Multi-Age Made Me Do It

A Teacher Tackles Differentiation in Math Instruction

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Chase has just turned six years old, Kaitlyn has just turned seven, and Nick is turning eight. Nate is beginning to sound out words; Jessie is reading chapter books. Danny still struggles with counting past 30, while Anthony loves to solve mental math challenges with numbers in the thousands. In my first- and second-grade class, a multi-age group of six-, seven-, and eight-year-olds, there are 20 children, and each of those children has a different set of needs and abilities. As the teacher, it is my job to meet those various needs and challenge their various abilities—a daunting task to be sure!

But then, again, is this range of skills that much more significant than one would find in any classroom? When I taught a straight-graded first grade, I had a slightly smaller age span, but the span of needs and abilities was nearly as wide. When I taught a straight-graded fourth grade, I think the span was even wider!

Because the children in my classroom are technically in different grades, I am required to differentiate my instruction. In a straight-graded room, even with that inevitable range of needs and abilities, it might be possible to get away with a one-size-fits-all model of instruction, but in a multi-age setting, neither parents nor administrators would stand for a program that did not account for variation. Although all teachers must reckon with the fact that one-size-fits-all lessons generally leave both struggling students and advanced learners without appropriate challenges, the teacher with students of several ages must confront this fact head on.

I never set out to tackle differentiated instruction, but teaching in a multi-age classroom forced me to try. Because I am responsible for both beginning readers like Nate and more advanced readers like Jessie, I have tried to create structures that allow all kinds of readers to grow. Because I

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am responsible for teaching Danny his basic math facts while I keep Anthony challenged, I have tried to devise a plan that will accommodate a range of skills and abilities in math. For me, a multi-age classroom has been the best kind of classroom and the worst kind of classroom. After all, differentiating instruction can be incredibly complicated and challenging for the teacher, but it is undoubtedly best practice. I am certain that my multi-age class has made me a better teacher because it has forced me to adapt, change, experiment, and innovate in an effort to provide a program differentiated to meet the needs of all my young students.

Developing a Differentiated Math Program

Math Compared to Reading and Writing

I have found that the challenge of differentiating instruction is most significant when it comes to teaching math. Common practices for teaching reading and writing—guided reading groups (Fountas and Pinnell 1996) or the writing workshop model (Calkins and Mermelstein 2003)—allow children to pursue work at a variety of levels. Most math programs, however, expect that the children will be working at the same level. Even more progressive programs like *Everyday Math* (University of Chicago School Mathematics Project 2002) or *Investigations in Number, Data, and Space* (TERC 1995), which are less lock-step and offer more open-ended lesson plans, are designed for use with straight-grade-level groupings.

Math in the Multi-Age Classroom

When I first took on my current multi-age assignment, my intention was to follow the model used by the other multi-age teachers in my building—teaching the younger students math while the older students worked independently, then teaching the older students math while the younger students worked on their own. I thought it would be simple, but after several weeks in the classroom trying to juggle two separate curriculums simultaneously, my head was spinning. I was spending double the amount of time preparing and teaching lessons and shrinking the amount of time students actually received instruction. I was hastily putting together busywork and desperately trying to monitor the entire group while providing instruction. With one group working on money and another working on addition, or a group moving into geometry while another group solved story problems, I was struggling.

In Search of a Solution

Convinced that there had to be a better way, I decided that my main problem was that, as a teacher, I was thinking about too many topics at once. I decided to try simplifying things by teaching only one conceptual strand at a time. If one group needed to work on addition, we would all work on addition. When it was time to study geometry, we would all study geometry. The idea of streamlining instruction in this way immediately calmed my nerves.

So I lugged all my new curriculum guides home and set about trying to map out a plan. At this time my school district had adopted the *Investigations in Number, Data, and Space* (TERC 1995) curriculum materials supplemented by the *Scott Foresman–Addison Wesley* (Pearson Scott Foresman 1997) math curriculum. The first- and second-grade *Investigations* programs each come in six-volume box sets. The first- and second-grade *Scott Foresman* series each have four hardcover volumes worth of teachers' guides and eight paperback volumes full of reproducibles. I spread these materials out on the floor of my living room—all 28 volumes worth—and I was quickly overwhelmed once more.

There was something about all those stacks of guidebooks that I found particularly daunting. Because I knew that the school district had officially adopted these materials, I felt responsible for teaching every single lesson, using every single reproducible, assigning every single homework set, and investigating every single topic. I felt responsible, and yet I knew that it was impossible. One teacher with one grade level could attempt the task. One teacher with two grade levels in one classroom certainly could not. I began to doubt whether teaching math in a multi-age classroom was realistically feasible.

At lunchtime a few days later I was sharing my worries with Bill Dunsay, the second- and third-grade teacher in the building. Bill had been teaching for many years, and the past 10 or so he had been in multi-age rooms. He taught two math groups, but he also explained that he taught some combined math lessons and individualized other aspects of his program. "Don't worry about what's in the guide books," he told me. "It's too much. No one could ever do it all." What a relief to have this acknowledged! "Just teach the standards. That's what you're ultimately responsible for."

Bill's advice proved to be incredibly liberating. Rather than feeling that I had to cover every page in each of those 28 curriculum guides, I simply had to ensure that I addressed each of the standards. Since the Massachusetts mathematics frameworks (Massachusetts Department of Education 2000) are written for students in kindergarten through grade 2, I no longer had to fuss with matching up multiple textbook strands; I simply had to work with one list of standards. I began to view the curriculum guides in a whole new way—no longer as a daunting puzzle but instead as reference books for lesson ideas and materials.

Fitting straight-graded curriculum guides into a multi-age context simply is not possible. Deciding first to teach only one topic at a time and then to focus on the state standards allowed me to develop a curriculum map that was friendlier for the multi-age teacher. However, it did not get me around the fundamental challenge of differentiating instruction. I believed that differentiating instruction in math meant teaching different lessons to a younger group and an older group, but teaching two math lessons every day, while less difficult in terms of planning, was still logistically challenging. I found that I was worrying less about what I should teach and more about how to schedule in two groups, keeping one group busy while the other was having a lesson. My new concern was that I was shortchanging my students out of instructional time.

Structures for Differentiation

This concern pushed me to experiment as a teacher, and after plenty of trial and error, I have come to believe that teaching small group lessons is only one way to differentiate math instruction. I have found that open-ended investigations can challenge almost all students, while tiered tasks—tasks that are fundamentally the same but adjusted for different levels—can be assigned as independent work. I have found that the same problems can be done independently or with support from the teacher and that whole-class instruction can spiral, introducing topics to some children while others are reviewing. Today, as I think about the ways in which I differentiate math in order to support a wide range of learners, I realize that I regularly use three main task structures—open-ended tasks, tiered tasks, and spiraling-scaffolded tasks. Thanks to these structures for differentiation, I no longer worry about shortchanging students out of math instruction. Instead, I have come to believe that math in a multi-age classroom is not only feasible but a model of best practice.

Types of Tasks: Open-Ended, Tiered, and Spiraling-Scaffolded

Open-Ended tasks

Open-ended tasks are those that have no single answer and/or no single method to determine an answer. Students can be challenged to generate more than one solution or to develop a simpler or more complex solution. This work is generally self-directed, although it can be facilitated by a teacher or discussed as a class. Examples of these tasks include working with pattern block puzzles, creating combinations of coins, or recording equivalent number sentences discovered using a number balance. The whole class may be challenged to solve a problem, but its members are able to come to the answer in a variety of ways. For example, when trying to find out how many students are in the school, students may count cubes, draw pictures, group blocks into "tens" and "ones," or use traditional pencil and paper algorithms. Open-ended tasks are generally self-directed, although they can be facilitated by a teacher or enhanced by class discussion. They are intended to facilitate students' own constructions of understanding.

Tiered Tasks

Tiered tasks are geared toward specific skill levels. For example, younger students play the "Winning Number Game" with one die, older students play the game with two dice, and advanced students play the game with three dice. Packets of addition worksheets can be tiered as well. The pink worksheet packet might have single-digit addition problems, the yellow packet double-digit addition problems, and the green packet many-digit addition problems. Tiered-tasks tend to be self-paced opportunities to practice skills and develop fluency.

Spiraling-Scaffolded Tasks

Spiraling-scaffolded tasks work on the assumption that math instruction should "spiral" (Bruner 1960) and that providing more or less "scaffolding" (Bruner 1978) is one way to differentiate instruction. Traditionally, math curriculums do spiral, teaching a concept in first grade that will be reviewed and extended in second grade. For example, first graders might learn to tell time to the hour, while second graders might review telling time to the hour and also learn to tell time to the minute. Since my classroom is multi-age, I assume that my students are standing on the same spiral staircase but that they happen to be at different locations on the stair. A lesson on telling time to the hour should be appropriate for all of my students, and those who have previous experience with the concept will benefit from a lesson on telling time to the minute as well.

Scaffolding is assistance that allows a learner to perform a task that he or she is not yet ready to handle independently. Mathematical work may be scaffolded in a variety of ways, but teacher modeling or coaching and student use of manipulative materials are ways in which I generally offer students assistance. A student learning to add might first work with a teacher and blocks, then graduate to working independently with the blocks, and finally work independently without the blocks.

Spiraling-scaffolded tasks involve a mix of whole-group, small-group, and independent work, some of which is teacher directed and some of which is self-paced. Direct instruction in algorithms is best suited for this structure.

Differentiation through Open-Ended Tasks

My first "Ah-hah!" regarding differentiating instruction came through using some of the open-ended tasks in the *Investigations in Number, Data, and Space* (TERC 1995) curriculum. The first-grade program includes work with "How many of each?" problems that pose questions such as this one: "There are eight vegetables on my plate. Some are peas and some are carrots. How many of each could I have?" Children are asked to show their work in pictures, numbers, or words. This sort of question prompted a wide variety of responses, and I realized that an open-ended problem-solving situation allowed both older and younger students to find an appropriate level of challenge.

Travis, a child just beginning to understand quantities and combinations, sat down with crayons in response to the peas and carrots question and drew plates of green peas and orange carrots, then counted them up to determine that there could be five peas and three carrots, two peas and six carrots, and so on.

Maggie approached "How many of each?" problems much like Travis did, by drawing pictures and counting. As she worked on a question about 10 animals, some of which were cats and some of which were dogs, she began to grow tired of drawing so very many legs and whiskers and tails. Before long, Maggie realized that she could use her fingers to find her answers, and she stopped drawing each cat and dog and simply wrote down number combinations with one little cat or dog illustrating each answer.

Sarah had more experiences than Maggie or Travis with formal addition. Therefore, her answers, 5 peas and 3 carrots = 8, 4 carrots and 4 peas = 8, and 7 peas and 1 carrot = 8, took on a more traditional feel.

Megan's work looked a lot like algebra as she created abbreviations in her number sentences. In recording combinations of dogs and cats, she wrote equations like $4d + 4c = 8$ and $5d + 3c = 8$. She could also be pushed to find more and more combinations.

When encouraged to find all the possible combinations for "How many of each?" problems, Sam developed a chart with numbers counting up in one column and numbers counting down in a second column. When other students saw this strategy, it quickly caught on among a small group, and they wound up working together to develop charts for questions with three or more variables.

All of the children in my first- and second-grade group were able to solve these questions in some manner. Younger students made more use of concrete drawing and counting, while older students made use of more abstract equations. Everyone was able to come up with at least one possible combination, but those who were ready could be encouraged to stretch themselves by finding more or all of the combinations.

I found that problem-solving situations could be rich learning opportunities for my students. Maggie, for example, who first drew each dog and cat with whiskers and wagging tails, got tired of repeatedly drawing so many details and had an incentive to test out a more abstract approach. For this sort of student, an open-ended problem can served as a catalyst for developing more efficient mathematical strategies, sparking them to move from the concrete to the abstract. Students also look at the strategies that others are using and adopt those that make good sense, as when others tried out Sam's chart of combinations.

Differentiation through Tiered Tasks

While I found that these open-ended tasks could provide students with rich learning opportunities, I also knew that these tasks alone were unlikely to help children develop computational fluency. In an effort to balance open-ended problem-solving work with practice in basic math facts, I turned to old standbys—worksheets—and new standbys—dice and card games. It was fairly easy to gear these tasks for several different levels, since my math curriculum guides often introduced an activity in the first-grade book, revisiting it on a more advanced level in the second-grade book. For example, I could create an easier worksheet packet by pulling reproducibles from the first-grade *Scott Foresman-Addison Wesley* (Pearson Scott Foresman 1997) lessons on graphing, but I could also create a more challenging packet by pulling from the second-grade reproducibles on graphing.

I was inspired to modify games for a variety of different levels after realizing that *Investigations in Number, Data, and Space* (TERC 1995) first introduces a simple version of the card game "Compare" and later has a more advanced version called "Double Compare." The game, which is similar to the game "War," is played first by comparing the values of two cards, then later with students each drawing two cards and adding the sums to determine which players' cards total a greater value. Other *Investigations* games like "Beat the Calculator" were easily adapted for more or less challenge. Younger students like Travis and Maggie play the game "Beat the Calculator" with simple strings of numbers (2 + 2 + 3), while older students like Megan and Eli play with more complex strings of numbers (14 + 20 + 16 + 8). Sam, who was eager for more challenge, tackled even more challenging number strings (136 + 195 + 214 + 545).

Generally today I set up expectations requiring a minimum level of work from all students. Then I ask a higher level of work from older students and a still higher level of work from those students in search of a greater challenge.

Differentiation through Spiraling-Scaffolded Tasks

With open-ended problem-solving tasks that students can access at a variety of levels and tiered-tasks that provide students appropriate practice with basic skills, it certainly seemed as though I had the issue of differentiation under control. There was only one major hitch. I still had not found a structure well suited to the differentiation of direct instruction in mathematical algorithms. For while a handful of children may be able to develop an efficient strategy for adding multi-digit numbers simply by tackling a sheet of story problems, the vast majority of children benefit from teacher instruction that involves the modeling and explanation of traditional algorithms accompanied by guided practice. It was the question of how to organize direct instruction that had me stymied.

At first I thought that tiered instruction would work for direct instruction as well as independent practice tasks; I would simply teach two lessons to two groups. Unfortunately, that proved to be more complicated than I had anticipated.

When I taught a straight first grade, I would teach a lesson on multi-digit addition to the whole group, modeling the traditional algorithm of combining "ones" and combining "tens." Then I would send everyone off with a set of practice problems. I would circulate about the room, providing extra support to those who needed it. When I began to teach the multi-age group, I assumed that I could use this same framework, simply running two different groups. So I tried to instruct first graders while the second graders practiced and to instruct the second graders while the first graders practiced. It seemed so straight forward! Unfortunately, I had not accounted for those students who needed extra support—the ones who, in a straight-graded class, were getting extra help when I circulated around. Now, while I was trying to teach the second graders, I was also trying to manage first graders who were not able to complete their work independently. Travis was constantly interrupting the group I was trying to teach. If I took a minute to try and help him, the group of students sitting around me would chitchat and lose focus. If I tried to shoo him back to his work or ignore him, his behavior inevitably fell apart. He would be scribbling on his neighbor's paper, starting an argument, or dancing around to make others giggle. Soon I was punishing him, but I knew that this was not fair. He needed help, and I was not offering it. I felt that I was cheating him out of the support that he deserved. Sarah, too, was struggling. While she was not causing disruptions, she was quietly sitting in her seat doing nothing. Knowing that some of these children needed help, I tried to have stronger students help those who were struggling. Travis's comedy routine only became more elaborate. Not only were Travis and Sarah getting nothing done, but now that I was distracted the group I was teaching was distracted and the helpers were distracted. When I compared the experience that students had in my straight-graded classroom with the experience that students were having in my multi-age classroom, I knew that it was not on par. Struggling students in the straight-graded class had been receiving a much higher level of support. Something else had to be done.

Since assigning independent practice was proving unmanageable—and even unfair—I decided that the practice simply had to become part of the lesson. My lesson time with each group became longer, and the work I expected students to complete independently was no longer lesson practice but easier work that students could handle alone. This system was more manageable—Travis's behavior improved—but it still did not seem right. I felt now I had not only dropped the level of support that I was offering to struggling students but also was letting down the level of rigor in the room for all students.

In an effort to meet individual student needs—both those of struggling students and those of advanced students—I decided to throw out the tiered model for use in direct instruction. Instead of differentiating on two levels, I needed to develop a way to meet individual needs. This is how the spiraling-scaffolded task evolved. I decided that I would try teaching one brief lesson to the whole group on material that would be new for some and review for others—multi-digit addition. Then I would allow students who were comfortable to work through problems for independent practice at their own paces. Students who were new to the material or less comfortable with the material could stay with me and would receive extra support in a group. Travis was clearly relieved to be allowed to stay for more support. Sam was thrilled to tackle the work at his own pace. In this way, I was once again supporting my struggling students, and I was providing a degree of independence that my more advanced students seemed to appreciate. As I used this format again on a second day, more students were comfortable working independently, and the group of students who needed teacher support was smaller. On the third day, the bulk of the class was working independently, and only Travis and Sarah remained for extra help. At this point, these two could support each other, so I sent them off to work without me. To my relief, they really were able to help each other through the problems. I was finally able to turn my attention to my more advanced students. Instead of circulating about, I called back the first batch of independent workers, who were ready for more challenge. This group was mostly composed of older students, but there were also a few like Sam who, while younger, were ready to take on something new. Together this group worked on multi-digit addition involving regrouping. In this way, everyone remained engaged with their work, and the level of rigor in the room remained high.

Now when I want to teach using direct instruction and guided practice, I set up a unit of spiraling and scaffolded tasks. For example, in teaching topics like multi-digit addition or subtraction, the whole class, including both the older and younger students, begins seated on the rug. To start, I model solving a math problem using manipulatives and recording my work on the board. Next, I move on to a second problem, but this time the children participate in solving the problem and writing on the board. Then I move on to a third problem, and this time I let the class "teach" me how to do the work. I pretend that I have forgotten what to do next and model typical mistakes. The children know that I am pretending, but they delight in catching my errors and explaining correct procedures!

At this point the more advanced students have been reminded of familiar procedures and cautioned against potential errors, and they have articulated the concepts at hand. They are itching to dive in to this work. Other students may be fairly comfortable with what they have seen but not be ready to tackle it independently, while beginners have simply taken in a broad impression of the concept and are not at all ready for independent work. To ensure that each of the students has an appropriate level of support for taking on a sheet of practice problems, I ask each child to tell me if he or she would like to "stay or go."

Children who choose to "stay" grab a clipboard and a pencil and stay on the rug to work through the problems together at a pace set by the teacher. Children who choose to "go" take the work to their own seats. They are free to work at their own pace, but they are accountable for completing the same amount of work at the end of the period as the "staying" group completes with teacher support. When I first introduce this structure, I am clear with the children that I am not available to help those children working independently. They may whisper questions to each other, or they may return to the rug group. Children who work a few problems on the rug and realize that they are able to work independently sometimes choose to "go," quietly leaving the group for their own seat. These students then solve problems independently, pacing themselves and working either with or without manipulatives. Other students continue to work with the support of the teacher at the teacher's pace. When the whole group has grown able to take on the task independently, I then work on problems involving regrouping with those students who are ready for an additional challenge.

The Role of Choice

Choice is a key element in each of these structures for differentiating instruction. When an open-ended problem is posed to students, they must make choices about the materials and methods they will use to solve the problem. When a tiered task is offered, they must choose work that is more or less challenging. When a spiraling-scaffolded task is used, students chose whether to work independently or with teacher support. Whether a task is open-ended, tiered, or spiraling and scaffolded, choice allows each child to take on an appropriately challenging task and requires that they take responsibility for their own learning.

I usually let the children make these choices, because it allows them to retain ownership for their own learning, setting up a more focused and motivated classroom environment. On occasions where I have told students what tasks to do, I have been met with more off-task behaviors. Travis, whose behavior deteriorated when I originally sent him off to work without support, was able to work well independently when he was able to choose to do so himself.

Most of the time I find that my students make good choices about their level of work. Most students are motivated to challenge themselves intellectually and yet to stay on solid footing. Occasionally, though, children do make choices that I feel are inappropriate. A child might choose work that is too difficult in order to impress a friend or a parent. A child might choose work that is too easy in order to stay with a buddy or indulge in a bit of laziness. As the teacher, I am not afraid to set up some baseline expectations for students when the task is introduced. I might require a certain number of problems be solved or that students tackle a certain level of work. Going above and beyond is always presented as an option.

Conclusion

When I began teaching a multi-age class, it was math that I found so very challenging to differentiate. The resources for teachers on differentiating math instruction are limited, and the publishers of math curriculum guides have yet to create materials that work easily in a multi-age setting. As I sat down to begin planning math instruction for my first multi-age class, surrounded by piles of guide books and state frameworks, I was incredibly overwhelmed. Anyone else who has tried it has certainly felt the same.

I have noticed that many schools with multi-age groupings have given up on differentiated math. In what is most likely an effort to prevent teacher burnout and to keep the quality of instruction high, many teachers of multi-age classes revert to straight-graded groupings for math instruction. If the school has more than one grouping at a particular level, for instance, two first- and second-grade groups, they might send all of the first graders to one teacher and all of the second graders to another teacher. If the school has only one grouping at a level, the teacher might teach the first graders math, while an assistant teaches math to the second graders or the second graders complete busywork.

If the teachers of multi-age classes have given up on differentiated math instruction, what can we expect in straight-graded classrooms? It is interesting to me that so many schools do differentiate their instruction in the context of literacy but not in math. Why is math harder to differentiate? Just as students' reading levels vary widely in both multi-age and straight grade-level groups, their mathematical skills cross a range. Although differentiating math instruction is challenging, is it not best practice? If a school is committed to multi-age education in all other areas, why not in math, too? If differentiation is possible in other subjects, why not in math, too?

Although, I most certainly do not have differentiation all figured out, experimentation with a variety of structures has led me just a little closer to a differentiated math curriculum. I would love to see the publishers of math curriculum materials take on this knotty issue, organizing a program that would account for the needs of broader ranges of learners in a single classroom. I know that differentiation in math is possible—every year I find myself moving toward better practice in this area—but at present there is no curriculum plan making good use of these types of tasks, comprehensively addressing problem-solving, fact fluency, and instruction in algorithms. I would love for teachers to have a single, orderly guide book that lays out a manageable plan for differentiation so that those of us who are committed to accommodating a variety of needs in math instruction might struggle less to make it a reality.

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