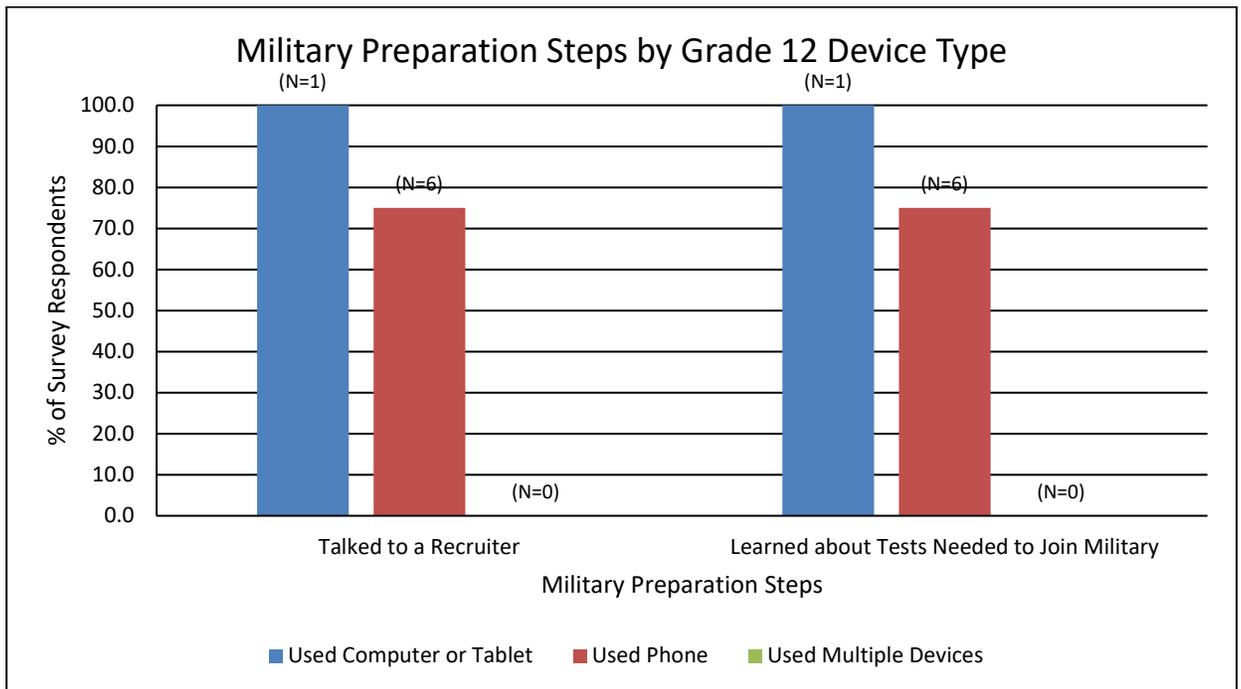
Q2: Long-term, what job(s) do you plan to have?

- See longitudinal results for this item (for grades 10-12) starting on p. 40.

Q3: How likely are you to pursue a career in science, technology, engineering, and mathematics (STEM) fields?

Student Response	Freq	Pct
Very unlikely	54	19.8
Unlikely	44	16.1
Undecided	78	28.6
Likely	61	22.3
Very likely	36	13.2

Likelihood that Students Will Pursue a STEM Career by Grade 12 Device Type
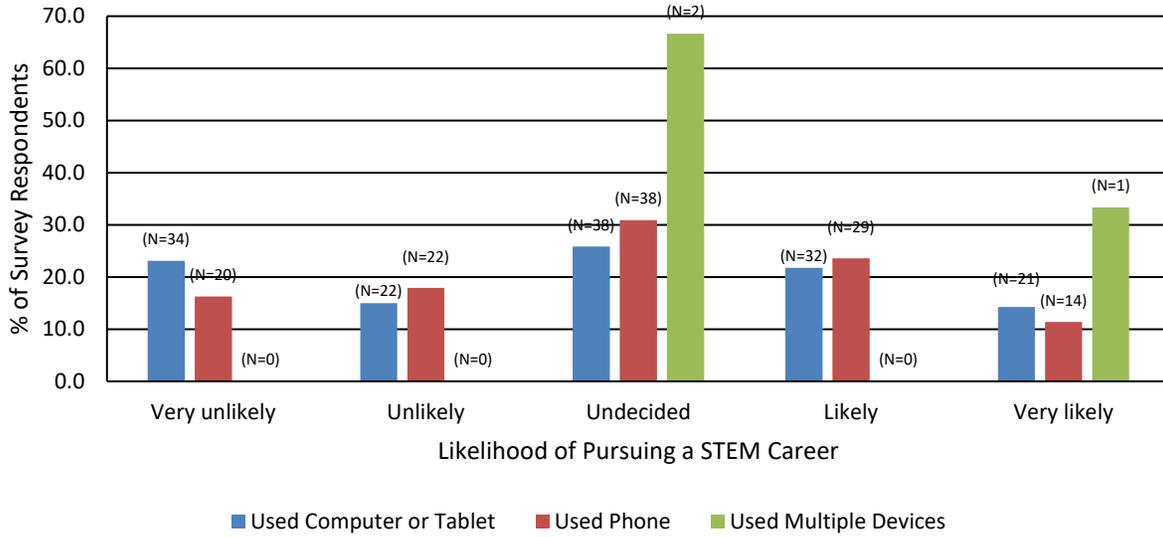
COVID Survey

Considering the pandemic, we added a series of survey questions this year about the impact that COVID-19 has had on students' schooling. Students filled out the COVID survey independently using REDCap, unless they had an IEP or were an English Learner (in which case an assessor read each survey item to the student). As with the other measures collected using REDCap, we included an attention check item to make sure that students were reading carefully. Data were dropped for 8 students (all of whom used a phone) who did not respond correctly to the attention check item.

- **Have you gone to classes in your school building for any part of this school year?**

Student Response	Freq	Pct
No	100	61.7
Yes	62	38.3

Note. This question was added during the middle of data collection, so the N is lower than the N for the other COVID Survey items.

- **Have you attended school virtually (through a computer or iPad, and not in a school building) for any part of this school year?**

Student Response	Freq	Pct
No	1	0.4
Yes	267	99.6

- **When attending school remotely during this school year, how many hours per day have you spent doing school activities such as watching live or recorded lessons, participating in group discussions over a video call, or completing assignments?**

Student Response	Freq	Pct
Less than 1 hour	14	5.2
Between 1 and 3 hours	55	20.6
Between 3 and 5 hours	84	31.5
Between 5 and 7 hours	68	25.5
More than 7 hours	46	17.2

Note. One student was not asked to respond to this item because she did not attend school virtually.

- **Mark which of the following remote learning strategies your math course has used and whether you find the strategies your math course used easy to access and helpful for your learning:**

	Math Course Used		Easy to Access		Helpful for Learning	
	YES	**NO**	**YES**	**NO**	**YES**	**NO**
Strategy	**Freq (Pct)**	**Freq (Pct)**	**Freq (Pct)**	**Freq (Pct)**	**Freq (Pct)**	**Freq (Pct)**
Live video lessons	242 (90.6)	25 (9.4)	217 (89.7)	25 (10.3)	180 (74.4)	62 (25.6)
Recorded video lessons	177 (66.3)	90 (33.7)	153 (86.4)	24 (13.6)	145 (81.9)	32 (18.1)
Self-paced online courses	169 (63.3)	98 (36.7)	151 (89.3)	18 (10.7)	140 (82.8)	29 (17.2)
Printed assignments to be completed at home	62 (23.2)	205 (76.8)	47 (75.8)	15 (24.2)	52 (83.9)	10 (16.1)
Online assignments to be completed at home	241 (90.3)	26 (9.7)	217 (90.0)	24 (10.0)	189 (78.4)	52 (21.6)
One on one interactions with a teacher	156 (58.4)	111 (41.6)	142 (91.6)	13 (8.4)	144 (92.9)	11 (7.1)
One on one interactions with more than one teacher	75 (28.1)	192 (71.9)	69 (92.0)	6 (8.0)	72 (96.0)	3 (4.0)

Note. One student said that on one interactions with a teacher are used in her math class, but she does not use that strategy herself. So, we coded her data for "math course used" as 'yes', and we coded her data for "easy to access" and "helpful for learning" as missing.

- **When doing schoolwork remotely during this school year, have you used a personal device (tablet, laptop, etc.) or one provided by the school?**

Student Response	Freq	Pct
I have used a personal device	129	48.3
I have used a school device that had to be shared with a brother or sister	8	3.0
I have used a school device that I did not have to share	130	48.7

Note. One student was not asked to respond to this item because she did not attend school virtually.

- **When doing schoolwork remotely during this year, how have you accessed the internet?**

Student Response	Freq	Pct
Used internet at home	243	91.0
Used a school-provided internet hotspot	18	6.7
Used a cell phone	3	1.1
I did not have access to the internet	2	0.7
Equally used multiple sources to access the internet	1	0.4

Note. One student was not asked to respond to this item because she did not attend school virtually.

- **How reliable is the internet you have had access to this school year?**

Student Response	Freq	Pct
Very reliable	148	55.4
Somewhat reliable	86	32.2
Neither reliable nor unreliable	13	4.9
Somewhat unreliable	10	3.7
Very unreliable	10	3.7

Note. One student was not asked to respond to this item because she did not attend school virtually.

- **How often were you unable to complete schoolwork because of resource problems related to virtual learning (unreliable internet connection, no access to a device, can't access assignments, etc.)?**

Student Response	Freq	Pct
Very often	12	4.5
Often	39	14.6
Sometimes	92	34.5
Rarely	86	32.2
Never	38	14.2

Note. One student was not asked to respond to this item because she did not attend school virtually.

- **Do you feel that you have had more, less, or the same amount of schoolwork in math class this school year compared to previous years of high school?**

Student Response	Freq	Pct
A lot more	86	32.1
Some more	56	20.9
About the same	71	26.5
Some less	33	12.3
A lot less	22	8.2

- **Do you feel that you have learned more, less, or the same amount in math class this school year compared to previous years of high school?**

Student Response	Freq	Pct
A lot more	14	5.2
Some more	30	11.2
About the same	70	26.1
Some less	61	22.8
A lot less	93	34.7

Student Interview Coding

In 10th, 11th, and 12th grade students were individually asked "Long term, what job(s) do you plan to have?" In 10th and 11th grade, students were verbally asked this question during their assessment session. In 12th grade, students completed this item electronically via REDCap. Note that for 12th grade, data were dropped for 3 students because they did not take the survey seriously. Also, 3 other students who have partial grade 12 data (on other measures) did not complete any of the Post-High School Survey items. Therefore, the N for the Year 12 data is 273 students.

We coded students' responses using the 2020 O*NET-SEC, a database created by the U.S. Department of Labor/Employment and Training Administration (see https://www.onetonline.org/find/stem). Depending on the specificity of students' answers, responses were coded either with a two-digit or six-digit code. In addition, we coded for whether the career was STEM or STEM+M (including medicine).

10th grade coding

	STEM		Non-STEM		STEM+M		Non-STEM+M	
	Freq	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**
Overall	58	15	318	85	192	51	184	49
Men	40	69	109	34	59	31	90	49
Women	18	31	209	66	133	69	94	51

Note. This excludes students who did not express a particular career interest and those whose answers were too vague to classify (N = 79).

Most frequent careers:

- Registered nurse: 18 students
- Hairdresser, Hairstylist, and Cosmetologist: 18 students
- Veterinarian: 14 students
- Athletes and sports competitors : 13 students
- Pediatrician: 11 students

11th grade coding

	STEM		Non-STEM		STEM+M		Non-STEM+M	
	Freq	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**
Overall	58	18	263	82	155	48	166	52
Men	42	72	95	36	56	36	81	49
Women	16	28	168	64	99	64	85	51

Note. This excludes students who did not express a particular career interest and those whose answers were too vague to classify (N=32).
Note. Data for 1 student were accidentally deleted due to assessor error.

Most frequent careers:

- Registered nurse: 31 students
- Athletes and sports competitors : 18 students
- Hairdresser, Hairstylist, and Cosmetologist: 12 students
- Clinical and Counseling Psychologists: 9 students

12th grade coding

	STEM		Non-STEM		STEM+M		Non-STEM+M	
	Freq	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**
Overall	40	17	202	83	109	45	133	55
Men	24	60	70	35	35	32	59	44
Women	16	40	132	65	74	68	74	56

Note. This excludes students who did not express a particular career interest and those whose answers were too vague to classify (N=31).

Most frequent careers:

- Registered nurse: 29 students
- Engineer: 8 students
- Lawyer: 6 students
- Physical therapist: 6 students
- Hairdresser, Hairstylist, and Cosmetologist: 6 students
- Real Estate agent: 6 students

Appendix

Additional Information about Student Demographics

Assessed Students in Grade 12
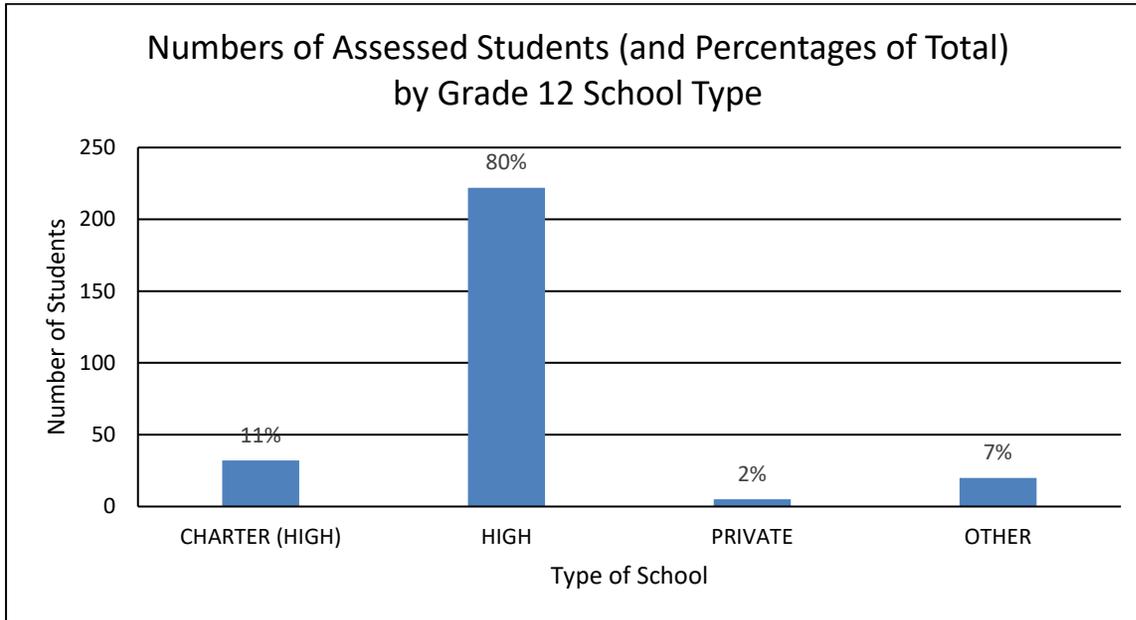
Numbers of Assessed Students (and Percentages of Total) by Grade 12 School Type

Note. "Other" schools include 1 that only serves students with IEPs, 1 K-12 school, 1 alternative school, 1 online school, 1 residential center, 2 non-traditional schools, 2 schools serving grades 7–12, and homeschool.

Percent of Assessed Students by Grade 12 School Type and Type of Device Used During 12th Grade Session

Note. "Other" schools include 1 that only serves students with IEPs, 1 K-12 school, 1 alternative school, 1 online school, 1 residential center, 2 non-traditional schools, 2 schools serving grades 7–12, and homeschool.
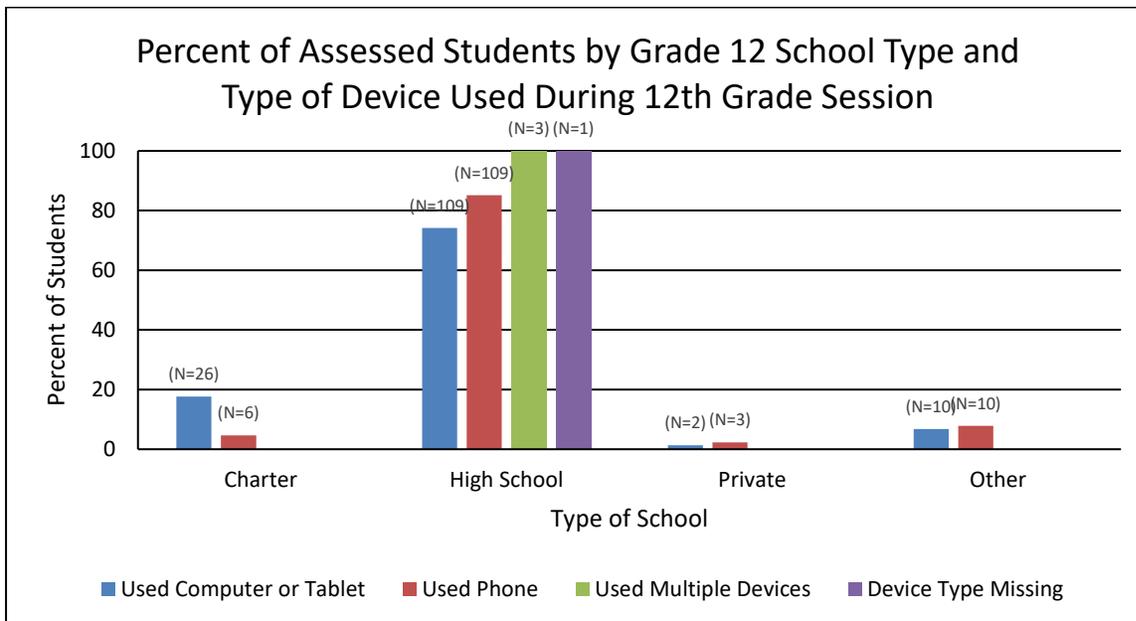
Numbers (and Percentages) of Assessed Students by Current Grade Level
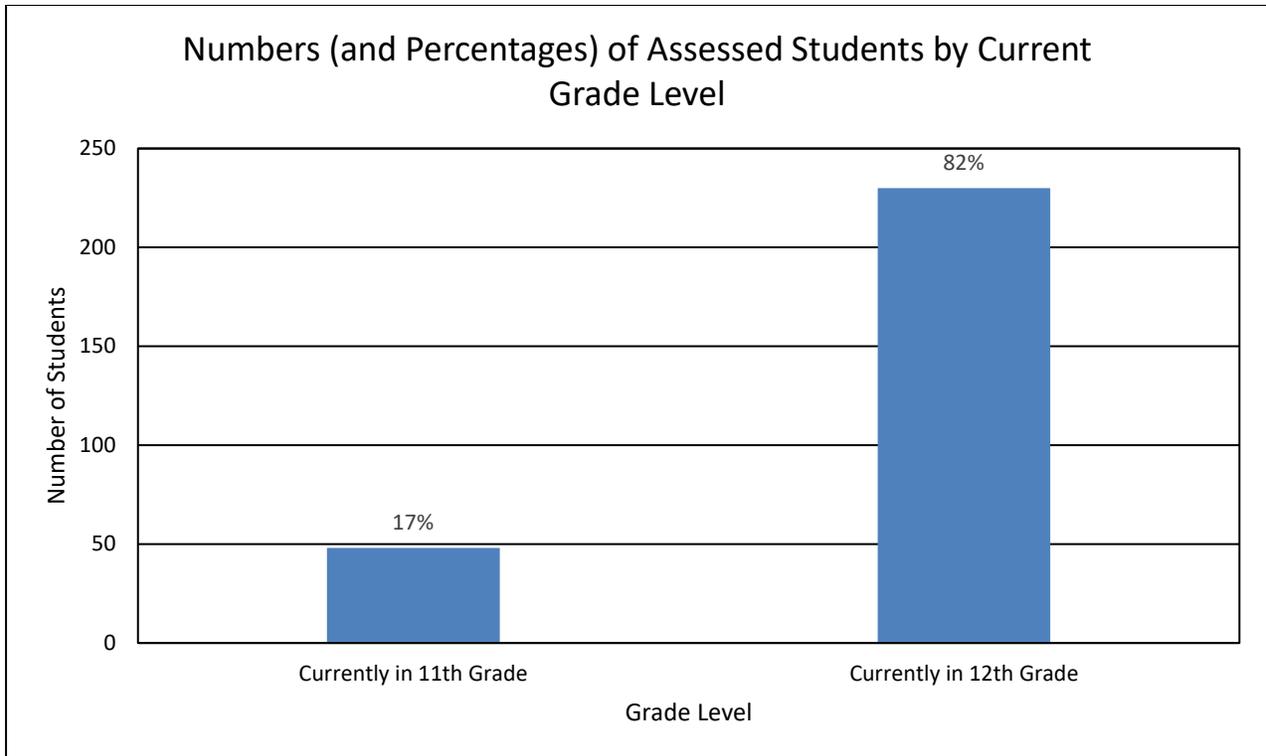
Note. One student who only completed the student surveys did not provide his current grade level and did not respond to follow-up attempts. His grade level data are missing.

School Enrollment Across Years (Assessed Sample)

Grade Level[1]	N	Attended MNPS School		Did Not Attend MNPS School	
		Freq	Pct	Freq	Pct
5th Grade	517	517	100.0	0	0.0
6th Grade	513	508	99.0	5	1.0
7th Grade	503	483	96.0	20	4.0
8th Grade	496	460	92.7	36	7.3
9th Grade	485	432	89.1	53	10.9
10th Grade	455	395	86.8	60	13.2
11th Grade	353	309	87.5	44	12.5
12th grade	279	246	88.2	33	11.8

Note[1]. Grade level if not retained.

Grade 12 School Enrollment by Type of Device Used During 12th Grade Session

Chart: Percent of Students by Grade 12 School Enrollment

Attended MNPS School:
- Used Computer or Tablet: ~92% (N=135)
- Used Phone: ~85% (N=108)
- Used Multiple Devices: ~67% (N=2)
- Device Type Missing: 100% (N=1)

Did Not Attend MNPS School:
- Used Computer or Tablet: ~8% (N=12)
- Used Phone: ~16% (N=20)
- Used Multiple Devices: ~33% (N=1)

X-axis: Grade 12 School Enrollment
Y-axis: Percent of Students (0–100)

Legend: ■ Used Computer or Tablet ■ Used Phone ■ Used Multiple Devices ■ Device Type Missing

DCS and Juvenile Custody Across Years

Grade Level[1]	# Students in DCS Custody
5th Grade	0
6th Grade	0
7th Grade	0
8th Grade	6
9th Grade	7
10th Grade	13
11th Grade	13
12th Grade	11

Note[1]. Grade level if not retained.

Note. We have documentation that the students listed in the above table were in DCS (TN Department of Children's Services) custody and/or juvenile custody at some point during the respective school year.

Additional Information about Student Outcomes

Distributions of Scores Across Direct Child Assessments

Woodcock-Johnson: Quantitative Concepts Subscale Distributions

CMAT Subscale Distributions

CMAT Algebra: Age-Based Standard Score Distribution
(Entire Assessed Sample, N=263)

CMAT Geometry: Age-Based Standard Score Distribution
(Entire Assessed Sample, N=263)
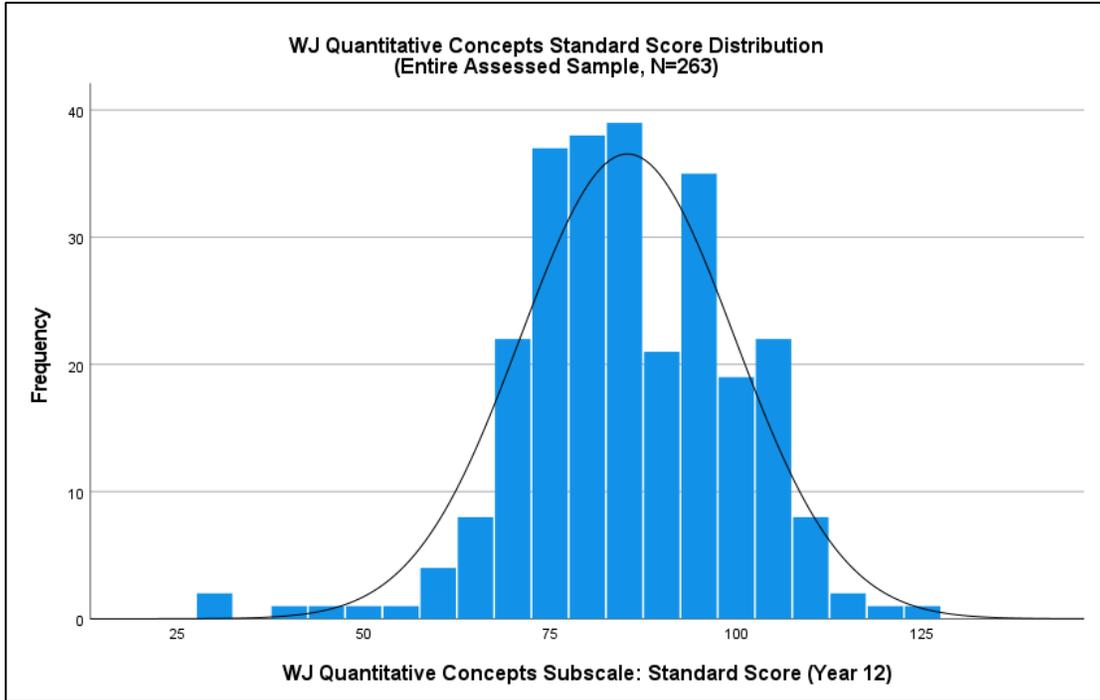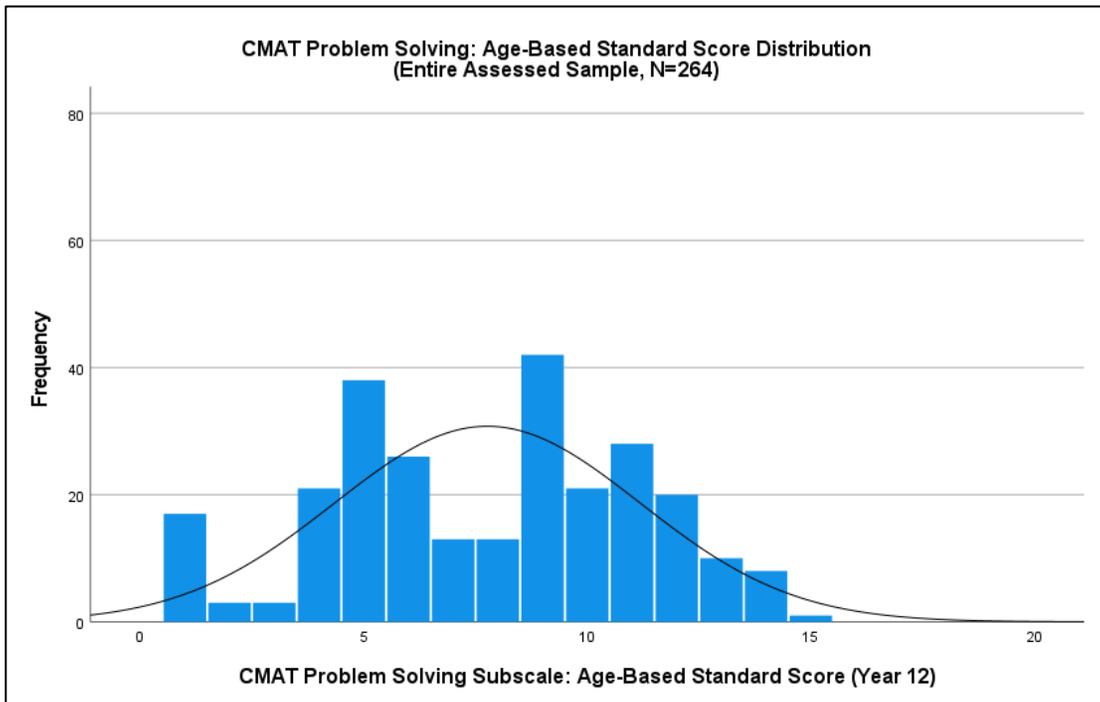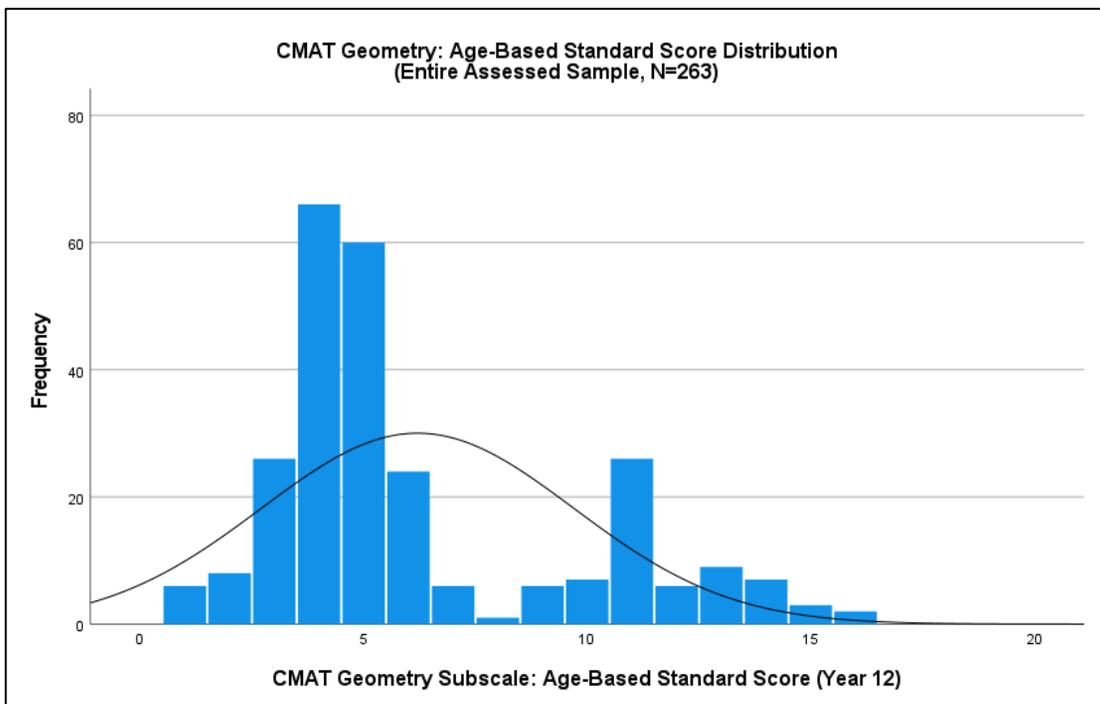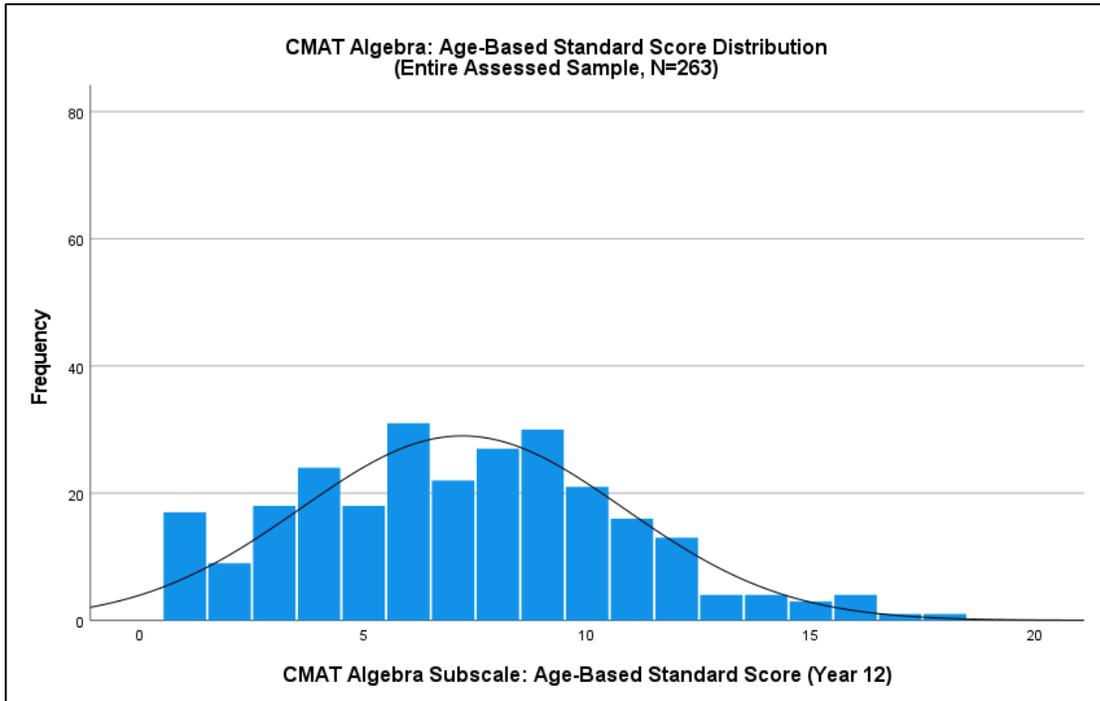
Student Outcomes by Retention Status

Student Outcomes on CMAT Subtests by Retention Status

	N	Min	Max	Mean	Median	SD
Not Retained						
Average Age=17.94 years, Average Grade=12.8						
CMAT: Problem Solving						
Age-Based Standard Score	218	1.0	15.0	8.2	9.0	3.32
Age Equivalent	218	6.3	18.0	14.3	14.8	3.51
Grade Equivalent	218	1.2	12.7	9.1	9.7	3.43
CMAT: Algebra						
Age-Based Standard Score	218	1.0	18.0	7.7	8.0	3.56
Age Equivalent	218	8.3	18.3	14.4	14.5	3.16
Grade Equivalent	218	3.2	12.7	9.2	9.4	3.01
CMAT: Geometry						
Age-Based Standard Score	218	1.0	16.0	6.6	5.0	3.66
Age Equivalent	218	8.8	18.3	13.6	12.5	3.07
Grade Equivalent	218	3.7	12.7	8.5	7.4	2.89
Retained						
Average Age=17.86 Years, Average Grade=11.8						
CMAT: Problem Solving						
Age-Based Standard Score	46	1.0	14.0	5.6	5.0	3.14
Age Equivalent	46	6.3	18.0	11.6	10.8	3.18
Grade Equivalent	46	1.2	12.7	6.5	5.7	3.15
CMAT: Algebra						
Age-Based Standard Score	45	1.0	11.0	4.8	4.0	2.83
Age Equivalent	45	8.3	18.3	11.7	10.5	2.73
Grade Equivalent	45	3.2	12.7	6.7	5.4	2.70
CMAT: Geometry						
Age-Based Standard Score	45	1.0	11.0	4.5	4.0	1.82
Age Equivalent	45	8.8	18.3	11.9	11.3	1.82
Grade Equivalent	45	3.7	12.7	6.8	6.2	1.73

Note. One student only completed the Problem Solving subtest this year.

Student Outcomes on Woodcock-Johnson Subtests by Retention Status

	N	Min	Max	Mean	Median	SD
Not Retained						
Average Age=17.98 years, Average Grade=12.8						
Quantitative Concepts						
W-Score	218	457.00	566.00	521.84	521.00	15.74
Standard Score	218	30.00	123.00	87.28	86.50	13.63
Retained						
Average Age=17.91 years, Average Grade=11.8						
Quantitative Concepts						
W-Score	45	456.00	552.00	509.36	508.00	16.43
Standard Score	45	30.00	113.00	76.33	75.00	14.43

Note. Grade 12 Quantitative Concepts data for 1 student was accidentally deleted due to assessor error.

Students Below a Tenth-Grade Level on CMAT

- Students were selected who were **below a tenth-grade level** this past year on all 3 CMAT subtests.
- This group ended up including 120 students, which is about 46% of the students on whom we had analytical data across all 3 CMAT subtests this year.

Comparison of Students on Grade 12 Assessments
(Below a Tenth-Grade Level on CMAT vs. Not Below a Tenth-Grade Level on CMAT)

	Below a Tenth-Grade Level on CMAT Subtests (N=120)					Not Below a Tenth-Grade Level on CMAT Subtests (N=143)				
	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD
CMAT PS (Std. Score)	120	1.00	9.00	5.23	2.32	143	1.00	15.00	9.94	2.58
CMAT ALG (Std. Score)	120	1.00	8.00	4.57	2.28	143	3.00	18.00	9.42	2.99
CMAT GEO (Std. Score)	120	1.00	7.00	3.98	1.20	143	1.00	16.00	8.08	3.69
WJ Quant. Cpts. (Std. Score)	119	30.00	102.00	75.88	11.26	143	66.00	123.00	93.52	11.28
Math Mindset (Total)	120	3.00	18.00	11.65	3.57	143	4.00	18.00	12.99	3.18
TIMSS Math (Total)	119	33.00	104.00	71.36	15.86	143	41.00	102.00	75.57	13.95
TIMSS Science (Total)	120	36.00	88.00	63.13	11.98	142	27.00	88.00	65.42	12.21

Note. Quant Concepts data was accidentally deleted for 1 student due to assessor error. TIMSS Math data was dropped for 1 student who failed the attention check criteria, and TIMSS Science data was dropped for one student for the same reason.

Student Characteristics

	Below a Tenth-Grade Level on CMAT Subtests		Not Below a Tenth-Grade Level on CMAT Subtests	
	Freq	Pct	Freq	Pct
Ethnicity				
Black	106	49.8	107	50.2
White	7	41.2	10	58.8
Hispanic	6	28.6	15	71.4
Other	1	8.3	11	91.7
Gender				
Male	45	41.7	63	58.3
Female	75	48.4	80	51.6
ELL in Pre-K Year				
ELL	6	25.0	18	75.0
Not ELL	114	47.9	124	52.1
Pre-K Curriculum Condition				
Building Blocks	77	45.0	94	55.0
Control	43	46.7	49	53.3
Pre-K School System				
Head Start	56	55.4	45	44.6
MNPS Pre-K	64	39.5	98	60.5

Note. One student is missing a pre-k ELL designation.

Early Correlates of Later Skills

<table>
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<tr><th colspan="18" align="center">Pearson Correlations</th></tr>
<tr>
<th></th><th></th>
<th>Fall PK QC (Std. Score)</th>
<th>Spring PK QC (Std. Score)</th>
<th>Spring K QC (Std. Score)</th>
<th>Spring G1 QC (Std. Score)</th>
<th>Fall PK AP (Std. Score)</th>
<th>Spring PK AP (Std. Score)</th>
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<tr>
<td rowspan="6">12th Grade Outcomes</td>
<td>WJ Quant Cpts (Std Score)</td>
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<td>CMAT Geometry (Std Score)</td>
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<td>TIMSS Math (Total)</td>
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Note. Pairwise deletion was used to calculate these correlations, so some of the Ns are different correlations.

Additional Information about Student Survey Outcomes: TIMSS Math and TIMSS Science

Student Ratings for Math Subscales by Type of Device Used During 12th Grade Session

The following graphs show students' TIMSS Math scores across years when broken apart by the type of device used during their grade 12 assessment. Only students with TIMSS data at all timepoints (grades 6 – 12) were included: 118 completed on a computer or tablet, 98 used a phone, and 3 used multiple devices.

TIMMS Math Confidence Scale Averages Across Years by Grade 12 Device Type (N=219)
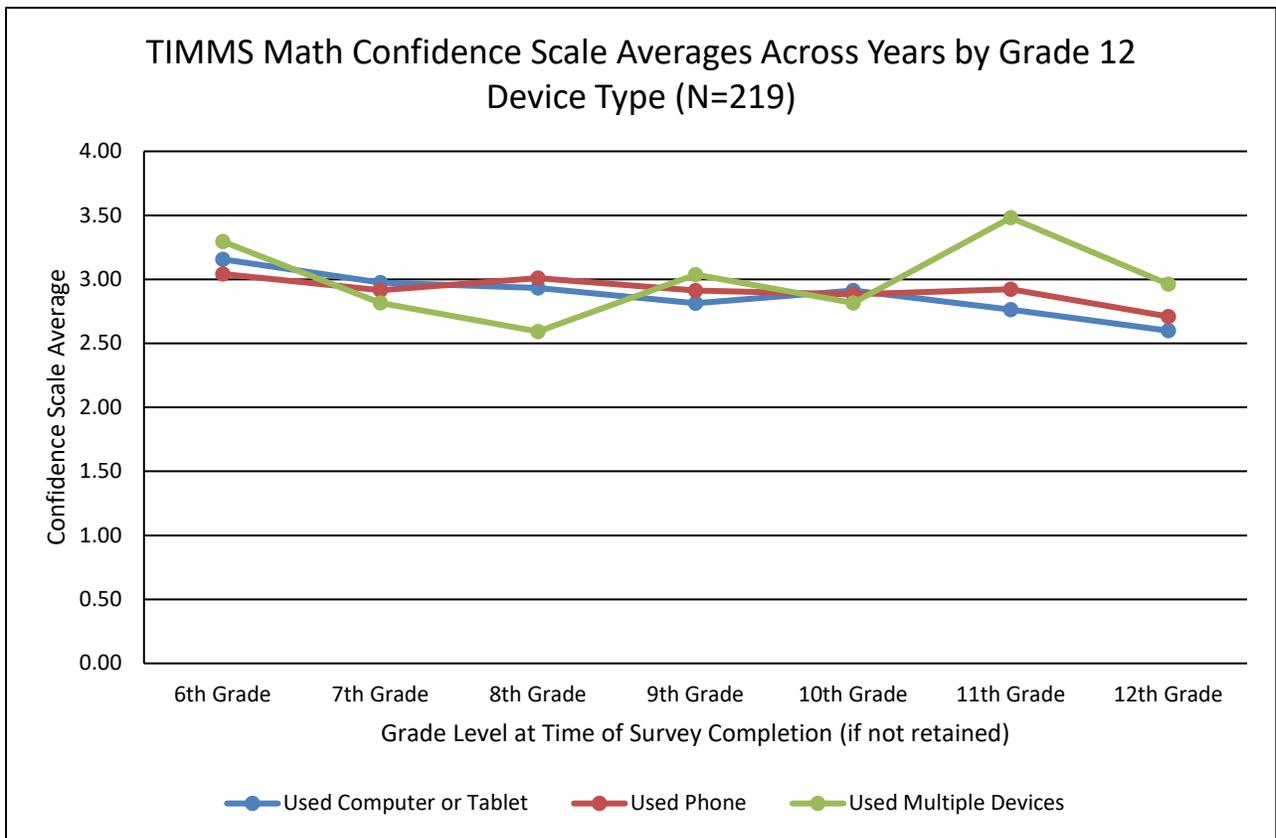
TIMMS Math Value Scale Averages Across Years by Grade 12 Device Type (N=219)
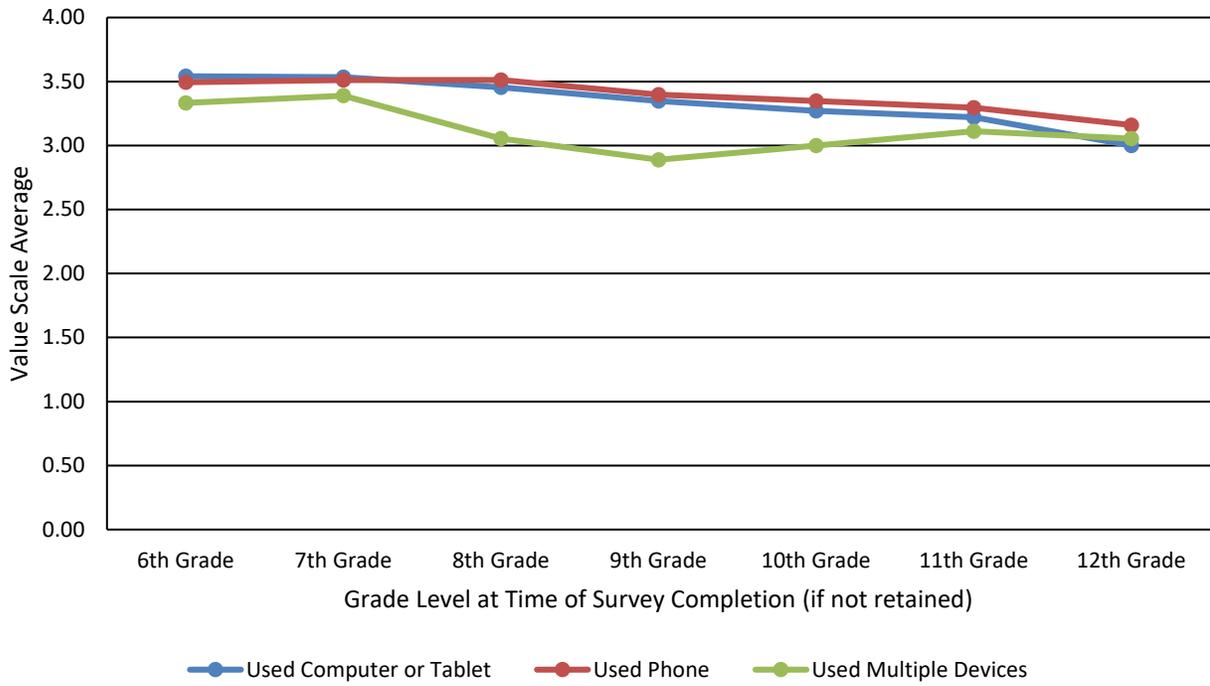
TIMMS Math Like Learning Scale Averages Across Years by Grade 12 Device Type (N=219)
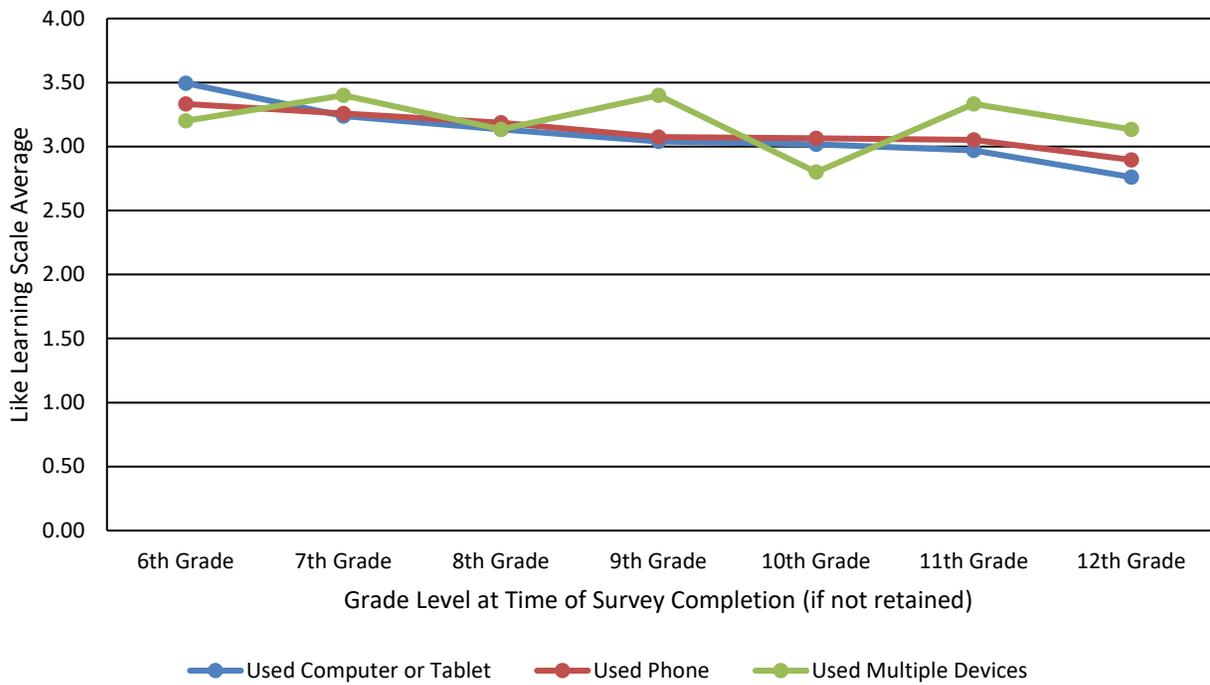
TIMMS Math Engagement Scale Averages Across Years by Grade 12 Device Type (N=219)
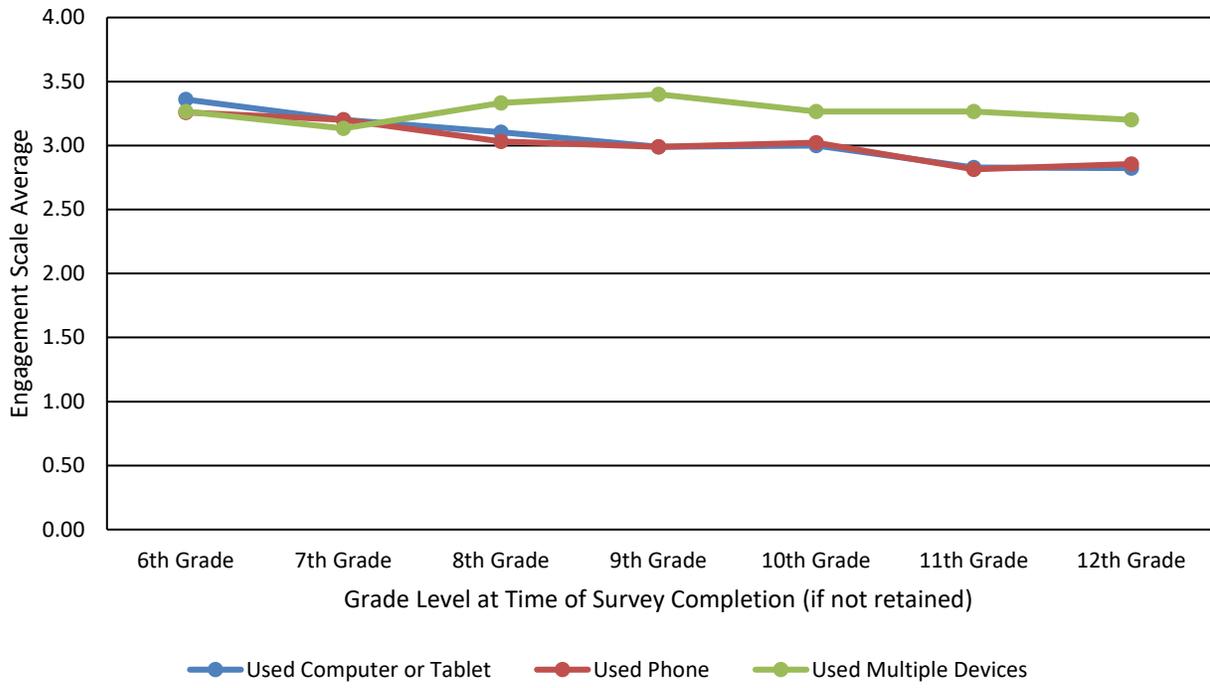
Student Survey Outcomes: Mathematics Mindset

Beginning last year (11th grade), we asked students about their mathematics mindset. Items were taken from Boaler et al. (2018) and used a 6-point response scale. We reverse coded the items so that on every question, 1 = strongly agree and 6 = strongly disagree. Higher scores indicate that students have more of a *growth* mindset, while lower scores indicate a *fixed* mindset about learning mathematics.

This year, students responded via REDCap, and the mindset questions were included as the last section of the TIMSS Math. For that reason, we used the TIMSS Math attention check criteria for these items, dropping data for any students who (1) missed 2 or more attention check items, and/or (2) gave the same response across every TIMSS Math item.

Of the students assessed this year, 12 did not meet the attention check criteria, so their data were dropped. Of those students, 8 used a phone, and 4 used a computer or tablet.

	N	Min	Max	Mean	SD
Mindset Scale Average	**266**	**1.00**	**6.00**	**4.12**	**1.15**
People can learn more math, but they can't really change their basic math knowledge (reverse coded)	266	1.00	6.00	3.57	1.48
There are limits to how much people can improve their basic math ability (reverse coded)	266	1.00	6.00	4.13	1.54
You have a certain amount of math intelligence and you can't really do much to change it (reverse coded)	266	1.00	6.00	4.67	1.41

Student Ratings for Math Mindset Subscales by Year (Entire Assessed Sample)

- The Math Mindset items were administered at 2 testing timepoints throughout the Math Follow-Up Study (11th and 12th grades).
- The table below shows the scores over time for those 224 students who completed the Math Mindset items at all possible timepoints.

		Math Mindset Avg		Can't Change Basic Math Knowledge		Limits to Improving Math Ability		Can't Do Much to Change Math Intelligence	
Grade Level[1]	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
11th Grade	224	4.08	1.11	3.39	1.40	4.08	1.59	4.78	1.35
12th Grade	224	4.11	1.16	3.54	1.47	4.13	1.54	4.66	1.39

Note[1]. Grade level if not retained.

Student Ratings for Math Mindset Subscales by Type of Device Used During 12th Grade Session
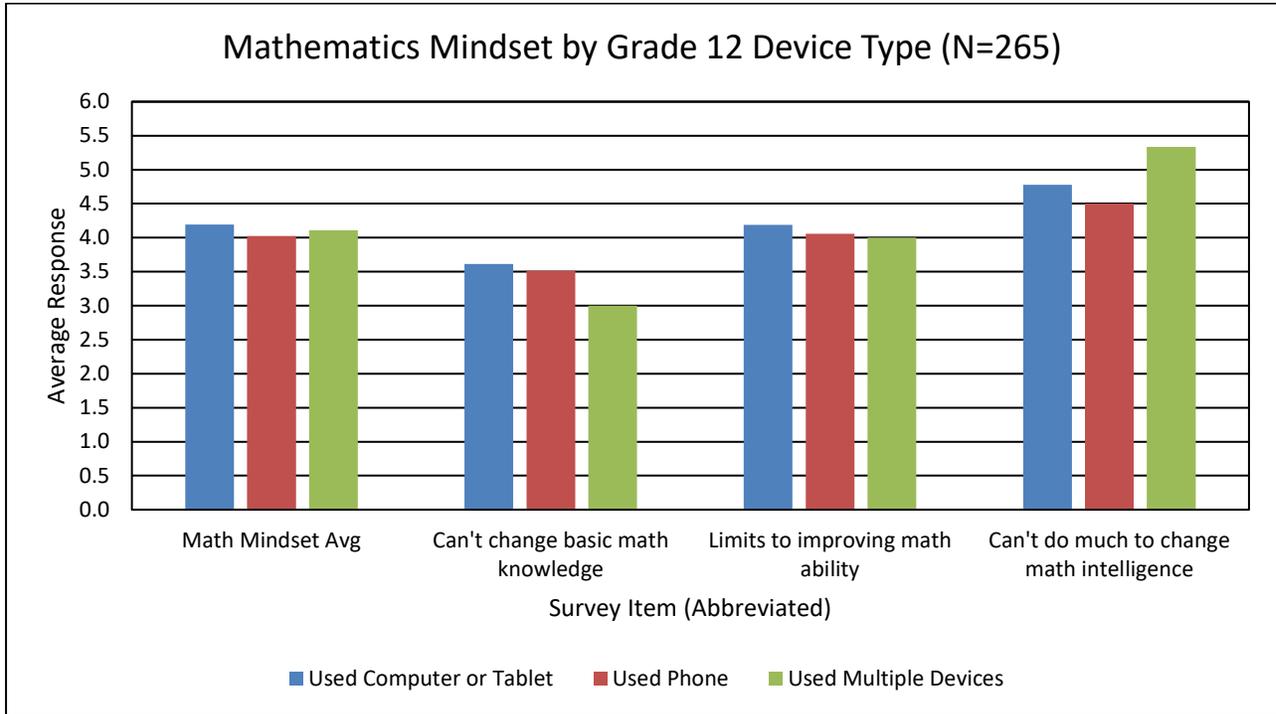
Note. Because only 1 student was missing a device type, those data were dropped from this graph.

Student Ratings for Science Subscales by Type of Device Used During 12ᵗʰ Grade Session

The following graphs show students' TIMSS Science scores across years when broken apart by the type of device used during their grade 12 assessment. Only students with TIMSS data at all timepoints (grades 10 – 12) were included: 119 completed on a computer or tablet, 99 used a phone, and 3 used multiple devices. Because only 1 student was missing a device type, we excluded those data from the following graphs.

TIMMS Science Confidence Scale Averages Across Years by Grade 12 Device Type (N=221)
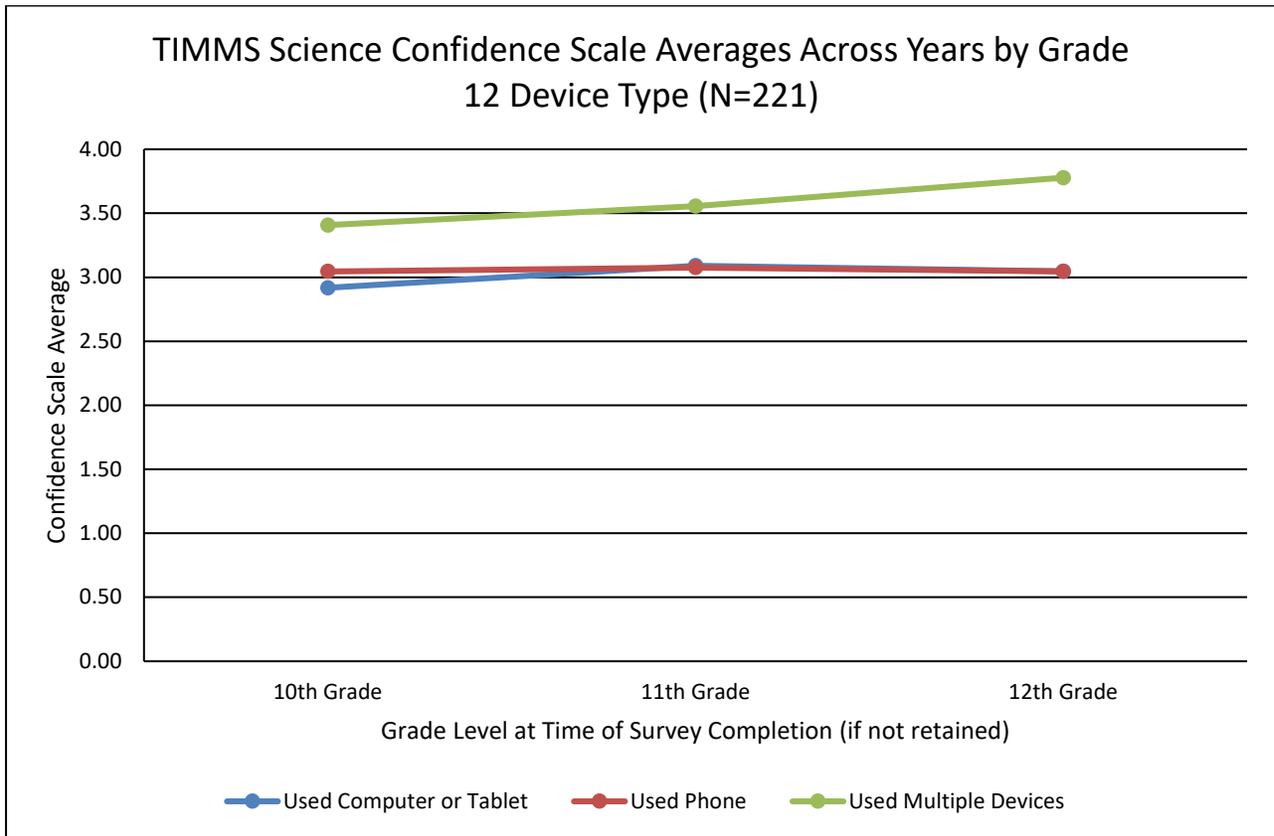
TIMMS Science Value Scale Averages Across Years by Grade 12 Device Type (N=221)

TIMMS Science Like Learning Scale Averages Across Years by Grade 12 Device Type (N=221)