MULTIAGE CLASSROOMS:
A New Way to Learn Math

A recent study reveals how children work together to solve math problems in multiage groups.

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"How did you count those blocks so fast?" seven-year-old Sara asked ten-year-old Dan as she examined the design they had constructed together. Each of the four groups of blocks had one red, one white, and one blue block arranged in a symmetrical pattern.

"I didn't count," Dan responded. "I just saw four groups of three, and I knew that was twelve."

This is not a scenario from a one-room schoolhouse at the turn of the century. Sara and Dan are learning in a contemporary multiage classroom where children of different ages often work together.

What Is a Multiage Classroom?

A multiage classroom contains children who are at least one year apart in age, and the classroom structure is theoretically linked to a concept put forward by Vygotsky (1978), who suggests that there are two developmental levels at which children learn. At one level, children can do things on their own; at the other level, they need guidance. Between these levels is what Vygotsky calls the "zone of proximal development," where children who receive assistance can stretch their learning beyond what they are able to do alone.

Recent research appears to support Vygotsky's theory, and advocates for multiage classroom grouping compare the structure to that of a family, where younger members have many opportunities to observe and imitate the competencies of older members (Katz, Evangelou, and Hartman 1990).

Teachers in multiage classrooms are more likely than those in same-age classrooms to accept a wide range of student abilities. The multiage structure also is better suited to address developmental discrepancies in individual children. For example, an older child who is developmentally delayed in a particular area has the opportunity to enhance his or her self-confidence by interacting with younger peers (Katz, Evangelou, and Hartman, 1990).

Learning Math in a Multiage Setting

We recently conducted a two-week study in four multiage classrooms during which we made daily observations to determine how mathematics is taught in a multiage setting. We were awed by the amount of collaboration and sharing that took place among children of different ages. Children working in small groups were busy sharing materials, ideas, and time. Sometimes the groups consisted entirely of novices, sometimes entirely of more experienced students, and at other times both types were included.

Our observations revealed three types of strategies the children used as they worked together: modeling, tutoring, and pairing/sharing.

Modeling. Just as Dan taught Sara how to calculate the number of blocks in their design, students with more expertise often modeled for others in multiage groups. While Dan was probably unaware that he was serving as a model for Sara when he multiplied four times three, and Sara did not immediately grasp the concept of multiplication, she was introduced to a new way of thinking about numbers.

We observed another example of modeling when Andy, an older child, was asked by the teacher to create a bilaterally symmetrical pattern with blocks.

"How do you know your pattern is bilaterally symmetrical?" the teacher asked him as he began constructing his pattern.

"Because I make one side and then I copy it to make the other side," Andy responded. "Then I know the sides are exactly alike."

In language even the youngest children in the group could understand, Andy had not only defined bilateral symmetry but

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accurately described one way to construct such a figure. When the teacher suggested to the others that they also make bilaterally symmetrical patterns, Andy assisted a younger classmate with the task, moving from the role of model to that of tutor.

Tutoring. We often observed children who had mastered a concept helping those who had not. For example, in a group of children working with coins, the teacher's goal was to introduce the various coins and their denominations to some, while those already familiar with the value of each coin learned how to make change.

David, to whom the concept of coin value was new, caught on quickly. After creating different coin combinations to equal 25 cents, he became very interested in making change. Leslie, who had been practicing making change, began to teach David how to do it. In the process, Leslie not only got needed practice but the satisfaction of knowing that she had helped David learn something new.

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Math Standards and Multiage Learning

The national mathematics standards for K–12 schools, developed by the National Council of Teachers of Mathematics (1989), establish five general goals:

1. That all students learn to value mathematics;
2. That they become confident in their ability to do mathematics;
3. That they become mathematical problem solvers;
4. That they learn to communicate mathematically; and
5. That they learn to reason mathematically.

According to the Council, "students should be exposed to numerous and varied interrelated experiences that encourage them to value the mathematical enterprise, to develop mathematical habits of mind, and to understand and appreciate the role of mathematics in human affairs." Students are also "encouraged to explore, to guess, and even to make and correct errors so that they gain confidence in their ability to solve complex problems."

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Pairing and Sharing. We observed one multiage classroom that makes a daily practice of sharing student-created math problems.

For example, here was Dana's problem: Her parents had told her she could buy a T-shirt that she wanted if she saved her money, but she needed to determine how much it would cost after adding the sales tax. Julie, only 7, was fascinated by Dana's problem. Although she had no knowledge of how to compute fractions, she paired with Dana to find a solution.

"My dad says that the lady will add six cents for every dollar that my shirt costs," Dana said.

"How much does the shirt cost?" asked Julie.

"It costs $9.99," replied Dana. "That means we have to add up six cents nine times and we'll have 99 cents left over. I don't know how much tax they charge for 99 cents."

As Dana verbalized her thinking, Julie began writing the number 6 nine times. Dana added them quickly, got 54, then added that number to $9.99 to get $10.53. With the teacher's assistance, they then added another six cents to come up with the answer to Dana's problem: The T-shirt would cost $10.59.

While such cooperative strategies might also be observed in single-age classrooms, the multiage setting seems to *invite* collaboration and sharing—creating an environment which supports the goals of the math standards established by the National Council of Teachers of Mathematics (*see box, p. 24*).

As we observed children of different ages sharing their thinking about solutions to math problems, it was apparent that multiage grouping provides students with opportunities to learn from each other. □

REFERENCES

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