

UPGRADING MATH CLASS

6 Difficulties Faced by Math Teachers
and How to Overcome Them

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EXECUTIVE SUMMARY

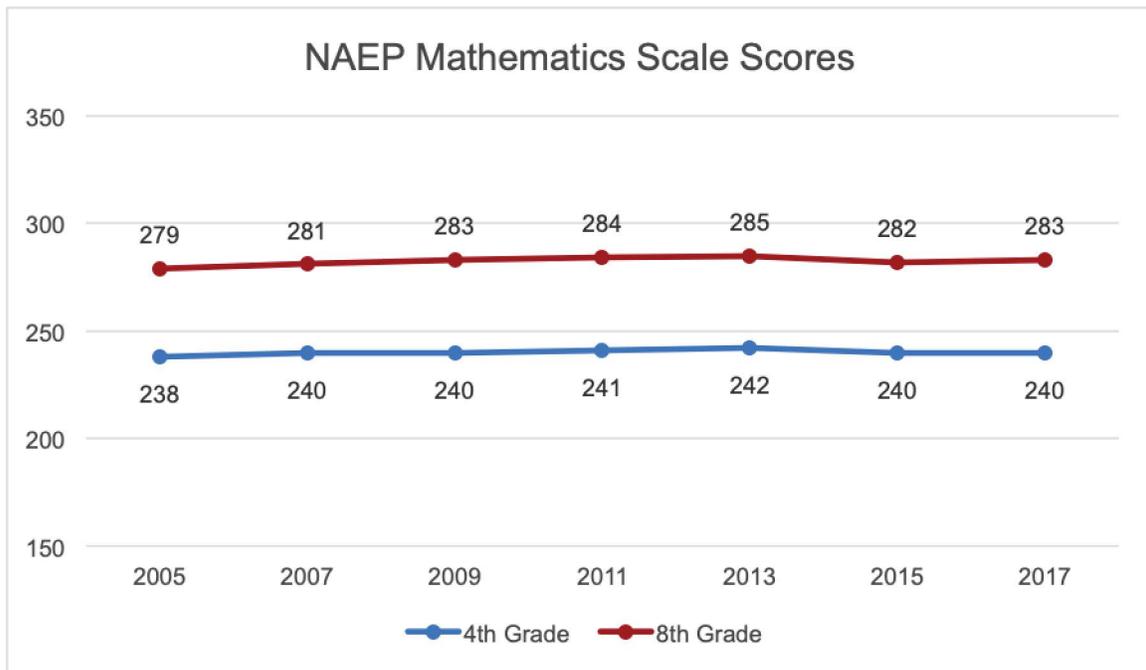
Kids are right. Math class is boring. Students are not actively engaged, they're not retaining key information, they don't receive targeted interventions specific to their individual needs, their social and emotional needs are not being addressed, and they don't have a safe place to explore their thinking without being punished. **The Focused Instructional Model (FIM)** from **The Institute for Excellence in Education** provides teachers and students with a new way of thinking about instruction and learning during math class.

This white paper will address each of the difficulties listed above and showcase how the FIM can help foster innovation and creative thinking in our students. Ultimately, they will graduate and become the leaders of our future – discovering technological, medical, and scientific advances. These advances will create jobs and solidify the role of the United States as a **global economic leader**.

PROBLEMS OF PRACTICE

According to the U.S. Department of Commerce, occupations in the **STEM** field are growing at a rate of 17%, outpacing other fields. Millions of STEM jobs are left unfilled every year. The United States must increase student achievement in the areas of Science, Technology, Engineering, and Math. In particular, mathematics is a sticking point for many students – they dread going to math classes and are anxious about learning new skills. Data from the National Assessment of Educational Progress (NAEP) proves that students and teachers are stuck in a rut. Since 2005, scores in 4th and 8th grade math have plateaued and very few improvements have been made.

For some reason, “I’m just not good at math” has become an acceptable statement nationwide. Parents say this jokingly during student-teacher conferences. **Nobody ever smiles and says, “I can’t really read,” but, strangely, it’s acceptable in society today to struggle with math.** The Institute for Excellence in Education and its Focused Instructional Model look to change the thinking of an upcoming generation of students. We firmly believe, and see in our practice, that increased achievement in math classrooms produces innovative and creative thinkers that will lead the charge toward creating jobs which will lead to sustained economic growth in the United States.



BIG PICTURE SOLUTION

The development of the Focused Instructional Model (FIM) began with a small group of dedicated educators in mid-Michigan in the early 2000's. These teachers were doing their best to cover every benchmark and provide high-quality learning experiences for their students. Their students were scoring well on end-of-unit assessments, but, when it came time to take the exam at the end of the year, they struggled and sometimes claimed they'd never even seen the topics before! This was after months spent on certain units of instruction. These educators created the FIM as a way to **cyclically repeat key mathematical concepts** so that information from their grade level was retained by students. After implementing the FIM, they quickly saw increases in student achievement.

While there are many important small details that make the Focused Instructional Model successful in schools, it can be broken down into three major components: the cyclical repetition of key concepts mentioned above, consistent (bi-weekly) formative assessment opportunities, and a unique remediation/enrichment system. These concepts are broken down in further detail in the subsequent pages of this white paper.

The Institute for Excellence in Education provided opportunities for the developers of the Focused Instructional Model to refine their system and share it with educators in Michigan and, in time, across the country. As academic coaches and providers of professional development, the developers shared the FIM with math teachers who then saw their own students grow academically. The components that comprise the Focused Instructional Model address many common difficulties faced by math teachers in the United States including a lack of student engagement, low retention of critical information, the importance of social-emotional awareness being overlooked, a lack of opportunities for students to take risks and explore their thinking, deficiencies in teacher training, and more. This white paper will explore these difficulties and offer solutions.



“IEE’s FIM Mathematics program makes my students think critically and persevere through problem solving.”

— **DANIELLE NIERGARTH**
MATH TEACHER
BAY CITY WESTERN MIDDLE SCHOOL
AUBURN, MICHIGAN

DIFFICULTY #1: INFORMATION RETENTION

Cyclical Repetition of Key Concepts:

Within the Focused Instructional Model, during daily “warm-up” activities, students are given the opportunity to explore their thinking on two math problems. For about 5 minutes they try to solve each of the problems (whether or not they have prior experience with the skills required to arrive at a solution). As long as students **put forth effort** and attempt to solve each problem, they receive positive reinforcement and sometimes points in the gradebook. This helps students understand that this is a **safe place** for them to take a risk and be creative in the ways they attempt to solve the problems. Teachers circulate during this warm-up time to get a feel for which strategies are being utilized by students and so they how they should address the problem when it’s time to move to the “solution box.” They mark papers with stars or stickers to acknowledge student effort and provide that positive reinforcement.



A student at Jose De Diego Community Academy in Chicago works on the FIM.

After the 5 minutes of effort, the teacher provides a “think aloud” and offers one way to solve each of the two problems. Students copy down what the teacher does in their own solution box and they compare what they did in the top box (effort) to what their teacher did in the bottom box (solution). They can make connections between their work and the work of their teacher.

The daily warm-ups preview upcoming important information and review previously learned key concepts.

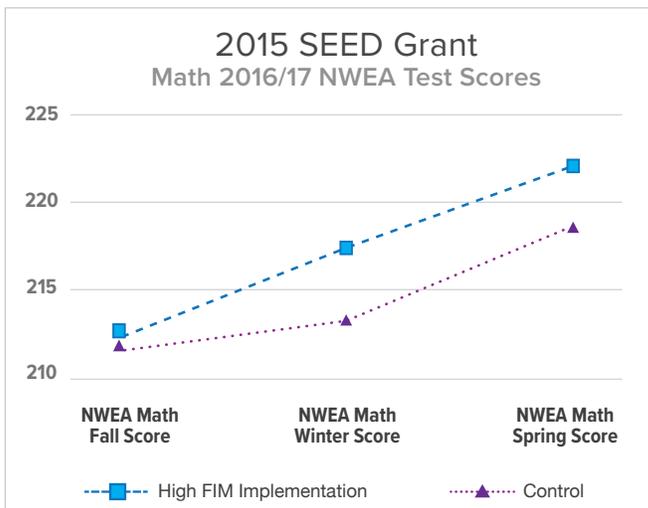
The cyclical repetition of the most important concepts from each grade level help solidify the concepts in the minds of the students.

DATA DEEP DIVE #1

Supporting Effective Educator Development Grant from the U.S. Department of Education



A teacher at JM Alexander Middle School in Charlotte, North Carolina guides her students through the FIM process.



In 2015, The Institute for Excellence in Education was part of a team of educators that received the Supporting Effective Educator Development (SEED) grant. IEE and its Focused Instructional Model took the lead on the math side of the Power of Two project, which was an initiative of the National Forum to Accelerate Middle Grades Reform. The Power of Two provided students with a paired intervention experience in English Language Arts and mathematics classrooms. The purposeful pairing of these subject areas addressed the need for students to make rapid academic growth in a short period of time (one school year).

6th and 7th grade teachers in Michigan (multiple districts), North Carolina (Charlotte-Mecklenburg Schools), Illinois (Chicago Public Schools), and California (Moreno Valley School District) received training and coaching around the Focused Instructional Model. There was a **robust data collection** component of the SEED project – a randomized controlled trial (RCT) was spearheaded by the Center for Prevention Research and Development (CPRD) from the University of Illinois. Using a treatment vs. control study, data was collected from 53 classroom pairs across the 4 states, with 1,095 students involved in the study.

Treatment students that used the Focused Instructional Model for one year in classrooms where the model was implemented with high fidelity showed statistically significant greater math achievement than students in control classrooms. These students were more likely to initiate positive interactions with each other, were more motivated to do well in school, held higher academic expectations, lower negative mindset, and lower disruptive behavior when compared to students in the control classrooms.

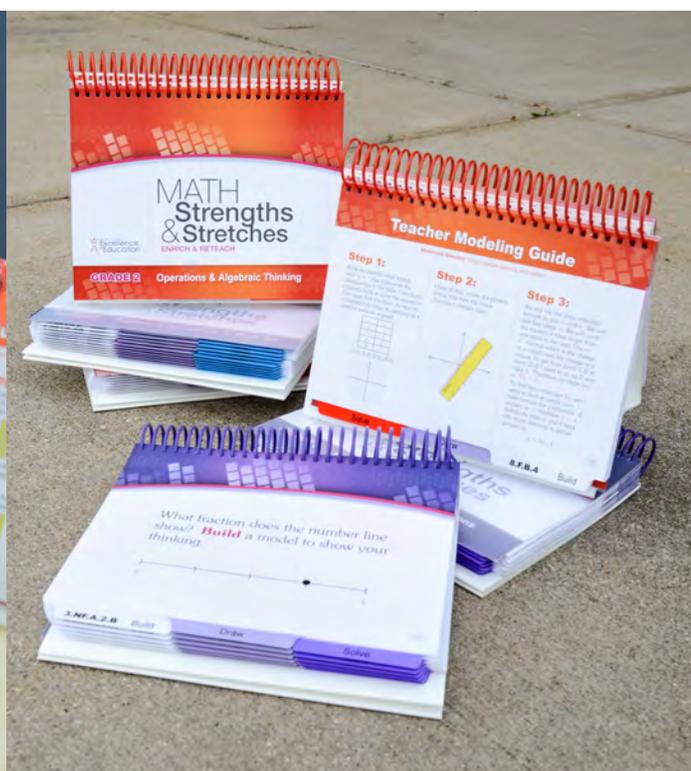
The project team was encouraged and excited to see these results after only one year of implementation of the Focused Instructional Model. During the second year of the study, control classes received the FIM training and coaching. Data is still being examined but the outlook is positive. Positive results from this study resulted in other schools and grade levels in these four states adopting the Focused Instructional Model in hopes of replicating these increases in student achievement.

DIFFICULTY #2: TARGETED INTERVENTION

Math Strengths and Stretches (MSS): Math Strengths and Stretches is a unique system that helps meet the needs of all students, no matter where they are in the learning process. MSS allows students to work freely within the *concrete-pictorial-abstract* continuum of learning. Students can **build, draw, and solve** problems to help increase understanding. When students can use colored counters, Base-10 Blocks, Unifix Cubes, or other manipulatives to help them solve problems, student engagement and understanding increases.

Data currently shows that, developmentally, students should begin the learning process at the “concrete” stage, using manipulatives to help understand new concepts. Unfortunately, 80% of the time, teachers begin instruction in the “abstract” phase – they immediately provide the algorithm so students can plug in numbers to arrive at a solution. Without building the problem with their hands or drawing it first, using the algorithm becomes a magic trick that provides the answer. Instead, students need background knowledge about *why* the algorithm works. Even accelerated students sometimes struggle to create visuals of mathematical concepts. MSS breaks down key concepts for students experiencing difficulties while inviting gifted students to be creative and try solving problems in different ways.

Math Strengths and Stretches moves students through the build-draw-solve continuum of learning.



DIFFICULTY #3: PROVIDING SOCIAL-EMOTIONAL LEARNING



A student from Bay City Western Middle School in Michigan showcases her Brag Tags.

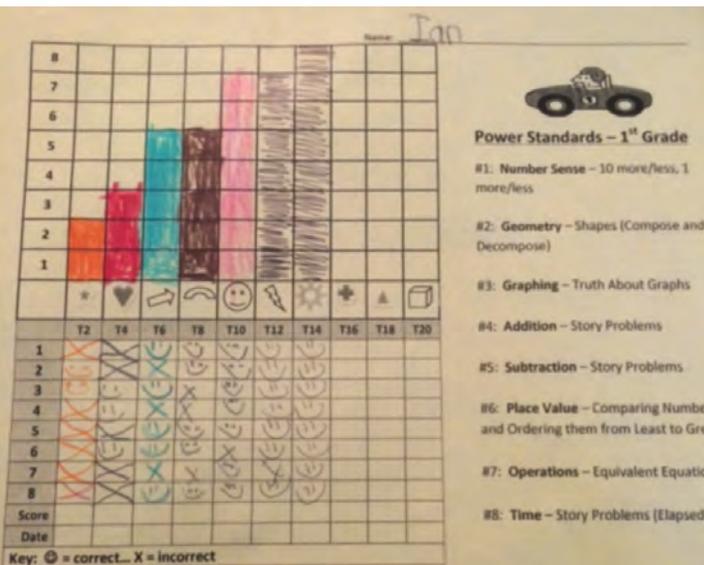
Whole-Child Development: It is no longer an option for teachers to focus solely on academics while working with their students – they must educate the **whole child** to help best prepare them for the future. Students at every grade level are experiencing social and emotional growth while they navigate through their core academic classes. There are many important **non-cognitive factors** built into the Focused Instructional Model that will help teachers understand the unique needs of students.

During training, teachers learn about Habits of Mind and how social-emotional learning can make a big difference in the lives of students. These non-cognitive skills are often overlooked, but they are incorporated into the FIM on a daily basis. Skills like persistence, resourcefulness, attention to detail, and determination help prepare students to be able to think flexibly when they encounter a math problem they don't know how to solve. Without these skills, students often feel defeated and quickly give up when they're struggling with a math problem.

Through FIM, students can earn “Brag Tags” when they master academic standards and when they exhibit positive social-emotional characteristics during class. Students are excited to collect these Brag Tags and they like to show off what they've earned.

DATA DEEP DIVE #2

Swan Valley School District, Saginaw, Michigan

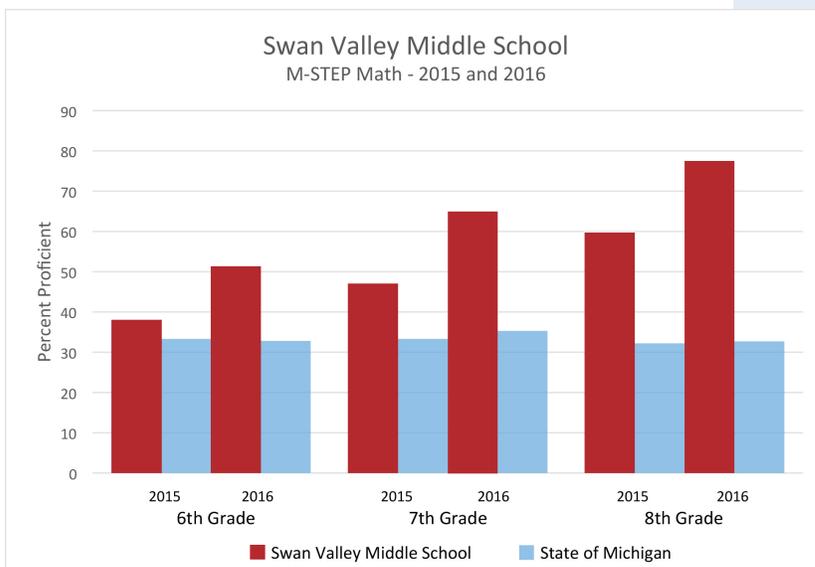


Ian, a student at Shields Elementary School, graphed his results and increased his scores throughout the school year.

Shields Elementary School in Swan Valley was one of the first adopters of the Focused Instructional Model during the 2012-2013 school year. 2nd grade teachers took a risk and implemented the FIM in their classrooms. This cohort of students **increased their percent proficient scores by 23.2% in one school year** (from 29.0% proficient on the 2012 state assessment to 52.2% proficient on the 2013 state assessment). The teachers and the principal were excited about the test scores but also about the way the students were changing their habits and their thinking around mathematics. The following school year, Swan Valley School District decided to spread the FIM to the remaining classrooms at Shields Elementary School and also to Havens Elementary, the other elementary school in the district. After multiple years of implementation, teachers noticed that students were more creative with their problem-solving abilities and that their perseverance and determination was permeating into different subject areas as well. Scores continued to climb and teachers and principals were thrilled that the Focused Instructional Model was helping their students grow academically, socially, and emotionally.

During the 2015-'16 school year, Swan Valley Middle School decided to implement the FIM and they saw great increases in data across all three grade levels. There was double-digit growth in percent proficiencies in 6th, 7th, and 8th grade while the state of Michigan

average showed little to no increases. In Michigan, percent proficient scores drop when students reach 8th grade. **At Swan Valley Middle School, 8th grade scores were about 45% above the state average.**



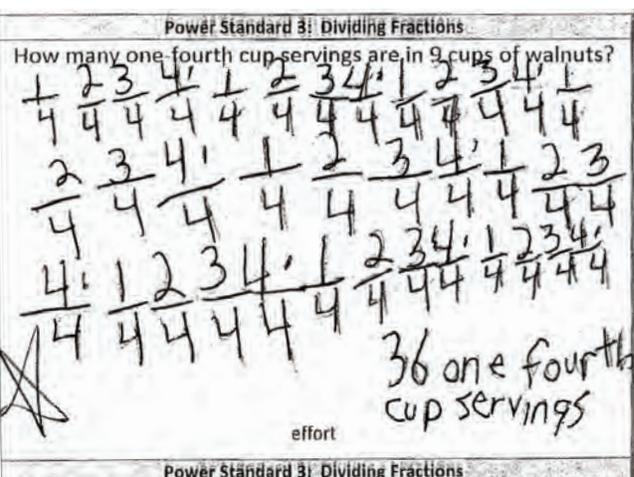
Swan Valley continues to work with the Institute for Excellence in Education and teachers work hard to provide the best possible learning environments for their students. That first cohort of 2nd grade students are now sophomores in high school and students are excited for opportunities to showcase their skills on the upcoming SAT assessment next year.

DIFFICULTY #4: SAFE LEARNING ENVIRONMENTS

Taking Risks is Encouraged and Rewarded:

The traditional model in math classes where teachers begin the class by reviewing the homework from the previous night, then they provide a lecture on a new topic and some sample problems, then they have students work on problems 1-50 in a textbook is no longer a viable option. Students are right – math class can be boring if teachers don't have knowledge of best practices and employ varied engagement strategies to keep their students curious about new topics. Students have **innate curiosity** that is often stifled when teachers immediately provide the formula or the algorithm that will produce a correct answer. Students need a safe place to explore their thinking and try out multiple ways to solve a problem.

The Focused Instructional Model allows students to **take risks** and **be innovative** when attempting to solve problems. Students see sample problems that they might not know how to solve; the FIM gives them space to be creative in their problem solving. The daily warm-ups include an “effort” box for students to explore their thinking without worrying about getting the problem right or wrong. Outside of FIM, from an early age, student papers are marked with red ink which leads to increased frustration and an aversion to mathematics in general. Within FIM, in the effort box, students can try new strategies while teachers celebrate and reward their innovative thinking. Providing a safe learning environment where students feel comfortable taking risks leads to developing **creative thinkers** that will be the leaders of the future.

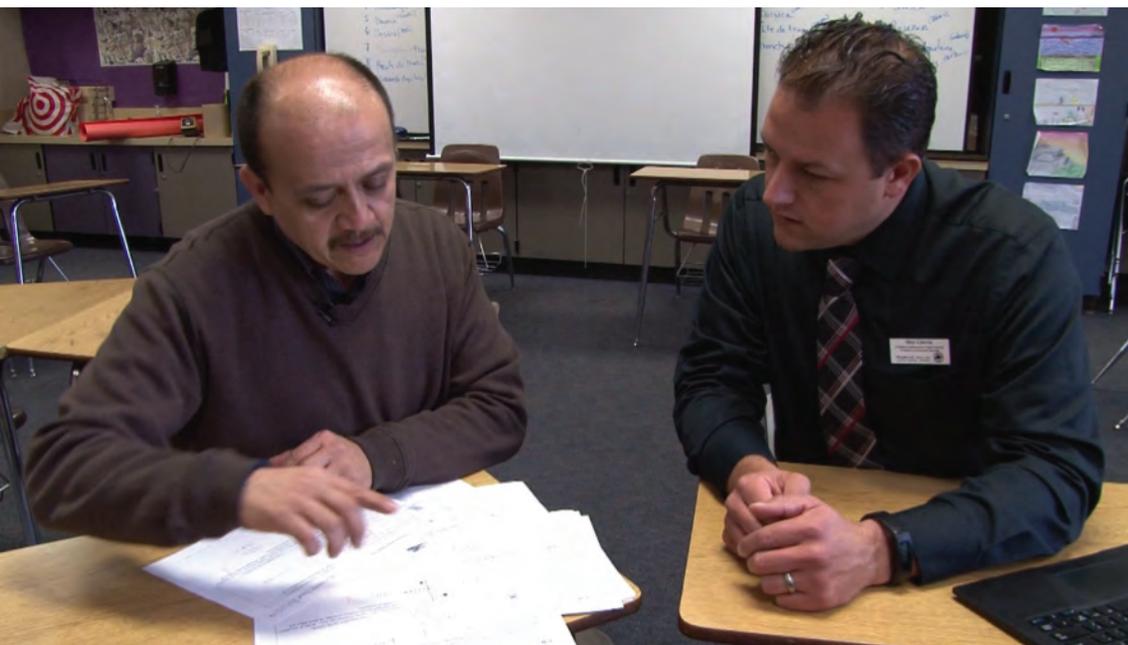


A 6th grade student attempts a division of fractions problem. Not the most efficient way to arrive at a solution, but a creative way nonetheless.

DIFFICULTY #5: EFFECTIVE TEACHER TRAINING

Empowering Educators: Professional development presenters at the Institute for Excellence in Education go through rigorous trainings so they can best serve the educators and schools in their network. They stay on top of current trends in education so they can help teachers implement best practices and, ultimately, increase student achievement. All presenters receive training in Cognitive Coaching which helps **empower teachers** to be self-directed so they can excel in their classrooms. After FIM training takes place, on-site coaches follow up with teachers to make sure the FIM is being implemented with fidelity. The coach uses Cognitive Coaching to mediate the **thinking of the teachers** with whom they work to help them produce students that are more cooperative and better problem solvers.

Often, schools hire professional development presenters and they fly in from another state to deliver information on a hot topic in the field of education. They might provide a binder and some examples for teachers, but, without follow-up academic coaching from a trained professional, these binders often collect dust on bookshelves. The Institute for Excellence in Education provides teachers with ongoing support to help them navigate through the FIM implementation process. Coaches help teachers disseminate the data so they can best meet the needs of their students. They model and co-teach during the FIM so teachers can see experts in action. Coaches facilitate reflective conversations with teachers to help them improve their craft. Teachers feel supported throughout the process and typically appreciate the ongoing support from a FIM specialist.



A teacher in Moreno Valley, California works with his FIM coach throughout the school year to ensure that the program is being implemented with fidelity.

DATA DEEP DIVE #3

Richfield Public School Academy, Flint, Michigan

The mission of Richfield Public School Academy is to create a high standard of academic excellence where all students can grow and become life-long learners. There are about 450 3rd through 8th grade students at RPSA. Teachers at Richfield implemented the Focused Instructional Model during the 2014-2015 school year.

After implementing the FIM with fidelity, teachers noticed that students were more willing to take risks instead of shutting down when they encountered a problem they struggled to solve. The teachers and students appreciated the cyclical repetition of key concepts so they could have continual practice with the most important concepts from their grade level. Coaches helped teachers implement the FIM system over multiple years. Along with the gains in the social and emotional development of their students, there were also academic gains. For example, **3rd grade scores increased by 15.2%** (from 21.3% proficient to 35.5% proficient) after one year of FIM implementation.

In 2017, Richfield Public School Academy was designated as a “**School to Watch**” by the National Forum to Accelerate Middle Grades Reform. RPSA excels in the four categories that define great schools according to the Schools to Watch rubric: Academic Excellence, Developmental Responsiveness, Social Equity, and Organizational Structures and Processes.

Teachers and administrators from Richfield Public School Academy receive their “Schools to Watch” award in June of 2018 in Washington, DC.



DIFFICULTY #6: APPROPRIATE DIFFERENTIATION

Consistent Formative Assessments: Within the FIM process, every-other Friday students are given an 8-question Progress Monitoring Test (PMT) to make sure they're progressing through the material at an appropriate rate. As students work their way through various units of instruction, their scores on PMTs increase, leading to excitement and increased student efficacy. Teachers frequently receive data so they can appropriately group students and **differentiate** instruction as needed. Students become **metacognitive** about their scores – they plot their own data on graphs and tables to keep track of their strengths and their areas that need improvement. Students can compare their personal data with class average data which leads to **rich data discussions**. The class sets goals and class average data is displayed publicly to promote an attitude of togetherness in the classroom. Teachers use the incoming formative assessment data to help form small groups for remediation and to keep a close eye on the overall progression of their students.



A student at Shields Elementary School in Saginaw, Michigan graphs her FIM results so her teacher understands her strengths and needs.

SUMMARY

It is a difficult time to be an educator in the United States. Teachers are bombarded with special requests from their administrators, from parents, and from students. There is an overall lack of respect for the noble profession nationwide which causes teachers to be frustrated and anxious. With increased emphasis on standardized test scores, teachers often find it difficult to be passionate about their profession. Students come to their classrooms with pre-installed viruses like lacking attention to detail, an inability to retain key information, and aversions to putting forth the effort it takes to persevere through a difficult problem.

The Focused Instructional Model from the Institute for Excellence in Education helps teachers and students become the best they can be. **Student engagement** is increased. The cyclical repetition of key concepts helps solidify important concepts in the minds of students. Consistent incoming **formative assessment data** allows for powerful differentiation. Students are provided with a safe place to take risks and explore their thinking without being force-fed a formula or an algorithm.

Overcoming the pitfalls of math classes is a daunting task; the FIM provides a roadmap to help teachers provide the best possible educational environment for their students to help them **reach their full potentials**.

NEXT STEPS

In order to retain our place as a **global economic leader**, schools in the United States must produce students that are innovative and creative when it comes to problem solving. Students at all grade levels must be exposed to high-quality learning experiences across multiple domains. They need guidance as they develop socially, emotionally, and intellectually. Teachers using the **Focused Instructional Model** in their math classes can help not only with the academic development of students, but also with their social and emotional growth so they are eager to learn and ready to apply their new learnings in the real world.

In their “Future of Jobs Report” (2016), the World Economic Forum predicted the top 10 skills sought by employers worldwide in the year 2020. These skills included complex problem solving, critical thinking, cognitive flexibility, creativity, and coordinating with others. The Focused Instructional Model from the Institute for Excellence in Education provides safe spaces for students to work on developing these critical skills while simultaneously providing students with practice on foundational mathematical skills.

To learn more about the Institute for Excellence in Education and the Focused Instructional Model, please visit **www.excellenceined.org**.