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Using African American Students' Preference for Working in Self-Selected Partnerships to Promote Math Achievement

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EDITORS' INTRODUCTION

Researching in the area of mathematics, Melton focuses on her fourth graders' struggles in accessing the content and their desire to work in partnerships. Although they appease her students, these partnerships cause greater frustration for Melton, and spur her to further analyze classroom interactions. Employing a "fishbone" diagram, Melton is better able to determine the source of difficulties that continue to arise. Using the insights gained by employing this tool, Melton looks at her data (videotapes, observations and field notes, student work, and her teacher research journal) through a different lens in order to more

appropriately address the issues with which the classroom community is struggling.

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When I began my action research, I had been teaching at Lincoln Elementary School for almost six years. Lincoln is a third- through fifth-grade school paired with Midvale Elementary School. Students from the two attendance areas attend Midvale for kindergarten through second grade and then attend Lincoln for third grade through fifth grade. The two schools' diverse student populations reflect the strikingly different neighborhoods in which the schools are located. Households in the Lincoln neighborhood are predominantly low-income, while households in the Midvale neighborhood are middle-income. Lincoln and Midvale are the most racially diverse in the Madison Metropolitan School District, with each containing almost equal numbers of minority and nonminority students. Of the 340 students at Lincoln, 35 percent are Black, 8 percent are Hispanic, 7 percent are Hmong, 49 percent are White, and 1 percent are Native American. The total number of students who enter and leave during an academic year is equal to 29 percent of the enrollment; this is considered high for the district.

I became interested in classroom action research as a way to examine my own teaching, with the goal of improving the achievement of those of my African American students who were more than a year below grade level in math. I was teaching fourth grade at the time. The racial composition and achievement level of the students in my class was typical of the school as a whole. About half the students lived in each of our attendance areas. Half were minority students. The students who were having the most difficulty learning math in my class were African American. The students who were most advanced were White. Some students from both racial groups were making average progress. Most of my African American students who had previously attended schools in other school districts viewed themselves as successful in tasks that required memorization, but not in problem-solving tasks. These were the students whom I wasn't reaching, my target students. They used but did not understand algorithms, preferring rows of problems on worksheets to discussions about problem-solving strategies. These students had no number sense and no other strategies for solving problems. They were not able to do math with understanding. I had learned from my professional development that understanding was the foundation of mathematics education. Students who understand what they know are able to use that understanding to solve problems and learn new ideas (Fennema & Carpenter, 1993). Some of my students did not have experience constructing meaning in math.

They were not used to talking about numbers and relationships between numbers. In order to construct knowledge, these students would have to be active participants in their learning. My teaching had to be based on student thinking, not just on a text or grade level.

I believed that helping my students construct knowledge would prepare them for higher-level math classes and algebra. This was in alignment with the philosophy of our school district, which was moving away from elementary math based on computation skills to instruction based on supporting students' growth of understanding.

One of the interesting observations I have made in recent years is that most of my African American students like to work with partners in math. Working together could be viewed as peer coaching between two active learners, or as one person learning while the other watched passively. My study of multicultural teaching influenced my view that this preference might be due to a stronger emphasis on community between African American students than between White students, who were more comfortable with an individual approach to learning. Whether working together was a cultural preference or simply an expression of friendship, I wondered if I would be more successful organizing my teaching in math around this learning style. So my two-part question became:

How can I apply my African American students' preference for working in small, self-selected partnerships to help them become active learners and problem solvers in math? How can I evaluate the effectiveness of these partnerships in promoting individual student achievement?

BACKGROUND

When I began meeting with the teachers and facilitators in my action research group, I was perplexed by the lack of progress I was seeing in some African American students' problem-solving abilities. It was important to me that students do more than memorize facts and algorithms. My goal was to help students develop understanding of operations and numbers. The questions I posed to them and the activities I used to change how they thought about numbers frustrated these students, who had reached fourth grade without developing basic number sense. First of all, they didn't see anything wrong with the way they understood math as solving computation problems with standard algorithms. Second, they were embarrassed when I asked them to use concrete models to represent their understanding, even though this was a general expectation in my classroom. Many of my students struggled with place value. They didn't know how to break numbers apart. Given a story problem to solve, they

didn't know where to start. They tried to use algorithms that they understood incompletely. Even though these gaps in math understanding indicated a need to go back to a more basic level, I felt pressure to prepare all my students for standardized tests and fifth grade. There had to be a way to move struggling students forward while respecting their diverse needs.

I was unsure about my ability to measure whether or how my teaching of problem solving was effective in getting kids to think and be active problem solvers. Many students seemed to want to get the right answer without having to think about it. They were motivated to learn to duplicate a process or algorithm instead of understanding the process and inventing their own algorithms, which was faster. I knew that some students lacked the fundamental number knowledge that they needed to do what I was expecting, based on my understanding of math learning. However, I was unsure of how to assess how well students were moving from one level of understanding to another. There was no curriculum for what I was trying to do. On the advice of a district consultant, our school had moved away from using a text. Teachers were expected to formulate their own curriculum based on their students' needs. I had to decide on my own when the class was ready to go on to the next concept and, at the same time, keep in mind the progress of each student. There was no scope and no sequence. I was uncomfortable about the lack of a plan for showing parents and students that specific goals had been met.

Another factor in my decision making was the students themselves, including their life experiences, background knowledge, and ideas. The students were my teaching partners. The students in my target group were resistant to changing how they thought about math, but they were motivated by the opportunity to work with a partner of their choosing. Observing their continued preference for partner work, I wondered if by honoring this preference I could create a situation in which they would be drawn into the activities that would help build their understanding. I briefly considered whether simply switching to a direct, prescriptive approach with less emphasis on constructing knowledge would create more equal opportunities for all my students to be successful.

My own sense of success as a teacher was tied to my students' success. If a system of students working with partners in math could help me meet the needs of the diverse learners in my classroom, I could feel more positive about my teaching. It was worth a try.

THE BEGINNING: COLLECTING DATA

The challenge for me was to support the preferred learning style of my African American students and make it beneficial to their learning. In the

fall, interest in working with partners was not limited only to African American students. Nor did all those students prefer to work with partners. While I encouraged students to work with partners and in cooperative groups in a variety of contexts, I was less confident about math. I wasn't sure that allowing students to work together on math problems would result in more learning for students who were struggling. For these students, I suspected, the effects of partner work would be neutral or negative if I did not intervene.

After a few sessions with the action research team, I began data collection by noting the positive and negative effects of students working with their preferred partner or partners. On the plus side, students looked forward to math. They were motivated to finish assignments. Three boys who were working together literally dove into their work. What these boys accomplished during the problem-solving work time was perhaps less positive. The more opinionated and confident of the three argued with the other two about strategies. Usually the less dominant boys gave in to him, even when he was wrong. When they worked without him, they were more open to learning, constructing their own understanding and explaining it.

Two of the girls who worked together seemed to confuse each other. One tried to show the other how to directly model a multiplication problem, but the first girl thought the model was unnecessary. She had a somewhat better understanding based on her knowledge of facts, but she was confused about applying the facts to problem-solving situations. Over the first few weeks of my action research, whenever I gave these girls challenging problems they would wait for help from me, find someone from whom they could copy ideas, or struggle with computations they thought would help, regardless of whether the algorithms or numbers they used fit the facts of the problems.

Two other girls were initially more successful. They both had good knowledge of facts and communicated their strategies, even if it took a great deal of time. When the tasks were easy, they used counting materials to model the numbers in the problems, drew diagrams of their work, and wrote appropriate number sentences. With more complex problems, one girl became frustrated and gave up. Her partner worked ahead without her. Another set of partners, one an advanced math student, the other not, talked a lot about their work and explained it to me very well. When they worked apart, it was apparent that only one of them could solve problems independently.

Partners working together in math class had many of the same issues as individuals working independently: some finished early, some needed much more time, and some were hesitant to begin. Although I was concerned about many issues, the students were solidly in favor of continuing the practice of working together.

FIRST REFLECTIONS

After my early observations, I wrote and reflected. I knew that there were problems with partner math. How could I define what was and wasn't working?

First I made notes of when and how partnerships worked in other areas of instruction. They worked well in story writing. Sometimes this was parallel work, during which the students just sat together and occasionally shared what they had written. Another story writing approach was collaborative in nature, with one person recording the other person's ideas and the two students taking turns writing and thinking. Unless students were required to work independently, they almost always completed worksheets with a friend. Students also read the weekly newsmagazine together and helped each other with the questions on the back page. Partners or small groups of students working together usually did social studies research projects. This was most successful when each student was assigned a role; otherwise, one person did the work while the other observed.

I was noticing that these forms of collaboration provided students with a measure of security and empowerment. They also reduced isolation and competition in the classroom, which was a benefit to the classroom community as a whole. What seemed to be lacking was a structure to ensure that one partner wasn't passively observing while the other partner did all the work. I just didn't know what form the structure would take.

THE INITIAL SURVEY

I wanted to find out if my observations that the students preferred working with partners could be substantiated. At a class meeting, I told the students about my research and asked them to help me collect data. They responded eagerly to the following three questions:

1. Do you like working with a partner? Why?
2. What subject do you like to work on with a partner?
3. Do you think you have learned something from working with a partner? What have you learned?

As I expected, the responses confirmed that my students liked working with partners in math. Only one person said she didn't want to work with anyone else. Two students said that they best liked working with partners in science. Another liked working with a partner best in writing. Comments about what they had learned from their math partners included: "learned how to use cubes," "it's easier," and "learned how to do division a different way."

I now had two types of data: observational notes that I had gathered while teaching, and survey results. I also kept a reflection journal. This was where I periodically reflected on and analyzed my teaching and my data. I felt confident that I was making progress. One of our action research facilitators told us, "Data can be information that is your friend." Although that statement seemed self-evident, applying it to action research helped me better understand the power of data from my own practice. I had forgotten just how much information I could gather from analyzing my actions and observing my students' actions. I observed and reflected every day, but there never seemed to be time to really think about the changes that I needed to make based on those observations. Instead it seemed that the observation of a problem led to a plan made in haste instead of a lasting solution. The idea of collecting more data and taking the time to relate the data to effective teaching was very appealing. Teachers in my school who had completed action research projects agreed.

My next step was to make a list of opportunities to collect more information about my class and target students, including videotaping students as they worked, interviewing students to find out what they were thinking, and doing individual assessments of my target students to find out if they understood the concepts they had worked on in partnership groups.

DEEP TROUBLE

While I continued relying on partners to enrich each other's math experience, my observations led to concern about the progress students were making in math. Looking back, I see that the students' difficulties had a variety of causes. These included the students' learning styles, the fact that I did not give specific directions about how they should accomplish partner work, my erroneous assumptions about students' prior knowledge, and my lack of effective interventions for students who were just beginning to develop number sense.

As I observed the whole group sharing problem-solving strategies, I noticed that when a student in my target group explained her or his strategy, she or he was very involved and confident. When other students explained their strategies, some of my target group students didn't even listen or try to follow along. In summary, the target group students weren't learning new strategies from their classmates during either partnership work or whole-group sharing. Participation increased when students were required to record strategies as their classmates shared them and to explain what they understood about those strategies. Yet some students were still disengaged from the process.

In December, my informal assessments showed that partner work was not aiding students' acquisition of number sense. Six of the students, when working on their own, weren't consistently able to add two-digit numbers correctly. It didn't matter that they had learned the standard algorithm. They were unconcerned about the columns of 1s and 10s. They didn't connect the use of concrete objects that represented the groups of 10 with the use of columns of numbers that provide an abstract representation of numbers of 10s and 1s. This showed me that some big gaps in understanding base-10 concepts still remained. It also indicated to me that my students had been "doing math" without actively thinking about it.

My best plans for listening in on partner work and recording conversations were thwarted by the realities of having to instruct, help, and answer questions as well as give positive feedback. I found myself running around the room so that I could encourage everyone and then getting caught up helping one or another group for a longer time.

PULLING BACK

I eliminated partner work for the rest of December. Students worked independently or as one group. I put more focus on individual learners.

I remained committed to my action research question. It seemed apparent that my enthusiasm for the question had led me to neglect the need to develop a well-structured framework for answering it. I knew that I needed such a framework; I just hadn't progressed far enough in my own thinking or found the time to put it together.

MORE REFLECTION

It was time again to reflect. In the past, journal writing about my students helped me to clarify my thoughts and led to much-needed insights. So I

began with more journaling. I also wanted to try out the problem analysis strategies we had learned in our action research seminar.

Writing led me to realize that my target group still wasn't defined. Although my action research group leader's advice was to target only a couple of students, I thought all my African American students could be my group. Then I decided to include all students of color, and then I decided to include all my students. But I realized that this would be unworkable. I couldn't collect data on everyone and still stay focused on my research question.

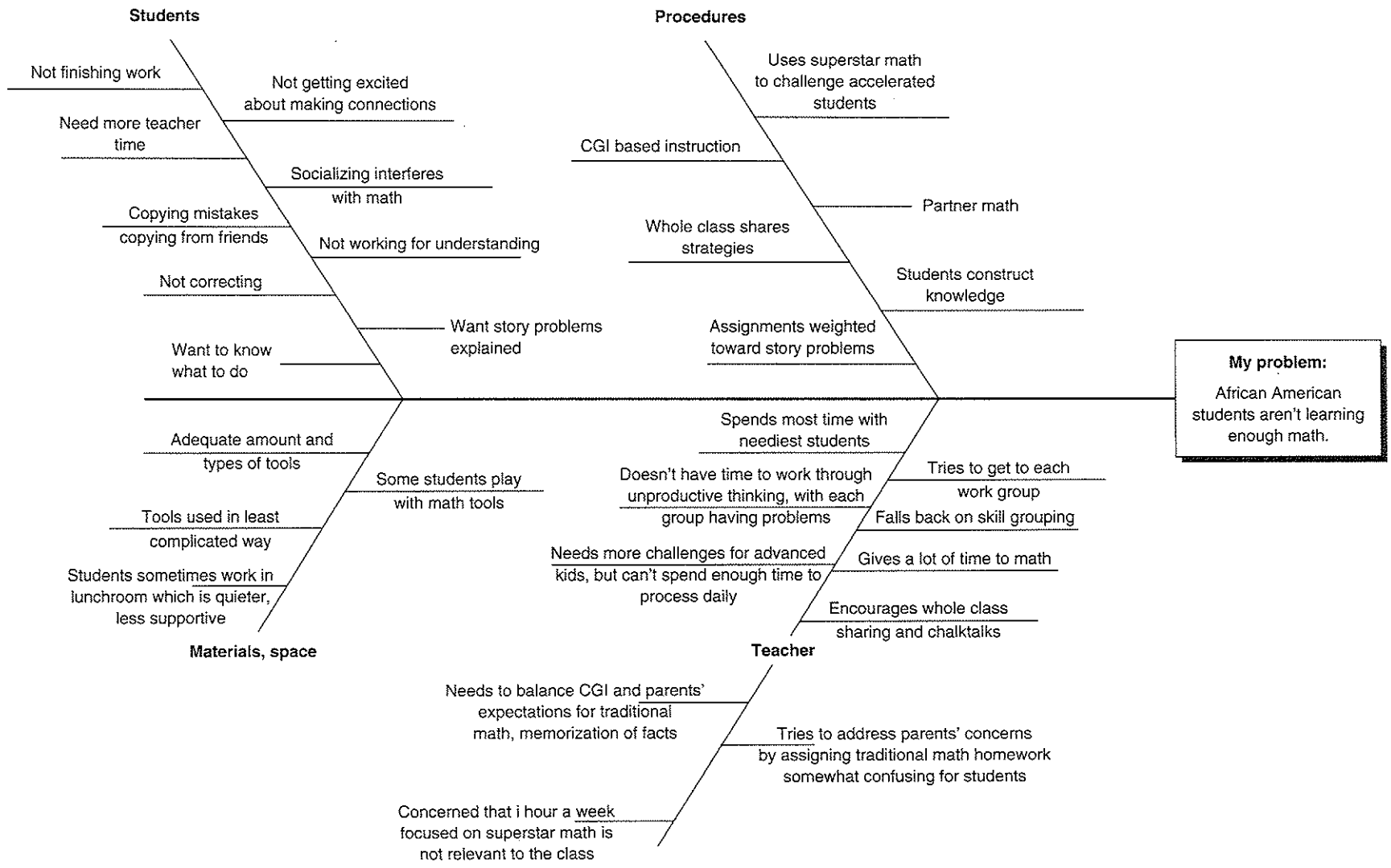
In addition to the problem of my lack of clarity about the target group composition, I noticed that I had been directing an inordinate amount of my time and energy toward one particular student. This student was undermining the whole notion of partner activity and risk taking in a nurturing environment by intimidating his partners and other students in the class during math. With the help of materials from a special education teacher who worked with emotionally disturbed students, I planned to look at his behavior, then set up a course for effective intervention. In the meantime, we were all distracted by his behavior.

I wanted to be ready with a new plan to present to the action research group in January. I was feeling inadequate. The students who needed to learn the most were not learning from my methods. They weren't making progress equal to that of some of their peers.

TIME TO THINK

During winter break, I was able to see the problem more clearly through the use of a problem analysis tool called the "fishbone." The fishbone is a graphic organizer for seeing cause-and-effect relationships. I used a fishbone diagram to define the parameters of the problem, which was essentially that my African American students were not learning enough math. The fishbone framework helped me organize all the information I had about the conditions in my math class that contributed to the problems my students and I were having. These conditions, causes, and effects fit into four categories, which became the "bones" of the fish. I now had a framework for cataloging all issues that needed attention, including problems with partner math. The fishbone also helped me focus on the items I could change. It became a document to guide my data collection. See p. 240 for the fishbone diagram.

The process of creating the fishbone diagram helped me identify a critical factor that I had ignored, which was that I had only vaguely defined my academic and behavioral expectations for partners. Students needed


Students
Not finishing work
Not getting excited about making connections
Need more teacher time
Socializing interferes with math
Copying mistakes copying from friends
Not working for understanding
Not correcting
Want story problems explained
Want to know what to do
Procedures
Uses superstar math to challenge accelerated students
CGI based instruction
Partner math
Whole class shares strategies
Students construct knowledge
Assignments weighted toward story problems
My problem:
African American students aren't learning enough math.
Adequate amount and types of tools
Some students play with math tools
Tools used in least complicated way
Students sometimes work in lunchroom which is quieter, less supportive
Materials, space
Spends most time with neediest students
Tries to get to each work group
Doesn't have time to work through unproductive thinking, with each group having problems
Falls back on skill grouping
Needs more challenges for advanced kids, but can't spend enough time to process daily
Gives a lot of time to math
Encourages whole class sharing and chalktalks
Teacher
Needs to balance CGI and parents' expectations for traditional math, memorization of facts
Tries to address parents' concerns by assigning traditional math homework somewhat confusing for students
Concerned that i hour a week focused on superstar math is not relevant to the class

defined criteria for success. I needed to be explicit in my expectations. After more reflection, I was able to list all the behaviors and goals that seemed intuitive to me but not to the students. The list was lengthy:

- Stay with the group.
- Use an "indoor" voice.
- Discuss the problem.
- Determine what is being asked.
- Take turns giving ideas.
- Take turns explaining the strategy.
- Instead of telling me you don't get it or the problem is too hard, say, "Does this mean?" or "Could we do this?"
- Make an estimate of the answer (using number sense).
- Take risks.
- Use time for math instead of socializing.
- Practice explaining the strategies and understandings.
- Record (on one piece of paper, if possible) how the problem was solved.
- Ask yourself, "Does this answer make sense?"

How could I share these ideas with my students in a way that was understandable and motivating to them? What next step would invite them into the process and build ownership in defining successful partner work?

Another issue that the fishbone diagram helped identify was that the students in my target group did not seem to learn by listening to or observing others. I recalled and later confirmed the fact that three of my students absolutely ignored math sharing when other kids were explaining strategies. They even ignored me, unless I was working with them one on one. This was a danger sign that called for an immediate response. I decided to do more direct teaching and to tutor the target students during our Drop Everything and Read (DEAR) time. While this independent reading time was very important, it was the only time available; doing math during recess time, before school, or after school was considered a punishment, not a help.

TALKING TO MYSELF: MORE REFLECTION

Our action research group met during the first week in January. As we shared what we had done since the last meeting, I put into words some of

my insights. Partners and student-formed groups were not supporting the learning that I expected in math. I had decided that it was necessary to combine partner work with other teaching strategies: whole-group instruction, math fact memorization, math sharing, individual tutoring, and afterschool math club participation. I shared my plan to give students a clearer explanation of how to work together.

The discussion in the research group prompted me to think more about how students see themselves. Maybe some of them didn't perceive themselves as active learners. Perhaps they needed more encouragement to define themselves as learners rather than as vessels to be filled with knowledge (facts and procedures) or simply as doers. I wanted to communicate to them that doing wasn't learning if they weren't thinking about making sense of what they were doing. One of the research group members reminded me that the copying that some students interpreted as doing and learning was likely undermining their confidence as well as their understanding.

I began to wonder about the role of the feedback I was giving students when I complimented them on their work together. Was I validating the behaviors I wanted to see? Or was I rewarding finishing over thinking? Was I rewarding the product instead of the process?

I thought more about the process of learning in math. What was math thinking? Why were some students more successful than others? Could I justify going forward in a curriculum-driven track when I knew that some children didn't have basic understanding? I kept thinking about grade-level expectations.

One of the underlying issues for my students was self-respect. Many of my African American students seemed to feel threatened by a system of learning math that wasn't giving them a chance to show what they knew. They asked me, "Can we do multiplication facts?" or said, "Let's do 'Around the World'" (a competition to see who can say a math fact first). Usually I didn't want to spend time on this game, even though students often requested it. Now I was realizing that some students had been waiting all year to be able to show that they had memorized their "times" tables at a previous school. My constant prodding to think and problem-solve with understanding was frustrating them and possibly eroding their self-concept. They wanted the facts, just the facts. One boy borrowed flash cards from his third-grade teacher so that he could use them in class. I bought a set for the class. Another student frequently asked for "regular" math problems. They were saying, in effect, "Enough of that 'Show me' and 'How did you get this answer?' and 'What does this problem mean?'" My target students were really sick of it.

I began to wonder if an underlying issue was my emphasis on solving word problems. Was there something wrong with my problems? Was my instruction culturally biased toward brainteasers and mental gymnastics

because I was successful at doing them? Did my problems require kids to have middle-class vocabulary to talk about math and the ability to navigate across cultures as they struggled with basic math concepts? If my instruction was disconnected with my students' lives, what could I do about it?

BEGINNING AGAIN

I didn't implement my plan for January until the end of the month. I was prepared to videotape partner work during math class, decide which students were going to work together, define partnership work in a class meeting with class participation, and evaluate partners and their learning. The plan would be implemented for one week.

This time, I picked the partners. I matched each target student with someone who was a successful math problem solver, but not so different in skill level that they would both be frustrated. At a class meeting, I shared my ideas for how partners should work together and asked students for their suggestions. They said that partners should listen to each other, give praise, and share ideas. Then we role-played how successful partners should respond when they found out who their partners would be. We also role-played what not to do. My students liked it when we used humor to illustrate permissible behavior. The students bought into the plan for implementing our rubric for successful partner work in math. They wanted their plan to succeed. No one wanted to be left out for behaving inappropriately.

We reviewed partnership expectations before getting to work. I gave each pair of students a form for recording problem-solving strategies, and I directed partners to choose roles. One student was to record the problem-solving process with numbers. The other was to record the process in words (narrative). It was up to each pair to decide whether the recording would be done on one page or on separate pages. That mattered, because if partners used separate pages, they could work on their tasks simultaneously, while if they used one page, they had to take turns.

During the last week in January, we implemented our new plan. We called it Partner Week. The first day was great. Students were very conscientious and goal oriented. They focused on their assignments without delay. They chose roles. I heard students reading the problems to each other and discussing them. I could tell from the finished work that the students understood the problems.

The rest of the week was about the same. For 40 to 50 minutes of each math period, students worked busily with their partners. Each day began with a reminder about the criteria for success. I roamed around the room during math, making notes of student thinking and partner behavior.

PARTNER WEEK: WHAT I LEARNED

Partner Week was a powerful experience. I learned as much as the class did, although I was learning about process while they were learning about math problems. I began to appreciate the importance of two factors in addition to careful planning and structure. They were the physical space and the emergence of a more cohesive math community.

Location

In response to an item on my fishbone diagram, I observed more carefully the work setting for my fourth graders. Work location was important to the children. Students were comfortable spreading out into any part of the room when I allowed them to do so. Sometimes I permitted students to read in the hallway or work on group projects in the cafeteria next to our room. But during math I expected everyone to stay in the classroom, where I could see what they were doing and provide help if needed. My room was fairly open, with desks taking up less than half the space. There were three large tables with chairs for group work. Some smaller tables were available for displays or small work spaces. I wanted the partner groups to have enough room so that they wouldn't be in each other's way, and so I assigned each group to a particular spot, which we called "offices" or "workstations."

I noticed that toward the end of the week some of the partner groups were getting close enough to other groups to make "nonmath" communication too easy. I learned something else about partners as well. When four students were in close proximity, the interactions tended to become social. The optimal number of students in a space was two. Assigned places in the room enhanced concentration.

A less obvious reason why partners needed to have private space was related to peer pressure. When friends were too near to each other, they seemed to feel obliged to send the message that the other person, their partner, was not really a member of the friendship group. When students focused on their partners instead of on their friends, they were amazingly on-task, polite, and cheerful.

Constructing the Community

At the beginning of the week, I focused discussion more on how well partners worked together than on solutions to the math problems. My goals were for partners to work cooperatively and creatively and to engage in problem solving with understanding. My students were thrilled

and very proud when, after a problem-solving session, I went around the room praising each pair for the behavior and thinking that I observed. One anecdote shows how important this was to the group.

After the first work period, we discussed whether we had done well at meeting our goals, and I shared my observations of how each group worked. Two students who were unable to do the partner assignment due to a schedule conflict returned to the room in time for the discussion. When I had nothing to say about how well the two students had worked together, the rest of the students pointed out my omission. They hadn't noticed that these students were not in the room for math, and they didn't want them excluded from what was regarded as a celebration of our success as a learning community. I quickly explained the situation and then commented about the quality of their peers' work at other times. This seemed to satisfy the concern.

The generous amount of praise and feedback was reassuring to students who weren't confident about their math ability. Private praise worked, too. I didn't always have time for public recognition of accomplishments because students often worked on problem solving until the bell rang. They didn't want to stop doing math.

I was able to videotape one math period. Children were very willing to talk to the camera. Most of their comments were very positive. Two new girls who didn't want to work with partners made honest comments about their reluctance to participate in the study.

Evaluation

Looking back, I know that what students learned about working together had lasting positive effects. Partner Week was a success for several reasons: I was well prepared with a structure; students had a clear definition of success with limited choices; they felt a sense of ownership in the plan; everyone was working in an atmosphere of security because they didn't have to defend their choice of partner or work location; and finally, there were intrinsic rewards, as well as recognition and praise, for following the directions for successful partner work.

Did learning take place? Yes and no. The target students participated fully. They seemed to gain confidence as a result of our shared expectations and of the more clearly defined learning environment. They were more successful solving problems and explaining their thinking. I don't think any large gains occurred, but a pattern of success was established. We didn't have as much time as I had expected for whole-class discussions of student work.

FEBRUARY

My action research goal for February was to analyze my observations from Partner Week. I also wanted to find time to give target students individual math instruction, adapt another math topic to partner math, videotape more partner interactions, survey students about their attitudes toward math, and find math puzzles for partner work.

I didn't accomplish all these goals. Action research has to fit in with your routine, and this list of additional activities was too much for mine. I did change some math partners. I wrote math problems and curriculum around the topic of energy conservation to complement our electricity unit. Two of the assignments were more open-ended, with opportunities for students to illustrate their ideas, graph information, and do more writing. Some students were more successful with these assignments than with the previous ones.

My group of target students changed when two African American boys transferred to another school and two African American girls transferred to our class. The girls came with little number sense and felt quite intimidated by our math class. They were reluctant to work with anyone except me. To ease their discomfort, I planned to expand partner work to include playing math games or practicing multiplication facts with flash cards because I thought that these activities would be less threatening.

During a class meeting, I conducted an informal survey. My question was, "What do you think would help you be more successful in math?" The person with the strongest opinion was one of my target students, who told me that she liked math class in Chicago better because there they did more problems with just numbers. Our policy at the time was to give homework in a different subject each night. The math homework was usually based on the day's lesson or was an extension of the science or social studies topic.

Math homework assignments became a way to build on my target students' strengths. After I gave one student multiplication worksheets for homework, everyone else wanted them too. Simple computations using a standard algorithm were a relief to my target students. Even though it didn't fit my criteria for good teaching, the benefits for some students were obvious. Students completed their homework. Most students in my target group were successful. They had something they could show their parents.

I began to make time for students to do more multiplication algorithms on the chalkboard during class. Because not all the target students had memorized their facts, I also started sending home fact practice sheets for a sequential review of multiplication facts. Because they knew most of the answers, students could finish them fast. I wasn't giving up on problem

solving and constructing knowledge—I was just doing a better job of building on the strengths of my target students, developing their confidence, and reducing the stress of learning in a way that was unfamiliar to them.

MORE THAN PARTNER MATH

Some of my target students continued to need one-on-one instruction. They were uncomfortable asking questions in a group or admitting that they couldn't understand some math talk. There wasn't time for enough individual instruction during math, and so I took time for it during our 30 minutes of independent reading each day and during an afterschool math club that I created.

The afterschool club met for 6 weeks in our classroom in the half hour before our school's regular afterschool program started. The eight girls who attended the club were very motivated. They enjoyed having a snack and discussing math in the smaller group. In this less threatening environment, the girls took more risks and asked questions. The activities included problems similar to those we did in math class, challenges that extended the problems, and some introduction of upcoming content in preparation for class work. On the days that the classroom computer was functioning, I split the group into two smaller groups. One group worked with me while the other played computer math games. I gave the boys from the target group, who were not in the afterschool club, differentiated assignments and continued to tutor them during part of the independent reading time.

My target students' families were supportive of my efforts. It was easy to get permission for students to stay after school, as long as the students were willing to participate. Parent attendance at conferences was good, too. I nurtured the home/school connections with home visits or conferences scheduled at parents' convenience, even when the only time we could meet was at the dinner hour, in the student's home. To keep parents informed about math, I often printed an example of student problem-solving strategies on the back of my weekly newsletters. When one of my target students was having a particularly difficult time understanding double-digit multiplication, I went to her house to show her mother how I was teaching her to think about decomposing the numbers in a multiplication problem. Her mother looked on as the student and I went through a problem together. She nodded and smiled. "Oh, now I know what you are doing. I saw a problem like that on the back of your newsletter." I am not sure whether working through a few math problems at the kitchen table gave this mother enough support for her to help her daughter with math, but we had a good time.

WHAT DID I LEARN FROM MY ACTION RESEARCH?

Since Lincoln Elementary School opened in 1985, the school's staff has been concerned about the gap in achievement between students of color and students from Euro-American backgrounds. Our school was created following a court-ordered desegregation order, to address the inherent inequity of separate and unequal schools for different groups of students. In 1995, when I participated in action research, the staff formed a self-study group to learn more about school reform and schools that were successful in closing the gap. As part of this study, we met with Fred Newmann, from the University of Wisconsin Center for Educational Research. Dr. Newmann headed a five-year, federally funded study that examined the relationship between school restructuring and student achievement. As I listened to Dr. Newmann explain some of his findings, I made these connections to my action research and what I learned from it.

1. *Cosmetic reform doesn't necessarily lead to attention to intellectual quality.* In other words, my innovation—a structure for partner math—by itself is not guaranteed to result in quality thinking. I communicated to my students that I was inviting them to be partners in the pursuit of quality thinking instead of just working to please me or to be able to say they finished an assignment.

2. *Student participation may be mistaken for thinking.* This leads me to wonder whether participating in Partner Math fosters thinking or just the *appearance* of thinking. I have more to learn about how to help students build understanding in mathematics.

3. *The school staff as community is very important to the learning process.* Colleagues in my research group enriched my classroom action research. The group and its facilitators became a teacher community. I am encouraged to work with other teachers at Lincoln in support of developing our professional community. We have already begun talking about the need to work together to create a predictable and consistent learning environment for our students. For me to be successful and for my students to be successful, I need to look outside the door of my room and spend some energy building the professional community.

4. *Successful schools have high expectations across the board. The goal is to challenge students to do higher-order thinking. Always measure your success against that criterion.* During my action research project, I learned how to explain my expectations to students so that they would share them. I also evaluated how I praised progress, to make

sure that I wasn't giving students confusing messages. Now when I praise students' work in math, I look for evidence of thinking that leads to understanding. I remind them that they are all very capable. To remind students of our goals, I give math problem set worksheets special names like "Bright Minds" or "Turned on Math."

MORE QUESTIONS

Is Partner Math a valid instructional tool? Yes. It was a useful instructional tool after I clearly defined my expectations for this form of classroom collaboration. Applying students' preference for working in partner groups helped me reach my goal, to help my African American students become active learners and problem solvers in math. Partner Math and flexible classroom organization benefited my target students as well as the other students in my class. Working together in a structured setting promoted teamwork that supported active learning. Students whose confidence was challenged by the unfamiliar expectation that they be able to explain math understanding orally and in writing gained confidence and found security in working together. Taking risks in learning became less threatening. We built a more solid math learning community than I have seen with previous classes.

I have different questions now, based on my reflection and writing. The major new question is, "How is my math instruction culturally biased by my own experience of learning math, and what should I do about it? How can I make it more culturally relevant for my students?" I am beginning to discuss this question with colleagues. I have already found several interesting articles on the subject, such as those in the *Journal of Negro Education*, published by Howard University. *Teaching Children Mathematics*, a professional journal published by the National Council of Teachers of Mathematics, is also a great resource. Another equally important question I have is, "How can I create a learning environment where it is safe for students to work with math manipulatives long enough to really develop their understanding of math concepts?"

EPILOGUE

Equity in education is my passion. It is what keeps me going professionally. Years ago I heard the criticism that White teachers merely collect a paycheck and go home, whether their students are successful or not. Even though I have never felt that this is true, I am haunted by the fact that I am guaranteed a measure of comfort in life because of my work, but my

students are not. It seems to me that how students view themselves in relation to mathematics is critical for educational equity. Math understanding and proficiency are prerequisites to higher educational opportunities. I have noticed that elementary students' lack of achievement in math contributes to diminished self-esteem as learners.

Looking back a decade to the time when I conducted this classroom action research project, I believe that, to some extent, the activities surrounding the study promoted classroom equity. My students learned that issues of inclusion and fairness could be discussed safely in a learning community. They knew that their opinions were important and their ideas valued because they saw them put into practice when we developed our model for partner work. I hope that this shared responsibility for the learning environment was, for them, a model for making the kinds of changes that could lead to greater equity.

The staff at Lincoln School cared deeply about equity. Five Lincoln teachers conducted classroom action research studies during the school year. I don't remember that we ever shared the specific details of our findings. In that sense, my study by itself didn't promote equity on a schoolwide level. Equity was something we talked about in terms of learning styles, discipline, and multicultural activities. Most teachers didn't work together on a daily basis. Equity wasn't a topic at our grade-level team meetings. Our learning coordinator, principal, and members of the community facilitated serious professional discussions about equity. I was proud to be part of a staff that recognized the challenge of educational inequalities for different ethnic and racial groups. My classroom action research topic fit perfectly with the professional environment at Lincoln.

In the years since I conducted this study, most of my professional focus has been in the area of effective math instruction. The year following the study, I helped select a new math series for our school. Then I began team teaching with another multiage classroom teacher so that I could teach two classes of math each day. I joined a number of professional organizations, attended workshops and conventions, and sought out professional resources. Four years ago, I participated in a yearlong, grant-funded project to promote diversity in math education. As part of the project, I taught in a pilot summer school program for students of color who were failing math and then participated in a yearlong math education seminar with the university advisor and a cohort of classroom teachers and math resource teachers. The next three summers, I led staff development in math instruction at my school for teams of teachers. For the last three years, I have held a math coaching position at my school. I run afterschool math programs, match students with mentors, give presentations to the staff, coach teachers and interns, write lessons, provide teaching resources, and work with

students. These activities have led me to a much deeper understanding of how children learn mathematics than I had 10 years ago.

The results of inequality are increasingly obvious to me: years of consistently low test scores for certain groups and high test scores for others, students who can't or won't finish high school, dreams unattainable and unmet. Maybe part of the problem is that the educational establishment, including universities and government institutions, fails to take seriously the need to change. Change might begin with a better definition of equity in math as it relates to the readiness of teachers to teach math. For me, equity in math education means first of all that all students are taught by teachers who are fully prepared to teach the subject to all students. It is unfair to expect students to be able to compensate for poor teaching and for the inaccurate conceptual understanding they formulated in the early elementary years.

For me, equity is impossible without accountability. Teacher training institutions have to be accountable for better training of teachers. School districts need to be accountable for ongoing professional development embedded in schools. In order to be accountable to all students, we need to have a deep understanding of the subjects we are teaching. Equity in math instruction will occur when all students are taught to fully understand math, rather than simply learning empty rules and algorithms that they can't explain. Students who are not proficient must receive extra instruction based on their level of readiness, especially in the early grades. They must be taught in such a way that they learn the big ideas that make math exciting and fun. But until math education is as valued as reading instruction, many—if not most—elementary teachers will not get the support they need to be prepared to teach all students successfully.

The issue of equity is multidimensional. There isn't one easy strategy to achieve it because the problem of inequity is so complex. In my research study, I attempted to demonstrate the power of inclusion. I believe that students deserve the opportunity to learn together as opposed to learning in separate spaces with different curricula and different outcomes. Racism contributes to inequities in the math classroom. Students come to school with vastly different levels of readiness, which are closely correlated to income levels—which, sadly, in our community are closely correlated to race. African American students in my urban school enter the primary grades brimming with confidence and motivation to learn math. For too many, this excitement evaporates as they fall further behind their nonminority peers. Students who don't receive effective interventions that could lead to higher achievement begin to show signs of apathy and failure by the time they are in fourth or fifth grade. In an ideal situation, part of every math period in the elementary grades would include differentiated small-group instruction

provided by the most highly trained professional in the room, the teacher. Otherwise these bright, competent students will continue to think of themselves as "not good in math."

Equity in the classroom won't be realized until every student is engaged in learning. Every teacher has to be committed to make the changes that will create a culturally relevant and welcoming environment that is intellectually the best for teaching each subject. This is a tremendous task for elementary teachers who must master several subjects. We need to fully understand, accept, and honor the different cultural competencies of our students. When we accept the norms that each culture brings to the table, we will teach differently.

A teacher's understanding of equity should include understanding how gender equity adds complexity to teaching with cultural competency. Our elementary school is now more diverse than ever. Yet the majority of students sent to the office are African American males. I believe that success in school is an important factor in reducing the number of incidences of behavior problems. Lack of school success leads to frustration that increases time out of class. This may be truer for boys than girls. Maybe we need a close examination of the relationship between low math achievement and negative classroom behavior. Teachers who want to promote equity have to keep students engaged in learning.

Disengagement leads to lack of learning, which leads to avoiding the subject of math. Girls and boys of all cultures practice math-avoidance behaviors that teachers need to recognize and overcome by engaging the students in active questioning, teaching students the language of math and ways to explain their thinking, and encouraging the use of models that students can use to build their conceptual understanding.

This year I began cofacilitating a mentoring program for minority students. The mentors are undergraduate minority students from the University of Wisconsin Math Department who have participated in two semesters of math courses. Each mentor is matched with students with similar backgrounds. Recently I had a conversation about equity and learning with a mentor who works with three African American fifth-grade girls. She shared some of her school experience with me. She told me that whenever a teacher stopped by her desk to ask if she understood, or if she needed any help, she would say "No." Then the teacher would walk away. A feeling of relief would come over her because she was able to stay under the radar, away from attention. As I listened to her describe this teacher-avoidance behavior, a light of recognition went on in my head. Although she did not consider herself to be a very advanced math student in elementary and middle school, she felt the need to avoid teachers more than the need to understand what she was learning. She told me that she

would have answered differently if the teacher had asked her to explain her thinking or given her more time. Fortunately, she could go to family members to find out what she needed to know. But many unsuccessful students don't have that option.

Equity means knowing every child as a person and being prepared to do whatever is necessary to reach him or her. Equity means never just walking away.

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