6-8 Math Curriculum Adoption

MAY, 2023

6-8 Curriculum Review Process: 2019-2023



Phase 1: Research and Vision

Learning from the field

We've used our current resources, Math Expressions and Big Ideas Math, for almost 10 years. In the last 10 years we've done a lot of learning -











Learning Partnerships

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS







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Looking at TSD Data

6th Grade MSTEP Data Over Time

School Year 🧅	Location Name 🧅	Assessment Program 🔷	Percent Students Advanced or Proficient 🔷	Percent Advanced	Percent Proficient	Percent Partially Proficient 🔷	Percent Not Proficient 🗢
2018-19	Troy School District	M-STEP	71.4%	51.3%	20.1%	19.0%	9.6%
2017-18	Troy School District	M-STEP	67.4%	48.8%	18.6%	21.6%	11.0%
2016-17	Troy School District	M-STEP	69.1%	51.9%	17.2%	20.6%	10.3%
2015-16	Troy School District	M-STEP	69.6%	49.2%	20.4%	20.8%	9.5%
2014-15	Troy School District	M-STEP	74.3%	54.9%	19.4%	19.1%	6.7%

7th Grade MSTEP Data Over Time

School Year 🔻	Location Name 🧅	Assessment Program 🔷	Percent Students Advanced or Proficient 🔷	Percent Advanced	Percent Proficient	Percent Partially Proficient 🔷	Percent Not Proficient 🔷
2018-19	Troy School District	M-STEP	67.5%	49.9%	17.6%	19.9%	12.6%
2017-18	Troy School District	M-STEP	70.3%	49.2%	21.2%	15.9%	13.8%
2016-17	Troy School District	M-STEP	67.1%	47.1%	20.0%	19.3%	13.6%
2015-16	Troy School District	M-STEP	73.3%	53.4%	19.9%	14.7%	12.0%
2014-15	Troy School District	M-STEP	74.8%	51.4%	23.4%	17.8%	7.4%

8th Grade MSTEP Data Over Time

School Year 🗢	Location Name 🔷	Assessment Program 🔷	Percent Students Advanced or Proficient 🔷	Percent Advanced	Percent Proficient	Percent Partially Proficient 🔷	Percent Not Proficient 🔷
2017-18	Troy School District	M-STEP	67.5%	49.3%	18.2%	18.2%	14.3%
2016-17	Troy School District	M-STEP	66.9%	48.1%	18.7%	15.0%	18.1%
2015-16	Troy School District	M-STEP	67.2%	49.4%	17.8%	17.0%	15.8%
2014-15	Troy School District	M-STEP	67.4%	45.5%	21.9%	19.3%	13.4%

*In the 2018/19 school year students took the PSAT 8

Math Cohort Data grades 3-7

% of Students by Test and Performance Level



This chart tracks student performance on Math M-Step for the same cohort of students from grade 3 (2015) through grade 7 (2019)

STUDENT MATH PATH Following Yea	r 💌			
Started in 🛛 🕶 2019-2020	2	2020-2021	2021-2022	2022-2023
Image: Math 5	896	826	833	856
Algebra 1 Honors	4	3	1	
Geometry Honors	1			
Math 6	496	416	479	490
Math 6/7 Honors	385	389	343	356
Math 7/8 Honors	7	9	3	9
Math 5	3	9	7	1
Image Math 6	526	511	409	519
Math 7	510	477	390	490
Math 7/8 Honors	16	34	19	29
Math 6/7 Honors	426	405	404	344
Algebra 1 Honors	25	31	3	
Geometry Honors	1	2		1
Math 7	40	16	25	21
Math 7/8 Honors	360	356	376	322
• Math 7	518	570	489	423
Algebra 1 Honors	10	39	11	15
Geometry Honors		1		
Math 7				1
Math 8	507	530	478	407
Math 8 VH	1			
Math 7/8 Honors	428	380	395	391
Algebra 1 Honors	337	300	342	329
Algebra 2 Honors		10	2	12
Geometry Honors	65	60	37	31
Math 8	26	10	14	19
Image: Math 8	491	492	498	422
Algebra 1	476	475	491	403
Algebra 2				1
Algebra 2 Honors				1
Geometry	8	9	6	9
Geometry Honors	7	8	1	8
Grand Total	3285	3184	3028	2955

Students' Opportunities for Choice

Reflecting on Standards & Pedagogy

Standards for Mathematical Practice

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

8 Effective Math Teaching Practices

To ensure mathematical success for all students, mathematics education will involve the 8 effective math teaching practices –

These practices allow teachers to implement our Michigan K-12 Math Standards.

NCTM (2014). Principals to Actions: Ensuring mathematical success for all.



Findings from Research and Vision

Our Vision for Mathematics



All students are doers of mathematics. We believe the purpose of our mathematics program is to cultivate students' positive mathematical identities so that all students:

- develop deep mathematical understandings
- •understand and critique the world through mathematics
- experience the wonder, joy, and beauty of mathematics

NCTM (2020). Catalyzing Change in Middle School Mathematics

Findings

Finding 1: Explore curricular changes

- Program data from the last 5 years preceding COVID revealed:
 - Student performance was slightly decreasing or stagnant (program data)
 - Cohort data showed a decrease in the number of students who achieved at advanced and proficient and an increase in students who were not proficient

Finding 2: Explore course sequencing

• Students are not able to fluidly move between tracks in middle school

Finding 3: Explore classroom pedagogy

 Explore task-based, inquiry-based, instruction that builds procedural fluency through conceptual understanding

Phase 2: Explore

Questions to explore during Curricular Pilot

How will TSD align our middle school math programming with our vision and beliefs?

- What does world class programming look like in middle school mathematics?
- How is students' conceptual understanding built? What is the learning trajectory that students experience in this curriculum? How are foundational concepts explored and presented?
- What opportunities do students experience in a task-based, inquiry-based, classroom? How do these experiences shape students' math identities and beliefs about mathematics?
- How, as a teacher, am I able to meet the needs of all learners in a collaborative, student-c entered, learning environment? What supports are provided in the curriculum to help me do this?

Middle School Math Curriculum Review Matrix

	Blue		Red		Gold		Green
\$\$	How does the curriculum present students with the opportunity to engage in Deep Learning? How does the curriculum allow for student discussion and talk? How is the curriculum inquiry and/or task based? How are topics cohesively sequenced in a storyline or learning arc that is engaging to students? How does curriculum support students in engaging in the standards for mathematical practice?	\$ \$ \$ \$ \$	How does the curriculum value students' mathematical ideas? How does the curriculum invite all students in? How does the curriculum provide choice and voice for students? How does the curriculum elicit joy? How does the curriculum allow for opportunities for differentiation?	§ § § §	How does the curriculum support teachers in using the 8 effective math practices? What professional learning is offered? How is it structured? Who runs it? How are teachers supported in on-going professional learning? How does the curriculum support teachers in differentiation? How is the curriculum connected to a research base or connected to a learning organization (university etc.)?	Ş	How does the curriculum support students in future pathways? How is the curriculum relevant to students' lives and college and career interests?
E١	vidence:	Εv	idence:	Ev	vidence:	Ev	vidence:

Review Rubric

Pilot Process

Team investigated 8 different curricula, narrowed down to two using review matrix

50% of our middle school math teachers participated in the pilot

Representation from each course participated in the pilot (Math 6, Math 6/7 Honors, Math 7, Math 7/8 Honors, Math 8)

All four middle schools participated

Structure of Pilot

- Semester 1, Connected Mathematics Project (CMP)
- Semester 2, Illustrative Mathematics (IM)

Scope of the Pilot

• Two or more units of each curriculum (CMP and IM) were taught by all teachers in the pilot

Two Pilot Curricula

Connected Mathematics Project (CMP) and Illustrative Math (IM)

Task-based, inquiry instruction and enhanced opportunities for students to access the Math Practice Standards, specifically:

- •Make sense of problems and persevere in solving them
- •Construct viable arguments and critique the reasoning of others
- •Model with mathematics





Pilot Process

Professional Learning during the pilot

- 1.5 day of professional learning was provided during the school day to all piloting teachers prior to the start of each pilot
- 4 job-embedded professional learning opportunities were offered to every pilot teacher during the piloting experience
- All middle school math teachers engaged in job-embedded professional learning around technology and our pilot curriculum
- During district PD, all teachers engaged in 2 days of learning on best practice and pedagogy Dr. Bostic and MSU facilitators
- Pilot teachers met as PLCs supported with building subs
- Math Specialists co-planned, co-taught and coached teachers throughout the pilot
- Pilot teachers were paid to work after hours

What data was collected

• Student and teacher surveys, work samples, videos, assessments

Pilot Teacher Input on CMP

Celebrations:

- The curriculum provides multiple ways for students to solve problems
- The curriculum allows students to deepen their learning through talk and collaboration
- Some teachers believed support provided has been sufficient to implement with fidelity

Areas of Need and Opportunities for Further Learning for Teachers:

- Some concerns about curriculum being invitational and relevant to students
- Many concerns about providing enough guidance materials were not manageable to use
- Some concerns about supporting the needs of all learners

Pilot Teacher Input on Illustrative Math

Celebrations:

- The curriculum invites all students into the mathematics
- The curriculum provides multiple ways for students to solve problems
- The curriculum allows students to deepen their learning through talk and collaboration
- Teacher materials provide enough guidance and are manageable to use
- Teacher support has been sufficient to implement with fidelity
- As a teacher, I feel confident to implement this curriculum

Areas of Need and Opportunities for Further Learning for Teachers:

- More guidance desired about fostering an engaging learning environment
- More professional learning desired on supporting the needs of all learners

Revisited Our Review Matrix

Middle School Math C	urriculum Review Matrix	CMP	
How down the	Rad	UIII	
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Overall ming/mpression: FWE Overall r COSCLE	ofing/impression. Overaŭ t	impoving atog/impression: Over	ali rating ⁱ mpression.

Recommendation: Illustrative Mathematics (IM)

Who is IM?



IM curriculum is authored and maintained exclusively by Illustrative Mathematics, a non-profit organization, led by noted mathematician and standards author Dr. Bill McCallum.

IM began at the University of Arizona, where Dr. Bill McCallum served as a professor

IM has been developed into a complete K-12 curriculum through grants from the National Science Foundation, the Bill & Melinda Gates Foundation, Carnegie Corporation of New York and others

IM is a research organization and consistently monitors their implementation and impact https://illustrativemathematics.org/impact/

Digging into IM

- Problem-based
- Universal design for learning
- Embedded supports for:
 - students with disabilities
 - English learners



- Extensions for students who are ready for more
- Built-in Instructional routines that support teachers and students
- Activity and lesson structure is predictable and purposeful
- Practice problem sets with built-in cumulative review

Preparing for Problem-Based Teaching and Learning:

LEARN MATH FOR LIFE



Problem-Based Lesson Structure:



80-15=45



7



7. Kate is looking for a frosting with the strongest red color. She finds three different recipes

using red food coloring and white frosting.

Which recipe has the strongest red color?

Recipe A	Recipe B	Recipe C
3 drops food coloring	12 drops food coloring	1 drops food coloring
5 ounces frosting	15 ounces frosting	3 ounces frosting
02108 3 6 9 12 15 Rook 9 5 10 15 20 25 Rook 9 8 16 24 32 40	Wer 12 24 Fresh (5, 8) Tuhai 27 Ey	6 1 2 3 4 5 1 2 3 4 5 1 2 5
012 24 36 48 (60) 72 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Frosting 50 rost	3
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Recipe	it Will Still b	e 14 less then





 Kate is looking for a frosting with the <u>strongest red color</u>. She finds three different recipes using red food coloring and white frosting.

Which recipe has the strongest red color?



 Explain and/ or show how you got your answer in question 7. On Schoology, you can type your answer or take a picture of your reasoning/work.

At one point they all had 15 ounces of frosting. So I circled the 15 in all the recipes and above It, B had the most food coloring for 15. So I knew since it was the most amount that would have the strongest taste.



 Kate is looking for a frosting with the <u>strongest red color</u>. She finds three different recipes using red food coloring and white frosting.

Which recipe has the strongest red color?

(Recipe B) Recipe C Recipe A 12 drops food coloring 1 drops food coloring 3 drops food coloring 3 ounces frosting 5 ounces frosting 15 ounces frosting 0 000 000000 000 00000 00000 3 5 5 5 3.5 15 8. Explain and/ or show how you got your answer in question 7. On Schoology, you can type your answer or take a picture of your reasoning/work. Recipe & because if you campare the Numbers to fractions (ecife Bis large mand is mare reasonable



Sample SAT Problem

The recommended daily calcium intake for a 20-year-old person is 1,000 milligrams (mg). One cup of milk contains 299 mg of calcium and one cup of juice contains 261 mg of calcium. Which of the following inequalities represents the possible number of cups of milk, *m*, and cups of juice, *j*, a 20-year-old person could drink in a day to meet or exceed the recommended daily calcium intake from these drinks alone?

- A) $299m + 261j \ge 1,000$
- B) 299*m* + 261*j* > 1,000

C)
$$\frac{299}{m} + \frac{261}{j} \ge 1,000$$

D) $\frac{299}{m} + \frac{261}{j} \ge 1,000$

Sample AP Exam Question

Sample Questions

AP Calculus AB/BC Exam

4. An ice sculpture in the form of a sphere melts in such a way that it maintains its spherical shape. The volume of the sphere is decreasing at a constant rate of 2π cubic meters per hour. At what rate, in square meters per hour, is the surface area of the sphere decreasing at the moment when the radius is 5 meters? (Note: For a sphere of radius *r*, the surface area is $4\pi r^2$ and the volume is $\frac{4}{3}\pi r^3$.)

(A)
$$\frac{4\pi}{5}$$

(B) 40π

(C) $80\pi^2$

(D) 100π



School Districts in Michigan Utilizing or Exploring IM

Course Sequencing & Student Opportunities for Choice

FINDING 2

Deep Engagement & Differentiation

- Our data showed us students tend to stay in the track they are placed in throughout middle school. It is difficult, even for students who are doing well in math, to move to the Honors track. Our current structure requires families to purchase summer learning opportunities in order for students to move between tracks.
- The IM curriculum allows us to provide deep levels of engagement & differentiation for all our math learners.

Timely Research Summary

"Our main finding, which we obtained by applying meta-analytical techniques to studies from the last two decades, is that the mean effect size of tracking on efficiency is null, whereas it is positive for inequality. This evidence provides no support for the existence of an "equality-efficiency trade-off" (Skopek et al., 2019, p. 224)–that is, the need to sacrifice equality to improve the overall performance of the educational system. Instead, this finding suggests that the stream of literature that emphasizes the role of tracking in enhancing both student achievement dispersion and inequality of opportunity relies on more solid empirical evidence than the theoretical arguments suggesting that tracking increases efficiency. Thus, our results indicate that de-tracking reforms–which postpone tracking, reduce the number of tracks, or smooth out the distinctions across tracks–have the potential to reduce inequality in educational opportunities based on social background without harming overall student achievement."

The Effect of School Tracking on Student Achievement and Inequality: A Meta-Analysis, by Éder Terrin and Moris Triventi, University of Trento

Research from ACT

High school teachers often prioritize covering a broad range of advanced topics in mathematics courses, while teachers at the college level think high school students should receive in-depth coverage of more foundational topics like number sense and basic algebra (Chait & Venezia, 2009). Students with a solid understanding of middle school mathematics are better prepared for an advanced course in high school, which improves their success rates in college-level courses (ACT 2009, 2012).

Other Resources

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Middle School Pathways





HONORS High School Math Sequence



FAQ about pathways

Is Math 8 content being skipped?

 Math 8 content will be intentionally and thoughtfully embedded into the middle school Algebra 1 course. This work will be completed in partnership with Michigan Math and Science Leadership Network (MMSLN) and IM

What information might families use to choose Math 8 versus Algebra 1?

• Buildings will host family information nights to discuss and illustrate the differences to help families make informed decisions

Supporting All Students

Advancement and Acceleration

- •Deep levels of learning
 - Investing in staff through professional learning
- •Enrichment materials
 - Embedded within Illustrative Math ("Are You Ready for More?")
- •Enrichment and enhancement opportunities
 - Math club, robotics, etc

•Traditional test-out opportunities to move more quickly through grade levels

Phase 3: Implementation

Phase 3: Implementation Plan

- Teachers practice IM's problem-based instructional model with integrity and believe **all** students are capable of learning grade-level mathematics.
- Teachers engage in IM Professional Learning, and have implementation support through IM coaching, university partners and Math Specialist at each building.
- School leaders and administrators understand and support the systemic changes that are necessary to change the teachers' practice.
- Families and communities engage with and support their students' learning.

Phase 3: Implementation Plan

PROFESSIONAL[™] LEARNING

Our professional learning enhances teaching practices and experiences for educators.

IM CERTIFIED PROFESSIONAL LEARNING ENSURES SUPERIOR LEARNING

To improve mathematics teaching and learning, teachers need access to highquality tools and continued learning.

IM Certified Professional Learning is expert-authored and deeply integrated with the curriculum, guiding teachers and leaders through instructional and practice shifts to provide long-term, sustainable support for improving instruction and boosting student achievement.

Professional Learning certified by Illustrative Mathematics is delivered by our IM Certified Facilitators, who undergo a rigorous qualification and training process to gain mastery in delivering impactful professional learning experiences based on the author's intent. IM Certified Facilitators deliver learning educators need, in a variety of formats, including onsite and live virtual classrooms.

IM K-12 MATH PROFESSIONAL LEARNING FEATURES

DESIGNED TO SUPPORT SHIFTS IN INSTRUCTIONAL PRACTICE Moving to a problem-based mathematics curriculum represents a significant practice shift for many educators. IM Professional Learning certified by IM guides teachers through the meaningful paradigm shifts that lead to improved student outcomes.

SUSTAINABLE, SCALABLE LEARNING

IM Certified professional learning is tailored to meet teachers where they are on the learning continuum, allowing educators at every level to develop their skills over time. Districts select the learning experience that best meets their needs—from an introductory session, to year-long support, to a three-year development package that builds teacher, coach, and leader capacity. DELIVERED BY MASTER EDUCATORS

IM Certified Facilitators undergo a rigorous qualification and training process to gain mastery in delivering impactful learning experiences based on the author's intent.

RESEARCH-BASED AND CURRICULUM ALIGNED

Our suite of professional tools helps teachers develop the skills and confidence to implement standards-aligned instruction, ensure curricular coherence within and across grade levels, facilitate meaningful mathematics discussions, and implement instructional routines that engage students and improve their learning.



LEARN MATH FOR LIFE

Mathematics



Illustrative Mathematics LEARN MATH FOR LIFE

The IM Implementation Reflection Tool (for Grades 6-12) Version 3, 2021-2022

Glastics: Darks, S., Wilson, J., & Ray-Rek, M. (2021). The illustrative Mathematics implementation Reflection Tool (for Grades 6-12). Illustrative Mathematics: On Valley, A © 2021 Illustrative Mathematics. All highes Reserved.

Phase 3: Implementation Plan 2022/23

2023 Middle School Math Implementation PD days

Full day meetings. 8 subs each day.

May 30 - Math 6 May 31 - Math 7 June 1 - Math 8 June 5 - Math 6

June 7 - Math 7

June 12 – Math 8

Summer Institute - tentatively Aug 8-11

Phase 3: Implementation Plan 2023/24

Back-to-school professional learning will be all about using our new resources

Job-embedded professional learning with IM coaches throughout the school year

Full time Math Specialist in each build to unpack units, co-plan, co-teach, and coach teachers and do intervention with struggling students

Monthly afterschool PLC meetings - with after school pay

Support for Families 2022/23 to Date

Middle School Parent Nights

- Baker: April 18
- Boulan: April 19
- Larson: April 20/April 24
- Smith: April 17

Community Round Table to answer questions from families

• April 13

Video to explain review process, changes to curriculum, and classroom sneak peak

Academics Website

Ongoing one-on-one conversations with families

Support for Families 2023/24

Parent learning sessions at buildings - with math teachers, math specialists and CIS

Parent learning sessions from experts in field

Classroom video examples - shared on our website

Every IM unit includes a section called *Family Support Materials*, which describes in plain language the big ideas students will encounter. These resources provide an overview of the mathematics students are learning, detail what to expect as the learning deepens, and include questions that promote conversation about the mathematics.

Every IM lesson includes a *lesson summary* and is written to help summarize the main mathematical points of a lesson, including any new vocabulary, in student-friendly language. They are meant for students to read on their own time, or perhaps to read to help catch up on a day they were absent. They are also useful for families who want to understand in more detail what their student is learning.

Monitoring our Success

Continuously gather teacher feedback about supports, next learning, implementation process

Measure student achievement regularly

- Reported annually
 - MSTEP/PSAT/SAT including cohort data
 - Benchmarks
- Studied with staff
 - Unit assessments
 - Student enrollment in Algebra 1
 - Student success (grades) in higher levels of mathematics

Thank you!