Professional Development Case Description
Author: Wayne Patty

The instructional unit that we selected is called, "Building Number Sense," and it is the second of six units of the first grade of "Investigations in Number, Data, and Space." In this unit, students learn about numbers in many different ways: they play games and solve problems that involve taking numbers apart; they count objects; they read and write numbers up to 100; they find the sum of two or more numbers; and they compare numbers. Students develop their own strategies for solving addition and subtraction story problems. They are encouraged to solve problems in ways that make sense to them perhaps using real objects or draw pictures to work out solutions. At least 37 hours of classroom instruction are involved. Students will already have some experience with counting, number combinations, and combining numbers. They will continue working on concepts found in this unit in the unit, "Number Games and Story Problems," which is the fifth unit of the first grade curriculum of "Investigations in Number, Data, and Space." The unit is divided into four investigations. Each of the first three investigations consists of nine sessions, while the fourth investigation consists of ten sessions. Each session is approximately one hour of instruction.

We provided 60 hours of professional development for the first grade teachers in the Summer, 2000 built around "Investigations in Number, Data, and Space." Approximately 8 hours was spent on the specific unit, "Building Number Sense." Each teacher was exposed either through personal experience or through presentations from peers to every lesson in the program prior to teaching it. We believe that this was a real strength in overcoming the lack of comfort with a new program. Since there was consistency in approach throughout the professional development, we think this developed some trust as well. They knew that the presenters had actually taught the program in real classrooms.

We believe that the challenges for most teachers are those facing educators who implement any Standards-based curricula: balancing the importance of hands-on, inquiry-based activities with the demands of a high-stakes testing environment. For example, in Virginia, we have Virginia's Standards of Learning tests, which are given at the end of grades 3, 5, and 8, and at the end of the courses for high school subjects. The pressure on teachers is to pour out a lot of information. For example, at this level, there is pressure to have children recognize numerals and write them whereas the underlying principles of "Investigations in Number, Data, and Space" is after real number sense and understanding.

Another challenge is the amount of pre-classroom work required for these units: duplicating, creating materials, etc.

And finally, a challenge is that "Investigations in Number, Data, and Space" does not suggest approaches that may be routine or usual for many teachers. It is always difficult to convince people that it is worth getting out of their comfort zone.

All of the above provided challenges in providing professional development for this unit. One of the most important challenges in terms of professional development was getting the teachers "on board" in terms of the value of this kind of teaching, convincing them that the extra effort was worth it.

In order to meet these challenges, the professional development was structured to give a lot of background in terms of the NCTM Standards and research into how children learn, and the program was connected to teaching that many of these teachers had previously done: Math Their Way. We also provided a demonstration lesson, which we conducted using the techniques and activities that "Investigations in Number, Data, and Space" uses and then had the teachers look at specific lessons and present them to their colleagues. We hoped that this would help "make it their own." They had lots of opportunities to talk about the lessons with each other and with the primary leaders, who were experienced teachers of "Investigations in Number, Data, and Space."

During the 2000-01 school year, which was the first year of implementation of "Investigations in Number, Data, and Space" in the first grade, we provided 45 hours of professional development for the first grade teachers. This provided ample time for: discussion of problems that arose in the classroom; for a review of instructional strategies in teaching this unit, for creating materials that would be needed in the classroom, and for extending the content knowledge of teachers beyond the level at which they were teaching. These 45 hours also provided ample time for "looking-back" after teaching this unit for the first time. For example, this discussion usually focused on,: What changes do you plan to make the next time you teach this unit? While experienced teachers of "Investigations in Number, Data, and Space" were the primary workshop leaders during the summer prior to implementation, the professional development during the school year was provided by a university professor, the mathematics coordinator in the county, and an intern with experience in teaching both elementary and middle school.

We also provided 30 hours of professional development for first grade teachers in Summer, 2001, and we are providing 18 hours during the current school year. This gives the teachers yet another opportunity to re-examine "problem" areas. A considerable amount of time was spent discussing ways to reach those students who are struggling.

Approximately 14 hours of professional development was devoted to this unit: 8 hours prior to implementation, 3 hours during implementation, and 3 hours after teaching this unit for the first time.

The primary workshop leaders for the 60 hours of professional development prior to implementation were two teachers (Diane Deckert and Jane Moore) from National-Louis University who have considerable experience in teaching Investigations in Number, Data, and Space. Other members of the workshop leader team were Wayne Patty, Professor of

Mathematics at Virginia Tech, and Marlene Robinson, Instructional Coordinator K-12 Mathematics for Albemarle County. The workshop leaders during the school year were Wayne Patty and Marlene Robinson, and the workshop leader team during the summer following the first year of implementation consisted of Wayne Patty, Marlene Robinson, and teacher leaders.

We solicited volunteers of teachers to be observed. Then, from these volunteers, we selected three based primarily on the time of day that they taught mathematics for the convenience of the observer.

We observed three teachers in October, 2001 so they were all teaching the unit for the second time. One teacher was just beginning the unit so this session was devoted to Investigation 1 Session 1, Quick Images. In this session, students were briefly shown images, in this case dot patterns. After each image was removed, students drew or made a copy of what they saw, compared this copy with the original image, and shared ways they thought about the image in order to remember it. They were also given an opportunity to revise their drawing. The portion of the instruction that was devoted to "quick images" was consistent with the project's vision. However it was only a 45 minute session, and the teacher devoted 15-20 minutes to a "traditional" type test in which the teacher read questions and the students wrote the answers on paper. We think this illustrated the pressure that the teacher felt to prepare students for Virginia's Standards of Learning third grade test. Since this teacher was just beginning the unit, it was impossible to tell how well she understood the content of the unit. Also we could not see any evidence that she understood how the content in the lesson fit into the big picture of the unit. However, we hasten to add that there was insufficient evidence to say that she did not understand. She asked questions and her behavior indicated that she was cognizant of student thinking. However we did not see any evidence of a focus on student conceptual development.

The second teacher explained that she had a difficult class of students who weren't quite up to grade level. The instruction involved ideas from two or three sessions of Investigation 1. She showed dot patterns and had the students show on their fingers the number of dots that they had seen. They explored the number of ways of making 7 and the number of ways of making 6. They also discussed sharing 6 cookies with 3 people and sharing 8 cookies with 4 people. Finally they counted out 20 pattern blocks, made a design on their own, and then recorded the number of each type of blocks that they had used. Based on her comments and interactions with the students, we believe she did understand the content of the module and how the lesson fit into the big picture of the unit. Based on her questions and reactions to student responses, she was clearly cognizant of student thinking, but for a large number of students, there appeared to be a gap between the teacher and the students in terms of their conceptual development; that is, her efforts did not appear to make the connection that she wanted.

The third teacher, who happened to be the first that we observed, was in Investigation 3 Sessions 5, 6, and 7. She introduced and divided the students into pairs to play Ten Turns. The instructions for this activity were: 1. Roll the number cube. What number

did you roll? Take that many counters to start your collection. Write the number you rolled and the total you have. (For the first turn, these numbers are the same.) 2. On each turn, roll the number cube and take that many counters. Find the total number of counters you and your partner have together. 3. After each turn, write the number you rolled and the new total. 4. Play for 10 turns. The class was organized in an unusual way. There were 18 students, and during the first half-hour, she worked with 10 of them while the other 8 went to PE. With this group, she used a pair of number cubes instead of just one. We were impressed with how quickly some of them found the total number of counters they had. During the second half-hour, she worked with the 8 while the 10 went to PE. This group worked with a single die, and some of them really struggled. There were four adults in the room, and there were four pairs of students so each adult worked with one pair. One student was not engaged at all. She wanted to tell us about everything except what she was supposed to be working on. The teacher said that she was like this every day. During the third half-hour, all 18 were present. During this time, they discussed Ten Turns, the question of the day, the calendar, and weather. We think this teacher's instruction was the most consistent (of the three) with the project's vision. Her discussions with the students made it clear that she fully understood the content of the unit and that she understood how the lesson fit into the big picture of the unit. Her questions, discussions, and responses indicated that she was cognizant of student thinking. The activities were focused on student conceptual development.

Based on our observations related to the implementation of the instructional materials, we would do basically the same thing in the professional development the next time. We are continuing to work with the teachers, and we recognize that it will take time for many teachers to sufficiently change the way that they have been teaching. We thought the professional development prior to implementation, the professional development during implementation, and the professional development following implementation was in the correct proportion. Moreover the teachers were pleased with the delivery of the professional development. It was clear to everyone that those teachers who had not participated in the professional development prior to implementation were at a disadvantage.