The numbers just get jumbled up in my head." Renee, a sweet six-year-old with huge brown eyes, described her frustration this way. Not being able to make sense of the number system can be debilitating to children in the early grades. Instead of continuing to struggle with addition, subtraction, and multiplication, Renee needs help to understand fundamental concepts of the number system. She needs to know such things as why, on the hundred chart, 27 is directly above 37 and below 17. She needs help before she falls farther behind and loses more ground on her self-concept and number sense.

Vast differences exist in the mathematical knowledge of students when they begin the first year of school (Baroody 1987; Wright 1991). Students such as Renee who are among the least advanced in their classes tend to remain so throughout their schooling and often give up on mathematics (Wright 1994a). Low-attaining students begin to develop strong negative attitudes toward school and mathematics. Early intervention is essential so that they can begin to recover some of the gap between their own knowledge and that of their average and above-average classmates. Thinking hard and focusing in a group is very difficult for these young students (Clay 1993).

What Is Math Recovery?
Math Recovery is an early intervention program that seeks to provide the kind of help that Renee needs. Similar to the Reading Recovery program, Math Recovery was developed in Australia by Robert Wright of Southern Cross University (Wright, Martland, and Stafford 2000). Development of the program drew substantially on the constructivist teacher experiment research that Leslie Steffe at the University of Georgia conducted (see Steffe and Cobb 1988). Identified six- and seven-year-old children such as Renee are pulled out of their regular class to work one-on-one with a specially trained teacher for thirty minutes per day, four days per week, for twelve to twenty weeks.

The Math Recovery program features the use of current research on how children best learn mathematics, intensive professional development and support for specialist teachers, and individualized
The lesson is built from the child to the activity rather than from the activity to the child.

Teachers use Learning Framework in Number (LFIN) (Wright, Martland, and Stafford 2000) to analyze the in-depth assessment interview. In Math Recovery, LFIN is regarded as spanning the number, or early arithmetical, development typical of children four to eight years old. The key to Math Recovery is the analysis of the assessment, which gives direction to teaching. Ongoing analysis of assessment tasks is always the basis of teaching.

Children usually progress through up to five arithmetical strategies stages from preschool to second or third grade. Stage 0 children cannot count a collection of objects even when the objects are directly in front of them. Children at Stage 1 can count objects only when they can see and touch them. Tasks designed to help children move from Stage 1 to Stage 2 involve uncovered counters initially progressing to as many as five covered counters.

At Stage 2, children count to find out the total number of objects in two separate collections. The teacher briefly displays and then screens the collections and tells the child how many are in each. When the teacher presents a task such as $3 + 4$ as two covered collections, Stage 2 children will count from one rather than count on from the number in the first collection. Fact families are covered in Stage 3, which is at or above the average for most first-grade children.

At Stage 3, children can count on and count down from to solve addition and some subtraction tasks. The strategy of “counting down to” emerges at Stage 4. Children at Stage 5 have developed a range of strategies other than counting by ones (Wright, Martland, and Stafford 2000).

Once a child has been identified as a candidate for the Math Recovery program, the teacher designs a special program for him or her. For example, Renee’s program would consider her current stage and levels of knowledge relating to number words and written numerals. The Math Recovery teacher must draw conclusions about Renee’s thinking and continually monitor her willingness to solve problems. A typical session includes activities that challenge Renee to increase the level of sophistication of her strategies (Wright et al. 2002). Her teacher begins with a lesson plan that involves four to six tasks that change as Renee progresses. Renee’s understanding determines the way in which the thirty-minute sessions develop.

The major teacher focus of the program is a paradigm shift; that is, the lesson is built from the child to the activity rather than from the activity to the child. Therefore, the Math Recovery teacher begins with potential tasks and settings but the child’s responses influence the teacher’s questions and may change the direction of the teaching or task and the use of the setting (Wright, Martland, and Stafford 2000). Math Recovery teaching sessions are planned to be intensive. The rewards are intrinsic; achieving success after thinking hard for a sustained period of time is a very positive experience for children. Wright et al. (2002) address the teaching tasks for the thirty-minute lesson and the instructional framework.

Professional development gives Renee’s teacher the ability to custom-design Renee’s instruction. Intensive training of Math Recovery teachers is one of the strengths of the program. Prospective Math Recovery teachers are trained in two graduate-level courses that introduce them to the theoretical basis of the program, the instructional techniques and strategies, and the videotap-
ing aspects of the assessment. All Math Recovery sessions are videotaped in order to ensure that they integrate assessment and teaching.

The trainers provide ongoing in-service training in which the Math Recovery teachers engage in discussions and examination of professional practices by reviewing videotaped segments of assessment and teaching. Teaching support also is available for the Math Recovery teachers if they need it. This training can impact how teachers work with all children, not just children in the Math Recovery program. As one Math Recovery teacher explained, “If I ever go back into the first-grade classroom, I would definitely change my methods of teaching.”

Use of the Math Recovery program has been growing in the Carolinas and in England since 1995. The program features one-to-one teaching as well as classroom and small-group adaptations and applications. By June 1998, thirty-three specially trained Math Recovery teachers in North Carolina and South Carolina had served four hundred twenty-five children. By 2002, implementation had extended to twelve states.

An Experiment

In school year 1998–99, one of the authors conducted a pilot study of the effectiveness of Math Recovery in upstate South Carolina. The sample in the study included two elementary schools in the community, one of which had a Math Recovery program and one of which did not. Twelve Math Recovery students at one elementary school were compared with ten counterparts, matched by arithmetical strategies stage, at the elementary school across town. The students at both schools were assessed three times, once at the beginning of the first grade, again at the end of the intervention, and finally at the end of the year. Their mean stages were compared both within groups and between groups.

The educational background and amount of teaching experience among faculties at the schools were similar. The school with the Math Recovery program, however, had significantly more minority students and a lower socio-economic status. The achievement of the students at the two schools, as measured by standardized test scores, was about the same.

The two groups of children in the study reflected the significant difference in the ethnicity of the schools. At one school, four of the twelve children in Math Recovery were Hispanic and three of them were ESL, whereas all the children at the other school were Caucasian.

This study had a number of limitations, including the small number of children involved. Only twenty-two children were studied—twelve at one school and ten at the other. The students were not chosen at random, and they were from two different communities and two different schools.

One might argue that any individual tutoring program is better than none and that a better study would compare Math Recovery to a different one-on-one program. No comparable program existed in the area, however. Results that show the efficiency of the Math Recovery program show not that more effective programs cannot exist but that Math Recovery can make a difference. A discussion of the results follows.

Did the Math Recovery children experience greater gains in the arithmetical strategies stages than their counterparts?

At the beginning of the program, the control group was significantly higher in arithmetical strategies than was the Math Recovery group (t = –2.162, p = .043), but at the end of the intervention, the Math Recovery children significantly outperformed the control group (t = 2.827, p = .01). Between the two groups, the two means are t standard errors different. The p-value is the probability that we would see such a value if there is no difference.

Viewed another way, the experimental group made significant gains in arithmetical strategies (t = 5.451, p = .000) during the period of the intervention and the control group did not (t = 2.000, p = .343). For the differences within the groups, the mean is t standard errors away from 0. Although both groups continued to improve after the intervention, the improvements were not significant for either group (t = .166 and p = .104, respectively). See figure 1 for the groups’ mean arithmetical strategies stages.

Each child in Math Recovery had the advantage of a program designed especially for him or her by a teacher who had been trained to use instructional strategies based solidly on current research on how children best learn mathematics. The children were given adequate “think” time, which enabled them to concentrate and to reflect on the results of their thinking. This, in turn, helped them reorganize their thinking and develop strategies that were new and more advanced than their former strategies.
The Math Recovery teachers constantly monitored the children; they did not waste time on “wrong” conclusions or practicing incorrect procedures. When conclusions were wrong, the teachers allowed the children to see the task uncovered, thereby giving them a chance to validate their answers. The next teacher-directed task also might be restructured to provide a scaffold to the problem. Because the tasks were not written, the teachers could easily change the size of either of the collections. One of the Math Recovery teachers explained in the interview, “Math Recovery is not a paper-and-pencil activity. It accepts the way a low-achieving child works through a problem. Instead of saying, ‘This is how you do it,’ the child is able to construct on his own until he gets the answer.” A Math Recovery program designed especially to meet their individual needs clearly made a difference for these children.

**Figure 1**

*Arithmetical strategies stages*

The mean arithmetical strategies stage of the Math Recovery students was significantly lower at the beginning of the intervention and significantly higher at the end of the intervention ($p < .001$).

![Arithmetical strategies stages chart](image)

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*Had the children maintained these gains at the end of the year?*

At the end of the first semester, the Math Recovery children assumed the same schedule as their “average” peers. They were no longer “pulled out” of class for special assistance in mathematics. Back in the classroom full-time, without one-on-one help from their Math Recovery teachers, the children continued to experience slight gains in the arithmetical strategies stages.

One of the classroom teachers said, “At the beginning of the year, Kristin [not her real name] had absolutely no concept of numbers. I mean, she was really confused. I was really scared about her; I knew I would never be able to spend enough time with her.” In the interview at the end of the year, Kristin’s teacher said she was “doing amazingly well.” Other teachers characterized their Math Recovery students as “on grade-level now.” The results indicate that the Math Recovery students had maintained these gains at the end of the year. Their report cards confirmed that they had continued to progress satisfactorily. Overall, the mathematics grades of the Math Recovery students were slightly higher than those of their counterparts. Chi-square tests revealed, however, that the difference was not significant.

*Are the children able to use these more sophisticated thinking strategies successfully in the regular classroom?*

The Math Recovery teachers said the children became more expressive, self-confident, and mature. The classroom teachers saw carryover into the regular classroom in a variety of ways. One teacher said that the students’ explanations of their answers pleased her the most. The children were mostly silent at first but became much more expressive by the end of the program. They were better able to explain their thinking. Another classroom
teacher added, “When they get that one-on-one help and it clicks, then they love it when it comes time for math. They know it’s something they can do and I can see a whole different attitude.”

Individual attention helped the Math Recovery students gain confidence in their own abilities to do mathematics. As one student said, “I could figure them [questions] out easier. I didn’t have to wait and spend all my time thinking about one question.”

**Conclusion**

Math Recovery is both a professional development program for teachers and an improvement program for students. Using videotaped lessons and reflective journals helps teachers improve their teaching. The ongoing assessment of children provides focus for both the students and the teacher. As Williams (2001) notes, “Teachers self-reporting indicated that the year-long Math Recovery staff development had significantly influenced their knowledge base about the stages of arithmetical learning; their understanding of individualization of classroom practices and their teaching had become more consistent with constructivist theory” (pp. 388–94). The program’s instructional strategies and staff development have direct application for the classroom. Using individual assessments in classroom teaching gives classroom teachers a good view of each child’s development in arithmetical stages and numerical reasoning.

The Math Recovery program gave twelve children the opportunity to recover at least some of the distance between themselves and their peers who had moved ahead of them. Some children find it difficult to learn in a whole-class situation. Math Recovery is different. The program’s tasks are not paper-and-pencil activities; instead, every session uses verbal tasks. The sessions establish an atmosphere of thinking in which each child must reflect on and explain his or her thinking. Most important, children have time to construct the meaning of the mathematics for themselves.

One-on-one programs are quite expensive, and Math Recovery certainly is no exception. The equivalent of two full-time teachers spent half a school year working with only twelve children in one subject area. Has it been worth the expense? These twelve children, their parents, and their teachers think so. The program might have prevented academic, emotional, and even behavioral problems that could have occurred as a result of low self-esteem. Ideally, all children would have access to an effective recovery program when they start to fall behind, whatever the cost.

**References**


