Supporting Differentiated Math Instruction in a Common Core World

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There are three incontrovertible realities that math teachers contend with each and every day. First and foremost is the tremendous range of math abilities within any given classroom. Our research indicates that this range is as great as, if not greater than, the ability range in reading (Smith, 2010). The second reality is that mathematics, unlike many other subjects, is a coherent and connected progression of skills and concepts – each skill building toward another skill and concept. These tightly interrelated series of learning progressions build upon each other and require the acquisition of essential prerequisite skills. The third reality in the math teacher’s life is that most teachers are required to utilize the same textbook or set of instructional materials for all the students in a given grade.

When one considers these three realities, it is hardly surprising to see the tremendous gaps – nationally and internationally – in math achievement. Albert Einstein’s well-known aphorism seems especially relevant to mathematics education: Insanity is doing the same thing again and again and expecting different results. Unfortunately, we have a long history of doing just that: sorting students into chronological age groups by grade levels and then giving each one the same level of treatment at the same time. This has not worked historically and it seems unlikely it will work in the future.

These realities for math educators are further complicated by the adoption of the Common Core State Standards, which raises the mathematics standards in most states significantly above their present level. Most would readily concur that we have failed a significant portion of our students in terms of math achievement, yet we are now in the midst of raising the bar even higher. So what’s a math teacher to do?
Differentiated Instruction

One clear path out of this conundrum is the use of differentiated instruction. While the majority of math educators recognize that differentiated instruction is necessary, many would also argue that the lack of available tools, resources and professional development opportunities complicates the effort to deliver on the promise of differentiated instruction. Unfortunately, most teachers today are left with limited support and few resources to assist them in the development and delivery of differentiated math instruction. Simply stated, there has been an absence of research based instructional tools, resources, curricula and professional development opportunities to support teachers in this endeavor. In terms of differentiated instruction, most of the attention and resources have been devoted to reading. In a post written for the National Association of Secondary School Principals blog, The Principal Difference, we compared the number of search results for “reading achievement” with “math achievement” on the National Center for Education Statistics (NCES) website and the Institute of Education Sciences (IES) website. The results were about 2:1 and 3:1 respectively. Google yielded similar search results: “differentiated instruction reading” versus “differentiated instruction math” (2:1); “summer loss reading” versus “summer loss math” (3:1); and “reading assessments” versus “math assessments” (3:1) (Smith, 2009).

This neglect in mathematics can also be seen in the amount of classroom time allotted for math instruction. NCES’ 2007 reading and mathematics assessments found that the typical fourth grade classroom dedicates more time to language arts instruction than math instruction. For example, 75 percent of educators reported that they spend seven or more hours per week on language arts, while only 24 percent of educators reported spending the same amount of time on math (National Assessment of Educational Progress, 2011).

Put simply, with the reality and demands of their teaching load, math educators often lack the time to meaningfully differentiate math instruction. In exasperation, the director of a public school math department once facetiously declared, “We all know the importance of differentiated instruction and we do it in two ways: we repeat it and say it louder.” While everyone laughed at this good-natured expression of frustration, it contained a strong element of truth, and what we now call the R-V (Repetition and Volume) Model of Math Differentiation, is probably the norm in most classrooms in our country.

As mentioned earlier, these stark realities are further complicated by the adoption of higher standards within the Common Core. As state and local education agencies are quickly discovering, the “adoption” of standards is significantly easier than their “implementation.” In an Education Week article, Catherine Gewertz addressed the challenge of implementing the Common Core State Standards:

As states and districts begin the work of turning common academic standards into curriculum and instruction, educators searching for teaching resources are often finding that process frustrating and fruitless.

Teachers and curriculum developers who are trying to craft road maps that reflect the Common Core State Standards can find themselves in a dispiriting bind: Their current materials fall short, and there is a dearth of good new ones to fill that void.

Resources to Support Common Core and Differentiated Instruction

The Importance of a Common Scale

The first step in helping educators differentiate math instruction is to provide a tool that allows them to measure both student growth and readiness. It is critical that mathematical achievement and the difficulty level of mathematical skills and concepts be placed on a common scale. After all, it is nearly impossible to differentiate for the wide range of ability levels in a typical math classroom without first knowing the extent of that range. In addition to allowing state and local education agencies to measure student growth and track student trajectories toward college readiness, employing a common metric allows educators to identify the gap between a student’s performance level and the level of the mathematics content expected at that grade level. Similar to a Lexile® measure, which places the text and reader on a common scale, the Quantile® Framework for Mathematics allows educators to use a Quantile® measure as a common metric for measuring a student’s level and the difficulty level of specific skills and concepts. In addition, MetaMetrics® has already aligned the Quantile Framework with the Common Core State Standards in Mathematics. Armed with this information,
Differentiated instruction is defined as a means of creating multiple pathways so that students of varying abilities, interests and learning needs experience equally appropriate ways to absorb, use, develop and present concepts as a part of the daily learning process (Theroux, 2004). In order to prepare students for success in and out of the classroom, teachers must differentiate the mathematics instruction to meet the needs of all learners and provide students with varied opportunities to learn and grow (Smith, 2010). In classroom environments, typically comprised of a heterogeneous mix of abilities, the Quantile Framework provides educators the ability to harness the power of a common scale to differentiate instruction and transition from whole-class instruction to small group or individualized learning. Imagine attempting to differentiate instruction without the use of a common scale and metric. While most educators are already able to at least identify struggling students through a variety of traditional means (e.g., exit slips, quizzes, group activities and assessments), they are reduced to simply guessing the magnitude of the gap between the student’s level and the difficulty of the skills and concepts. The Quantile Framework remedies that deficiency and provides a critical (and actionable) starting point for differentiation efforts.

By establishing the demand (difficulty) measure of hundreds of mathematical skills and concepts, MetaMetrics has identified “knowledge clusters.” The knowledge cluster for any particular skill or concept is composed of the specific prerequisite skills that precede the skill in consideration. For example, using models to investigate the concept of the Pythagorean theorem has a Quantile measure of 1010Q. However, for students at a lower level, identifying and classifying triangles according to the measure of the interior angles and the lengths of the sides – a mathematical concept with a Quantile measure of 610Q – may be more appropriate. For each specific math skill or concept, the knowledge clusters provide prerequisite skills along with the corresponding Quantile measure.

These knowledge clusters illustrate the interconnectivity of the skills and concepts, while providing educators with actionable information they can use to target instruction, forecast understanding and address student achievement. By utilizing descriptive knowledge clusters, the Quantile Framework allows educators not only to determine the gap between the learner and the skill to be taught, but to enable meaningful targeting by identifying the appropriate prerequisite skills.

Differentiating Math Instruction with Accessible Resources

The second step to improving teachers’ capacity to differentiate math instruction is to go beyond a single textbook or narrow set of instructional materials and to provide supplemental resources aligned to the Common Core State Standards. To aid educators in differentiating mathematics instruction, MetaMetrics has made available a rich collection of free online resources that have been aligned to both the Common Core State Standards and individual state mathematics standards using the Quantile Framework. The Quantile Teacher Assistant and the Math Skill Database provide access not only to the powerful instructional tool, knowledge clusters, but also to the continuum of developmentally sequenced skills and content beginning with kindergarten and extending through Algebra 2. These tools offer a host of free resources—including video tutorials, task suggestions, group activities, literature guides, online activities and supplemental skill sheets—calibrated to the Quantile scale. In fact, MetaMetrics provides over 3,000 targeted resources from a wide variety of well-known math content providers, including Khan Academy, SAS Curriculum Pathways, Conceptua, Gourmet Learning, Key Curriculum Press, Math Learning Center and Virtual Nerds. These online tools and resources support differentiation by allowing educators to easily use a student’s Quantile measure to match that student to relevant prerequisite skills and to address specific gaps in learning.

Beyond the Classroom – Differentiation at Home

Efforts to differentiate instruction need not always occur in the classroom. A less direct but closely related effort to differentiate for the heterogeneous mix of math ability in a typical classroom may take the form of increased instructional time and continued mathematics engagement outside the classroom. Technology now allows these efforts to take various forms, including the provision of targeted, home-friendly resources—resources that supplement and reinforce the skills and concepts acquired during the school year. In mathematics especially, attempts to curb the corrosive effects of summer learning loss must rely on keeping students engaged in meaningful year-round mathematics activity. Because mathematics most often requires instructional assistance for students to learn new skills and concepts, engagement in this sense may simply mean committing to activities and resources that reinforce and supplement the year’s lessons. Educators recognize that not every student is at the same achievement level, and this recognition fuels efforts to differentiate instruction. Just as important, however, student engagement with the appropriate level of mathematics must occur beyond the confines of the classroom. It must occur at home as well.
MetaMetrics’ free Math@Home® is one tool that allows students to access targeted math content online, beyond the classroom walls. Math@Home provides students with free, targeted math resources, such as websites, worksheets, video tutorials, and skill sheets, that support the textbook lessons studied throughout the year. These resources are courtesy of the same providers previously referenced for the Quantile Teacher Assistant. Additionally, Math@Home harnesses the power of prominent social networking features to allow students and teachers to share multiple resource lists with other users.

Conclusion

As the rigorous Common Core State Standards in Mathematics move from the adoption stage into the implementation stage, it is imperative that classroom educators be given the tools and resources that will allow them to move beyond whole-class instruction and begin to differentiate for math students at every level. It is likely that math classrooms will continue to present a wide range of student abilities. Harnessing the Quantile Framework, however, frees educators from the constraints of the “R-V Model” of classroom instruction. By utilizing a common scale – along with the technology and resources that support its application – educators finally have the tools needed to differentiate for struggling math learners and to ensure that all students are provided targeted instruction that matches their current ability level. Additionally, the free tools provided through the Quantile Framework enable math educators to access resources and target students at just the right level, making meaningful differentiation not only possible, but more practical and likely.
References


