Helping Young Children Learn Mathematics: Strategies for Meeting the Needs of Diverse Learners

by Jennifer J. Chen and Linnea Weiland

Dr. Jennifer J. Chen is an Assistant Professor in the Department of Early Childhood Education and Family Studies at Kean University.

Dr. Linnea Weiland is an Associate Professor and Department Chair of the Department of Elementary and Early Childhood Education at William Paterson University.

Ms. Emily's kindergarten class picked up acorns on a walk around the neighborhood. When they returned to the classroom, they put all the acorns into one bucket and counted the large collection together. Later, during small group activity time, Ms. Emily distributed a plastic bag to each child, labeled with a numeral from 1 to 20 and the corresponding number of dots for students who were unable to recognize numerals. Based on her knowledge of each child's number sense, she carefully selected reasonable numbers for each child. She asked the children to work in pairs, to put the appropriate number of acorns into the bags, and to check each other's work. A child with stronger number skills was paired with a child having weaker number skills.

Jason's bag was labeled "9" and Rasheed's bag "18."

Jason tried several times to count acorns, but each time, he lost track and kept counting past 9. Ms. Emily asked, "Jason, can you draw a picture of the 9 acorns to see if it might help?" Jason made circles on a paper to represent the acorns. Then, without further suggestion, he put one acorn on each circle, recounted them twice, and put the acorns into his bag. For Jason, the act of drawing the circles to represent the objects helped him organize the task and create the collection of 9 acorns.

Rasheed counted his acorns easily, putting 5 in each pile to keep track of where he was. When he had made 3 piles with 5 in each, he counted, "5, 10, 15," and added three more, "16, 17, 18." He didn't recount but confidently put the 18 acorns into his bag.

When they checked each other's counting, Rasheed was able to put 5 acorns aside and count from 5 to 9. Jason counted the acorns one by one as Rasheed moved them into a counted pile. By moving the acorns as Jason counted, Rasheed provided needed support to Jason.

Seeing the existing collection before him, Jason could count the 18 acorns with Rasheed's help in keeping track of what was counted. However, creating a collection of 9 from a larger pile posed an organizational challenge. Counting an existing collection is different from creating a collection of a certain number. Ms. Emily provided a suggestion through prompting that enabled Jason to complete the task. This anecdote illustrates the importance of providing developmentally appropriate and active hands-on tasks for children with the accessibility of multiple forms of representation and modes of inquiry. Furthermore, the counting using acorns activity was connected to the children's previous experience of picking up acorns in a familiar context (the neighborhood), which encouraged meaningful learning for them.

Today's early childhood settings are more diverse than ever before. Two phenomena have particularly contributed to this diversity: 1) demographic changes due to a massive influx of children from immigrant backgrounds, and 2) the inclusion of children with learning disabilities. In addition to the ostensible diversity in background characteristics and learning abilities, students also differ in learning styles. Many children exhibit a preference for how they may learn the materials effectively. Some of the most common learning styles are visual, auditory, and kinesthetic. The vast diversity of learning abilities, styles, experiences, interests, and knowledge of children is reflected in early childhood settings. It is increasingly common to find in an early childhood setting a diverse group of children: someone like Jason, someone like Rasheed, and yet others with their unique learning abilities and styles.

Considering the complex diversity in early childhood education settings, teaching children is generally daunting indeed. As daunting as it is, teaching mathematics, which consists of many abstract concepts, especially presents both unique challenges and opportunities for early childhood teachers. It is imperative that teachers provide developmentally appropriate and concrete tasks as well as accessibility to learning experiences in meeting the diverse needs of today's young children. Drawing insights from research and personal experiences of working with teachers and children, we suggest the following strategies for helping young children learn mathematics:

- incorporate children's prior knowledge, experiences, and interests
- demonstrate and encourage multiple forms of representation
  - — demonstrate the same mathematical concept using multiple modes (e.g., symbols, pictures, objects)
  - — encourage children to represent their understanding of a mathematical concept in the manner that makes sense to them
- apply differentiated instruction
- practice flexible grouping
- connect children's literature to understanding mathematical concepts.

Incorporate children's prior knowledge, experiences, and interests

Incorporating individual children's varying prior knowledge, experiences, and interests related to understanding a particular mathematical concept can increase their motivation and make learning more authentic and purposeful for them. Familiar classroom routines (e.g., calendar, snack) provide many such opportunities. For instance, during the calendar routine, the early childhood teacher can encourage a child who anticipates her birthday to count from the calendar how many days remain before her birthday. The teacher can capitalize on snack time to invite a child distributing snacks to figure out if there are enough boxes of raisins for each child in the class. English language learners especially can benefit from using classroom routines to learn mathematics because these activities can help reinforce the learning of new language, especially as they relate to mathematical concepts. Utilizing concrete materials and real-life situations, such as manipulatives for counting and pies for understanding fractions, can also enhance young children's understanding of complex mathematical concepts.

Demonstrate and encourage multiple forms of representation

Children do not only learn differently, they may also represent their understanding in different ways. Recognizing this, it is important that early childhood teachers demonstrate multiple forms of representation of an answer to a mathematical problem as acceptable, and encourage children to articulate their understanding in the mode that is comfortable for them. For example, a kindergarten teacher might ask, "Suppose there are 12 toy cars in my bag. Some are red and some are blue. How many red toy cars and blue toy cars might I have? How could I show this?" Children could solve this mathematical problem using various modes, such as actual toy cars, blocks to represent toy cars, pictures of toy cars, other pictorial symbols, and numerals. The teacher could also expand on the children's solutions by modeling them through these varying modes of representation. Since there is more than one answer to this toy car problem, and many ways to represent the answer, the activity encourages inquiry and promotes thinking.

Apply differentiated instruction

Differentiated instruction has been found to be an effective strategy for improving student learning (Hughes, 1999). Differentiated instruction is founded on the tenet that every child learns differently, and that modifying instruction is an effective way to meet the needs of diverse learners (Tomlinson, 2005). Providing differentiated instruction, however, does not mean individualizing lessons for every student in the classroom. Instead, the instruction allows students to acquire the same concepts and skills but at different levels corresponding to their individual abilities. The teacher can expand the acorn activity described earlier to encourage kindergarteners to apply their familiar strategies in solving addition problems. For example, in solving 9 + 8, a child with only basic counting skills might utilize concrete objects: count out 9 acorns and 8 acorns individually, combine them, and then count the entire collection of acorns one by one to come up with the total of 17. A child with sophisticated number sense might say, "I know that 8 and 8 is 16. Nine is 1 more than 8. Then 16 and 1

Utilizing concrete materials and real-life situations, such as manipulatives for counting and pies for understanding fractions, can also enhance young children's understanding of complex mathematical concepts.

makes 17." A child who has learned about place value might say, "If I take 1 from the 8 and add the 1 to the 9, I will have 10. Then, there will be 7 left from the 8. 10 and 7 will make 17." Applying different strategies in tackling the same problem, these children would demonstrate that the sophistication of the solution process varies as a function of their mathematical abilities.

Practice flexible grouping

. . . flexible grouping focuses on applying flexibility to group and regroup children according to specific learning goals, activities, and needs.

As opposed to ability grouping, flexible grouping invokes a different set of strategies that teachers can employ to address the needs of diverse learners within the regular education classroom. As the concept implies, flexible grouping focuses on applying flexibility to group and regroup children according to specific learning goals, activities, and needs. Thus, flexible grouping is a constant changing landscape that provides children the opportunity to learn in a variety of settings (e.g., whole group, teacher-led small group, student-led small group, dyad, individual) (Chapman, 1995). Within the regular education classroom, flexible grouping has been found to be an effective strategy for teaching diverse learners, such as high-ability students (Hughes, 1999), low-achieving students (Castle, Deniz, & Tortora, 2005), and children in the multiage classroom (Chapman, 1995; Hoffman, 2002). Particularly, Castle, Deniz, and Tortora (2005) found that teachers attributed the positive impact of flexible grouping on student learning to three main factors: 1) achieving learning needs based on focused instruction, 2) sustaining student attention on the instructional task, and 3) boosting student confidence.

Early childhood teachers can also apply flexible grouping to effectively teach mathematics to children. For instance, depending on the learning goals at hand, the teacher can pair a more advanced learner with a child having a learning disability or form groups of children with mixed abilities. The teacher's carefully thought-out dyad grouping of Jason and Rasheed described in the introductory anecdote is a case in point. Sometimes, teachers create groups of children with similar skill levels so that the difficulty of tasks can be varied across groups. Other times, teachers form groups of children with similar interests or 47 experiences so that they can learn about a common topic together.

Connect children's literature to understanding mathematical concepts

Utilizing children's literature in teaching mathematics not only can enhance early childhood learners' understanding of abstract concepts in concrete ways, it can also serve as a vehicle for addressing diverse learning abilities and styles. Children's math-related books have been increasingly incorporated and shown to be effective in teaching mathematical concepts (Forrest, Schnabel, & Williams, 2006; Huber & Lenhoff, 2006; Whitin & Whitin, 2006). The following set of activities based on the children's book, *One Hundred Hungry Ants*, written by Elinor J. Pinczes and illustrated by Bonnie MacKain (1999), demonstrates how teachers can incorporate this book to facilitate children's understanding of mathematical concepts:

In the story, a hundred ants are marching to a picnic and want to get there as quickly as possible. Marching one by one takes a long time, so one of the ants suggests two by two, then four by four, and so on.

After listening to the story, young children can count aloud the number of ants that are illustrated on each page. The teacher models oral counting by twos on the page where the ants march in pairs. By doing this, she provides the opportunity to enhance learning for visual and auditory learners.

When the teacher asks the children to physically become the ants and march one by one and then two by two, she has created a situation that appeals to kinesthetic learners.

To further apply the mathematical concepts from the book and engage children in open-ended mathematical investigation, she could ask questions, such as:

- What would happen if there were 24 ants on their way to the picnic?
- How could you show different ways these 24 ants could march?
- How could you use blocks to show the 24 ants?

When children share their pictorial representations of the situation and describe verbally how they chose to show the ants marching, they are translating the visual into oral language.

By demonstrating their selected arrangements with blocks, and then describing the actions they use to solve the problem, children are again provided with the opportunity to make connection between concrete experiences and abstract concepts.

The activities described above utilize children's literature to enhance understanding of abstract mathematical concepts by:

- providing opportunities for concrete experiences
- presenting situations that maximize various learning modalities
- teacher scaffolding through modeling
- engaging children in open-ended mathematical inquiry and investigation
- promoting both individual and social construction of knowledge.

Conclusion

Every child arrives in the classroom with varying levels of experiences, interests, and knowledge in understanding mathematical concepts. It is incumbent upon the teachers to provide accessibility to learning opportunities that further engage children in learning mathematics at their own individual level and through social interaction with others. Indisputably, the one-size-fits-all approach is a problem in addressing the varying learning abilities and styles of children. Instead, to empower and meet the diverse needs of young children, it is imperative that early childhood teachers motivate and challenge these children at their own individual cognitive level by employing strategies, such as differentiated instruction and flexible grouping.

Early childhood teachers are in a unique position to design experiences for different children to acquire the same mathematical concepts in their own ways. The different approaches to counting by Jason and Rasheed described in the introductory anecdote illustrate this point. Furthermore, as the Chinese proverb goes, "I hear and I forget. I see and I remember. I do and I understand"; it is crucial that early childhood teachers provide a range of developmentally appropriate and child-centered activities to engage different children in the learning process. Not only do child-centered and hands-on activities necessitate active engagement in learning by doing, they also promote interest, exploration, and understanding for children of varying abilities and styles.

Proper adult guidance and positive interactions with teachers and peers can also help children, especially those with learning disabilities, ameliorate frustration and a feeling of incompetence in the face of challenging tasks. It is conceivable that regardless of children's cognitive abilities and learning styles, learning becomes more authentic and purposeful when their prior knowledge, interests, and experiences are considered and when their learning can be applied to their own lives.

Go to: www.ChildCareExchange.com for all the References to accompany this article.

Early childhood teachers are in a unique position to design experiences for different children to acquire the same mathematical concepts in their own ways.

Using Beginnings Workshop to Train Teachers
by Kay Albrecht

You do cook, don't you?: Chen and Weiland point out how cooking correlates readily with mathematical concepts. Do a quick check of teachers' curriculum plans to see who is still cooking in their classrooms. Then, use your observations as a springboard to expanding classroom cooking. Check the teachers' library for resources or order additional cooking idea books from school publishers, and make sure teachers have the tools they need to plan and implement successful cooking experiences such as measuring cups and spoons. Then, plan a staff meeting dedicated to cooking where teachers get to put cooking in the classroom into practice.

Literature!! It's a natural: Ask teachers to bring a children's book to the next staff meeting. Read through the books and find ones that have mathematical concepts. Explore how to expand and extend the mathematical content of the book into the classroom. Then, ask teachers to bring a mathematical children's book to the next meeting. Repeat the reading and extension activity. Consider repeating this idea several times during the program year to keep mathematical learning in teachers' minds, interactions, and curriculum plans.

Practice makes perfect: Use the four other suggestions as practice for teachers to explore improving mathematical teaching. Divide teachers into four groups and ask each group to brainstorm ways to: 1) incorporate children's prior knowledge, experiences, and interests; 2) demonstrate and encourage multiple forms of representation; 3) apply differentiated instruction; 4) practice flexible grouping. Share the ideas generated.

References

Castle, S., Deniz, C., & Tortora, M. (2005). Flexible grouping and student learning in a high-needs school. *Education & Urban Society, 37*(2), 139-150.

Chapman, M. L. (1995). Designing literacy experiences in a multiage classroom. *Language Arts, 72*(6), 416-428.

Forrest, K., Schnabel, D., & Williams, M. E. (2006). Mathematics and literature, anyone? *Teaching Children Mathematics, 13*(4), 216-217.

Hoffman, J. (2002). Flexible grouping strategies in the multiage classroom. *Theory Into Practice, 41*(1), 47-52.

Huber, L. L., & Lenhoff, R. S. (2006). Mathematical concepts come alive in pre-k and kindergarten classrooms. *Teaching Children Mathematics, 13*(4), 226-231.

Hughes, L. (1999). Action research and practical inquiry: How can I meet the needs of the high ability students within my regular education classroom? *Journal of the Education of the Gifted, 22*(3), 282-297.

Pinczes, E. J. (1999). *One Hundred Hungry Ants.* Boston, MA: Houghton Mifflin Company.

Tomlinson, C. (2005). This issue: Differentiated instruction. *Theory Into Practice, 44*(3), 183-184.

Whitin, P., & Whitin, D. J. (2006). Making connections through math-related book pairs. *Teaching Children Mathematics, 13*(4), 196-202.

meet the needs of young children. 3. Respect for diversity, equity and inclusion are prerequisites for honouring childrenâ€™s rights, optimal development and learning.Â Early Learning for Every Child Today includes a tool to support practitionersâ€™ understanding of child development. The Continuum of Development1 is a central component of the framework. It outlines the sequence of skills that children at different ages can be expected to acquire across broad developmental domains (physical, social, emotional, communicaÂ-tion/language and cognitive).