The Teacher's Guide to Flexible Interviewing in the Classroom

LEARNING WHAT CHILDREN KNOW ABOUT MATH

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CHAPTER ONE

▲ What Is Flexible Interviewing and Why Should You Use It?

This chapter covers three topics. First, we discuss why standard tests—classroom tests or end-of-the-year achievement tests—are of limited value for classroom teachers. In general, tests do not provide the kind of information that can help teachers teach. Tests may show how well a child is performing, but they yield little insight into how the child thinks, why the child fails to learn, or what can be done to help the child learn.

The National Council of Teachers of Mathematics (NCTM; 1995) proposes that, because of the limitations of tests, teachers need to engage in "alternative" or "authentic" forms of assessment. The focus of both assessment and teaching, NCTM argues, should be children's mathematical minds, not simply right and wrong answers. The second part of this chapter discusses one form of alternative assessment, the flexible interview, which we believe to be an extremely powerful technique for understanding how children think and learn. Using an extended example, we describe the basic features of the flexible interview. We explain how it can provide insight into children's thinking, into their errors and unsuspected strengths, and into their underlying competence. We argue that the information gained from the flexible interview can help you teach more effectively. You should use it in your classroom.

But that is easier said than done. How is it possible to interview effectively when you are required to deal with some twenty or thirty children in a bustling classroom? How can you integrate it into your teaching? How can you find the time to do it? Do you need extensive training to do it well? Initially, we did not know the answers to

these questions, so we tried to find out by experimenting in schools. The third part of this chapter describes how we collaborated with eighteen teachers to develop practical ways to use flexible interviewing in and out of the classroom.

The rest of the book, chapters 2 through 8, describes the results of our joint work—various ways in which teachers can use interviewing in the classroom; guidelines for interviewing; tips about how you can learn to interview; questions that can form the basis for interviews about key mathematical subjects; and, finally, how teachers evaluate their experience with flexible interviews in the classroom.

▲ *Some Problems with Standard Tests*

Readers of this book will have taken many standard tests throughout their school careers and will probably have a pretty good idea about what these tests are and what is wrong with them. You have taken classroom tests devised by your teachers, tests at the end of chapters in your textbooks, end-of-the-year achievement tests, intelligence tests, aptitude tests, and the like. You know that these tests are "standardized" in the sense that the method of administration must be uniform. Everyone gets the same questions in the same way, with the same time constraints, in the same language, and everyone has an equal chance to respond. In general, standard tests are devised to yield answers that can be scored without controversy—calculational responses, multiple choice, yes–no answers, and other short answers. The correct answers need to be obvious so that they can be scored by machine or at least fairly easily and with good agreement by human judges. So the essence of the standard test is uniform administration—everyone gets the same test in the same way—and ease of scoring.

Though flawed in various ways, standard tests were developed for good reasons. Indeed, one of the motivations for them was ethical. As far back as 1845, Horace Mann offered several reasons for introducing standardized tests to the schools (Wainer, 1992):

> They are impartial.
> They are just to the pupils.
> They prevent the officious interference of the teacher.
> They take away all possibility of favoritism.

> They make the information obtained available to all.
> They enable all to appraise the ease or difficulty of the questions. (p. 15)

In one way or another, these reasons revolve around *fairness* or impartiality. Thus, one justification is that standard tests prevent the teacher from favoring some children over others (perhaps by giving some children easier questions than others) or from interfering with the process of testing. Another justification is that the tests make the process public, so that an outside observer can see whether the questions were too hard or too easy.

The method for achieving this kind of fairness is to treat all students alike, to give everyone the same conditions for running the race. From this point of view, no one should be given easier questions than anyone else; no person should be judged on a different basis from another. A wrong answer should be a wrong answer for all.

So there was noble motivation for developing the method of standardized testing. Indeed, the method can produce some useful information for the classroom teacher. If it is successful, the standard test can describe, with reasonable accuracy and fairness, whether a child's performance has improved over time and how well a child performs compared with peers. Suppose that Kim correctly answers almost all problems on a classroom test of addition that you have devised. You may learn from these results that she is now able to solve two-digit addition problems with regrouping, whereas she was not able to do so before, and you may also be pleased to learn that her performance is at about the same level as her peers'. All of this is useful information, and the standard test is a reasonable method for getting it.

But there are many problems with standard testing. Chief among them is the fact that poor performance is very difficult to interpret. Some children misunderstand standard test questions; some are not motivated to take the test; others make trivial mistakes that lead to incorrect responses. In all these cases, low test scores do not necessarily indicate a real lack of ability. The scores show that the child performed badly, but they do not conclusively demonstrate that the cause was a lack of understanding or knowledge.

Consider this example: Jill has been given a standard test problem in which she had to determine how much change would be left over from a dollar if she bought two dozen eggs at 45¢ a dozen. Her answer was 20¢.

I: Say out loud how you did it.

J: Since it was 45¢ for one dozen and 45¢ for the other, and 45 and 45 is 80, so 80 from 100 or a dollar is 20¢.

I: So you said 45 and 45 is . . . ?

J: 80 . . . [She hesitates, drawing out the word *eighty,* and looks very unsure.]

I: Are you sure?

J: No, 90.

I: So the answer is?

J: 10.

In this case, the questioning revealed that her strategy was sensible: she knew that she had to add up the two amounts and subtract the sum from the total to get the answer. The only faulty part of her procedure was the number fact: she believed that 45 + 45 = 80 (which she did, in fact, subtract correctly from 100). But the incorrect number fact resulted from mere sloppiness. When given the chance to reconsider the number fact answer, she spontaneously corrected it and then completed the problem correctly. Clearly, her analysis of the problem was correct, her procedures were mostly correct, and the minor flaw in her recall was easily corrected.

Success on the test may also be deceptive. Most people have had the experience of getting through a test, indeed even doing well on it, without understanding much of the material. Just as a wrong answer may not indicate a lack of understanding, so a right answer may not indicate the presence of understanding.

Here is an example: Dorothy was told, "Listen carefully and tell me if the sentence I say is a good or bad sentence: 'Tom's sister haven't been shopping today.' " She replied, "Bad sentence." The interviewer asked, "Why?" Dorothy replied: "Because they didn't have food to eat for dinner." In other words, Dorothy seemed to think that the sentence was bad not because it was grammatically incorrect, but because it would lead to an unfortunate result—namely, nothing to eat for dinner.

We see, then, that tests deal with *performance,* with right and wrong answers, but that they typically fail to provide clear information concerning underlying *knowledge* or *thinking.* Correct answers to test items may not indicate the presence of understanding, and wrong answers may not indicate its absence.

It is even possible to argue that tests may discourage children from employing rich thought. Interesting, complex thinking generally does not take place in a short period of time in response to a narrowly focused test item. Indeed, children may learn *not* to think—or not to think deeply—in response to test items. Too much thought might lead a child to believe that none of the four multiple-choice answers is really correct, that the question was not very good in the first place, and that another issue is really involved. If the child tries to work all this out, he or she will not have enough time to get the (wrong) right answer that produces credit on the test.

What does this mean for you as a teacher? What use can you make of standardized tests? They may perform a valuable function in helping you to learn about children's levels of performance. You may not have realized that Noriyuki is now capable of doing double digit multiplication, or that Annie has difficulty with subtraction problems involving regrouping. But that is only a beginning. You need to discover whether Noriyuki really understands the multiplication problems that he can solve. Perhaps he just uses the computational procedure blindly and mechanically and doesn't understand anything about why it is used or when to use it. You need to find out why Annie is not able to solve these particular kinds of subtraction problems. Does she have trouble with the number facts, with "borrowing," or with basic concepts of place value?

Getting the answers to these questions will help you in your most important goal, developing strategies for helping both Noriyuki and Annie. What is the next step for Noriyuki if he does not really comprehend multiplication? How can Annie be helped to master subtraction with regrouping? If you can gain insight into the thinking of Noriyuki and Annie, into what they understand and misunderstand, into what strategies they employ, then you can teach them more effectively.

But standard tests are not designed to provide the sorts of information most useful for teaching. At their best, standardized tests—the classroom tests you construct, the tests provided by the textbooks, and the national or state achievement tests—can portray a child's level of performance—for example, whether a child is performing better than before, or at the level of peers. Typically, standardized tests provide little information concerning the knowledge or thinking that underlies the child's response. If you do not have this insight, you will not understand why a child is having trouble learning mathematics; you will not appreciate how a child arrives at

an answer; and your teaching will not be as effective as it could be. That is why we need alternative forms of assessment, particularly the flexible interview, which can provide fascinating insights into children's thinking.

▲ *Interviewing Jennifer*

The flexible interview is both old and new. On the one hand, good teachers have always talked with students to discover something about their thinking and learning. At least from the time of Socrates, teachers have engaged in dialogue with students to find out what they think and to help them learn. On the other hand, systematic use of the flexible interview has occurred only in the twentieth century. Jean Piaget, the great Swiss psychologist whose work revolutionized the study of the child, developed flexible interviewing (which he called "clinical" interviewing because he felt it requires clinical sensitivity, not because he was dealing with disturbed children) into a powerful technique with which to examine the processes of thinking. (You can read about his development and use of the method in Ginsburg & Opper, 1988, and Piaget, 1976.)

Whether old or new, the flexible interview deserves careful study. Talking with children is more complicated than it may appear on the surface. We begin by considering an example of an individual child who was interviewed concerning her knowledge of simple arithmetic. We highlight basic features of the method and the kinds of insights it can provide.

At the time of the interview, which took place about two-thirds of the way through the academic year in a relatively quiet room in the school, Jennifer was a first grader. The interviewer (Herbert Ginsburg) was not her teacher. He was an outsider (although a parent of children in the school), conducting the interview in order to obtain videotaped examples of children's mathematical thinking for use in teacher workshops. The goal of the interview was not to help Jennifer with some problem or even to investigate some particular aspect of mathematical thinking. Indeed, the interviewer knew nothing about Jennifer's learning history or level of performance, only that she was a cute and charming little girl who eagerly agreed to participate in the interview and answer the various questions.

Of course it is hard to know what Jennifer thought about the interview at the outset. From the child's point of view, the whole situation must have been highly unusual. The teacher simply told her that she would leave the room to do something interesting, perhaps to "play some games," with "Doctor" Somebody-or-Other, or perhaps with Susie's father. In any event, the purpose of the interview probably was not clear to Jennifer. Furthermore, the situation was made even more strange by the fact that in addition to Jennifer and the interviewer, a video camera operator and another adult were also in the room. Could all these factors conspire to undermine the success of the interview? You can judge for yourself. But it has been our experience that children adjust very easily to the videotaping situation; they get so absorbed in working on the mathematical problems and in the process of interviewing that they seem to forget about the camera and various adults in the room. And of course, if the child's teacher is conducting the interview, many of these problems do not arise.

The interviewer began by showing the child a small stuffed rabbit and squirrel. (The interviewer is designated by H and the child by J.)

H: Let's see. This is . . .

J: A rabbit.

H: A rabbit, O.K. And this is?

J: A squirrel.

Jennifer appeared to be charmed by the stuffed animals and seemed eager to play with them.

H: Squirrel, O.K. Now we're going to tell some stories about the squirrel and the rabbit. The rabbit has 3 carrots and the squirrel also likes carrots. And the squirrel, it's kind of a strange squirrel. . . . And the squirrel has 4 carrots.

As the interviewer described the squirrel liking carrots, Jennifer smiled. When the interviewer said that the squirrel was strange, Jennifer laughed and nodded her head as if to agree.

Note that the interviewer did not begin with an obvious, written math problem. Instead he employed a story about a squirrel and a rabbit. The situation was partly concrete in that characters in

the story were represented by stuffed animals, and partly abstract in that both animals were said to possess imaginary carrots. There were two reasons for using the story. One was that the interviewer was attempting to put the child at ease—to establish rapport. He wanted to convince her that the interview would be enjoyable, and for a first grader, a story, and especially the stuffed animals, might be better tools than a written math problem for accomplishing this.

Another reason is that flexible interviews often revolve around extended problems. The interviewer does not simply ask, "Tell me what you know about addition," or, "How do you subtract?" Instead, the interviewer attempts to present a particular problem for the child to grapple with. Of course, the nature of the problem should vary according to the age of the child and the child's experience in school. A young child might be asked to add collections of blocks, whereas an older child might be asked to add written numbers or even to do mental addition. In developing the problems, the interviewer needs to take into account the child's developmental level, what the child has been studying in school, and the like. But the important point is to give the child a *problem*—something specific to think about. In Jennifer's case, a combination of concrete objects (the squirrel and rabbit) and imaginary ones (the carrots) seemed to fit the bill.

Next the interviewer decided to check on whether Jennifer had been listening to and understood the problem.

H: So the rabbit has how many?

J: 3.

H: And the squirrel has?

J: 4.

When the child takes a standard test, you usually do not know whether he or she has understood the problem or even remembered the basic points (for example, that the numbers are 3 and 4). You do not know because typically you are not permitted to ask. But in the flexible interview, checks on the child's attention and understanding are not only permitted, but desirable. Why proceed unless you are sure that the child understands the basic problem?

Next, the interviewer posed the problem.

H: How many carrots do they have all together?

At this point Jennifer paused and seemed to be whispering the counting numbers. After a while, she spoke softly.

J: 6.

H: 6. How did you figure that out? I saw that you were counting a little.

Jennifer gave a wrong answer. But note several points concerning the interviewer's response. He did *not* say, "No, you are wrong. The correct answer is 7." Instead, he ignored the incorrectness of the response and asked the fundamental question of the flexible interview: "How did you figure that out?" This question, of course, comes in many forms: "How did you do it?" "How did you get that answer?" "How did you know?" But whatever the form, the purpose is to ask the child to explain what he or she has just done. Sometimes the interviewer can get some of this information just by observing the child. Thus, in this case, the interviewer had seen Jennifer whispering what appeared to be some numbers. Still, he needed more information concerning what exactly the child had done and therefore asked her to describe her method.

J: Right. I, so I like had in my mind a 4 and a 3 and then I, for 4 I put, I moved one of them over to the 4 and that was 5. And the other one over and that was 6.

As Jennifer described what she had in her mind, she pointed to her head. Her statement seemed to indicate that she started with the 4, the larger number, and then moved one from the remaining set (the 3) over to the same mental space occupied by the 4, getting 5, and then moved one more over to get 6.

Several things can be said about this. First, her wrong answer was not simply an incorrect guess or a faulty number fact. Rather, it was the result of a systematic strategy. It was as if she had started with a pile of 4 blocks, moved one more over to get 5, then moved another to get 6. In fact, this is one of the earliest kinds of addition in which preschoolers all over the world engage (Ginsburg, 1989). Her addition strategy could be described as combining sets and then counting the members of the sets to get the sum. Further, she may have been using—although we don't yet have enough evidence to be sure about it—the economical strategy of *counting on from the larger number.* It is easier to count on from 4 than from 3. (In this case, counting from the larger versus the smaller number really doesn't make much difference, but imagine that the child is trying to add 15 + 1.)

After Jennifer got the answer 6, she seemed to be a little puzzled, as if she knew that something was wrong. The interviewer decided on the spot to explore this interpretation. Note that in the flexible inter-

view, the interviewer is constantly engaged in interpreting the child's response and then has the freedom to develop questions that might shed light on the interpretation. Another way of saying this is that the interviewer theorizes and collects evidence to check the theory.

H: Is there anything left?

J: Yeah. 7.

As she said this, Jennifer looked up in the air as if she noticed that one imaginary carrot had not been counted. She then seemed to correct her earlier omission of this carrot by adding it to the total, and in this way got the right answer to the problem.

H: O.K. So you pictured them. You have a little picture in your mind of these carrots. You kind of moved them together. Oh, that's very good.

J: Like a puzzle.

Jennifer seemed to agree with the interviewer's interpretation and remarked that the problem was like a puzzle, which might have meant that it involved moving (imaginary) pieces into their proper positions to get a satisfying and correct result.

At this point, the interviewer knew that despite the initial wrong answer, Jennifer seemed to be a bright girl who thought intelligently about the simple addition problem. She used a strategy that seemed to indicate some basic understanding of addition. At the same time, she did not implement the strategy correctly. Given this information, the interviewer decided to give Jennifer some similar problems in order to check the generality of the results and the validity of the interpretations reached to this point.

H: Like a puzzle. O.K. Let's do another game like that. O.K. Now let's make believe that the squirrel has 6 carrots. Strange that squirrel likes carrots.

J: Yeah.

In saying this, Jennifer again smiled and looked amused.

H: Yeah. And rabbit wants to get 3 carrots. O.K. So squirrel is gonna give rabbit 3 carrots. How many carrots does squirrel have left?

This time, Jennifer did not ponder the question for any length of time. She responded immediately.

J: 3.

H: 3. How did you know that?

J: Well, I know, well, I know that 3 and 3 is 6. And so, and so I know if I take 3 away from 6 you have 3 left.

Now this is interesting and also a bit surprising. In response to the fundamental question ("How did you know that?"), Jennifer revealed the use of another strategy, which might be described as reasoning from the inverse. Her argument was basically that if it is true that 3 + 3 is 6, then it also must be true, because subtraction is the inverse of addition, that 6 – 3 is 3. Of course, she did not make her argument in exactly those words, and she was not conscious of the axiom that subtraction is the inverse of addition. But she seemed to know all this at an informal, *intuitive* level. Note too that the strategy employed on this problem was different from the one she used in the first problem, namely counting on from the larger number.

At this point, the interviewer was fascinated with Jennifer's performance and wondered what she might do next on another subtraction problem. As you will see, the result was intriguing.

H: Oh, very good. Very good. Let's try another one. Rabbit has 7 carrots and he gives 2 of them to squirrel. How many carrots does rabbit have left?

J: 4.

Jennifer said this softly, as if asking a question, perhaps a bit unsure of her response. If you are counting right and wrong answers, you will note that she is now wrong on two out of three problems.

H: O.K. How did you figure that out?

J: I did the same thing.

H: Same thing. Tell me about it.

Again the interviewer asked the fundamental question to learn how she solved the problem.

J: Well, I knew that 4 and 2 is 7. And if rabbit has 7 carrots and he wants to share them with squirrel, so he gives squirrel 2. He must have 4 left.

Jennifer's line of reasoning was remarkable. She began with an incorrect number fact, 4 + 2 = 7. But given that faulty assumption, her logic was impeccable. If 4 + 2 = 7, then it must be true that 7 – 2 = 4, because subtraction is the inverse of addition. Moreover, just as she understood that addition involves combining sets, so she realized that subtraction means partitioning them: rabbit would have to give a subset to squirrel and would then have a certain amount as the remainder.

Clearly, Jennifer was not simply guessing. Her incorrect response—she now was wrong on two out of three!—was not the result of stupidity, limited memory, a low IQ, or poor mathematical aptitude. Her answer was indeed wrong, but it was the result of an interesting reasoning process and sound, though intuitive, concepts of addition, subtraction, and the inverse relation between them. Psychologists, following Piaget (1973), would say that her answer was produced by an "invented" or "constructed" strategy (Ginsburg & Baron, 1992). Drawing on her experiences with numbers, Jennifer developed her own way of thinking about addition and subtraction. She defined addition and subtraction in her own terms, one of which was her belief that 4 + 2 = 7.

This is the main reason that you should use flexible interviewing. To understand children's performance in math, you need to look beneath the surface. You need to find out the meaning of a wrong answer—and of a correct one, too. You need to see that a wrong answer may not necessarily indicate a lack of knowledge. Indeed, it may have been produced by rather sophisticated understanding and strategy, as was true of Jennifer's 7 – 4 = 2. Standard tests seldom allow you to do this. The flexible interview is the primary instrument for accomplishing this purpose.

Moreover, the flexible interview can suggest ways of helping the child move forward. Although Jennifer seemed to have a good understanding of the concepts and reasonable calculational strategies, she did of course get wrong answers, and so it was the adult's responsibility to help her do better.

How might this be done? Suppose that all you knew—perhaps from a classroom test—is that Jennifer was wrong on the problem 7 – 2 = 5. One approach might have been simply to tell Jennifer that she was wrong and to inform her—repeatedly—of the correct answer. She could be given drill on subtraction problems like this, and one of the cards to be flashed frequently would be 7 – 2 = 5. This is what is sometimes affectionately referred to as the "drill-and-kill"

approach, and it is the traditional method of mathematics education.

This might have worked, in the sense that Jennifer would eventually *say* that 7 – 2 = 5, but from a constructivist point of view this type of drill is not a productive approach, for several reasons. One is that Jennifer, not understanding *why* 7– 2 = 5, might simply parrot whatever the adult says and not learn anything important. A second reason is that her problem was not really the failure to remember the correct answer to 7 – 2. Instead, the real problem was that she did not know the answer to 4 + 2. The standard test could not give you that information. Indeed, you would not have identified Jennifer's real problem unless you asked her how she knew that 7 – 2 = 4 —unless you interviewed her in a flexible manner.

How then to help Jennifer? Just drill her on 4 + 2? No: this too would be only mindless memorization. From a constructivist point of view, Jennifer would benefit more from having to construct a new understanding of 4 + 2 and how she could then use her existing knowledge of the inverse relation between addition and subtraction to solve the problem. Here is what the interviewer did.

H: Right. O.K. Very good. How could you make sure that you're really right about that? You said that 7 take away 2 was 4, right? Because 4 and 2 is 7. O.K. Could you show me with the blocks that 4 and 2 is 7?

The interviewer's strategy was not to tell Jennifer that 4 + 2 = 6 but to have her figure it out herself by using real objects. Immediately, Jennifer again defined the problem in her own terms. Instead of dealing with the problem suggested by the interviewer, she decided to figure out the answer to 7 – 2.

J: O.K. First let me get 7 blocks.

H: O.K. Good idea.

J: 1, 2, 3, 4, 5, 6, 7. O.K.

Jennifer then removed two blocks from the pile of 7.

J: So there's 2 over here.

H: So you did take away 2, right? So how many are left?

At this point Jennifer, apparently realizing that something was wrong, counted the blocks. She had expected that the answer would be 4, but there were obviously more than that in front of her. She knew this because she had placed 4 blocks in a square and saw that there was one left over. She paused.

J: Wait. Let me count these again.
H: O.K.

She counted.

J: O.K. So it's 5.
H: So 7 take away 2 is . . .
J: 5.
H: And you could show me with those blocks.
J: Right.
H: O.K. Very good.

The interviewer had placed Jennifer in a situation of conflict. (See Baroody, in press, for an interesting discussion of the role of conflict situations in teaching.) Her reasoning told her that $7 - 2 = 4$, but the experiment with blocks told her that $7 - 2 = 5$. Working with the blocks seemed to make a big impression on her and probably was more instructive than simply being told the correct answer. At the same time, she still had much to learn. She needed to retrace her reasoning in the original problem so that she would understand why she had earlier believed that $7 - 2 = 4$, and she needed to deal with her mistaken view about $4 + 2$. But she was off to a good start because the interview had provided insight into why she had made her original mistake.

▲ *The Essence of the Flexible Interview*

As we have seen, a good deal can be accomplished in even a brief interview. Indeed, the episode with Jennifer was only about four minutes long. Now let's summarize some key features of the flexible interview and what can be learned from it.

Presenting the Problem

The interviewer begins by presenting a problem that gives the child something specific to work with. Often, with young children, the problems employ concrete objects. With older children, the problems may involve numbers or even general ideas. But the essence of the matter is that the problems should engage children in active and extended thought that the interview can explore.

Checking Comprehension

The interviewer makes sure that the child understands the basic features of the problem. This can be done by restating the problem, changing the wording, or questioning the child about it. The interviewer enjoys the freedom to make whatever modifications in the problem are necessary and to check on the child's understanding of it. Why continue the interview if the child misunderstands the problem's basic requirements?

Investigating Thought

Once the child gives a response, the interviewer usually wishes to understand the child's thinking. The interviewer does not correct wrong answers. The interviewer usually does not *teach* at this point (although there are exceptions, which will be discussed in later chapters). Instead, the interviewer tries to investigate the thinking that underlies the child's response, whether right or wrong. How did the child solve the problem? What did the child mean by that answer? To find out, the interviewer may ask the fundamental question, which takes many forms: "How did you figure that out?" "How do you know?" "What do you mean?"

Interpreting

Unlike standardized testing, interviewing requires as much thought and effort on the part of the interviewer as on the part of the child. The most important feature of interviewing is interpreting the child's response. Indeed, the response is useless unless you have some idea what it means. Good interviewing is a very thoughtful activity. The interviewer constantly makes hunches about the child's thinking. This is a kind of practical "theorizing" about individual children that good teachers must engage in all the time.

Children's Constructions

The main reason for interviewing is that it can provide insight into the distinctive ways in which children think about—construct—the world of school mathematics. It is not an exaggeration to claim that many teachers do not know what their students understand and how they think. Many teachers have little appreciation of the meaning of wrong answers and hence think that the child has not learned anything, has little mathematics aptitude, or perhaps even suffers from a learning disability. But these interpretations may be wrong. As we have seen in the case of Jennifer, sophisticated reasoning and concepts may underlie wrong answers. Moreover, right answers may simply be rote responses, based on no understanding. The major benefit of flexible interviewing is that it can allow you to "enter the child's mind" (Ginsburg, 1998)—that is, to gain some understanding of children's constructions of mathematics.

Teaching

Of course, you have a practical reason for interviewing—namely, to improve your teaching. By providing specific information concerning the child's understandings, misunderstandings, and methods of solution, the interview allows you to devise strategies for teaching the child more effectively. If you know that despite her wrong answers, Jennifer understands the basic concepts of addition and subtraction and the inverse relation between the two, you have a lot to work with in your attempts to correct her faulty memory for some number facts. Understanding children's thinking allows you to treat them as individuals—to take advantage of their often unsuspected strengths and to identify their real weaknesses.

Understanding Children Who Are Different

A particular strength of the flexible interview is that it can help you to understand children who are different—who are not performing as well as other children, who seem to be learning-disabled, who do not communicate easily, or who are members of minority groups or different cultures. Often it is hard to get to know these children by using conventional methods like standard tests. Under ordinary conditions, these children often perform badly and seem not to know much. But conventional methods may not be suitable for revealing their true competence. You may have a much better chance

of getting beyond their poor performance and of finding out what they are really capable of if you employ flexible interviewing. Give them a chance. They may tell you some surprising things that will change your view of them.

▲ *Experimenting with Flexible Interviewing in the Classroom*

Suppose that you are willing to accept that flexible interviewing is a powerful tool that can help you understand your children's thinking and teach more effectively. How can you use this apparently difficult method in your classroom? Is interviewing of this type really practical if you have to deal every day with a class of some twenty or thirty children (or more)? How can interviewing be made a part of everyday classroom activities? How can it be integrated into and thereby improve instruction? How can you get through the math textbook and also have time for interviewing? Can interviewing be done in a group setting? Can you learn to conduct useful interviews without a great deal of special training? How do you come up with the questions to ask? Is interviewing worth the time and energy?

These are all realistic and eminently practical questions, which need to be answered before teachers can engage in flexible interviewing in the classroom. We were often asked questions like these when we conducted workshops designed to help teachers understand children's mathematical thinking. When we showed videotapes of interviews with children like Jennifer, teachers would often comment that the child's thinking was fascinating and that the flexible interview method seemed powerful, but that they did not see how they could possibly use it in their classrooms.

At first, we did not know how to respond to their concerns. Piaget developed the clinical interview method to investigate the thinking of individual children, and that is how psychological researchers use the method. They do not work with groups of children, and in fact they generally do not know much about what goes on in classrooms. For both of these reasons, they cannot provide answers to the teacher's practical questions.

What to do? We felt that the only honest way to find out whether and how flexible interviewing might be used systematically in classrooms was to investigate the matter directly with the collaboration of teachers. We would recruit some teachers to work with us, teach them what we knew about flexible interviewing, and

then together develop and evaluate several classroom applications of interviewing.

We went about this experiment in the following way: first, we contacted several teachers and school administrators with whom we had already worked. They were familiar with our approach to studying the development of children's mathematical thinking. In fact, several had already worked with us as students or colleagues in this area. With their aid, we recruited a total of eighteen volunteers who taught at the primary and elementary levels (grades K–4). These teachers were faced with the typical responsibilities of running a full-time classroom throughout the school year. They were not university researchers or employees. In several respects, however, they were not typical: they knew about our work, were interested in flexible interviewing, and volunteered for the project. But, of course, that is why we were interested in collaborating with them.

The teachers worked in four different settings: an inner-city school with a high proportion of African American and Latino students; a middle-class suburban school; and two wealthy private schools (with very few minority students). Each setting presented different challenges. But in all of these settings, the teachers were able to develop and use interesting forms of flexible interviewing. Indeed, we felt that some of the most innovative work took place in the inner-city school.

We began by conducting workshops designed to introduce the volunteer teachers to flexible interviewing with individual children and to explore what it reveals about the development of mathematical thinking. Then we worked with individual teachers to develop forms of interviewing with which they felt most comfortable for use in their classrooms. Some teachers decided to explore interviewing individual children; others worked with groups of children. One teacher was particularly interested in how children might be helped to interview each other. We visited each teacher's classroom about once a week over a period of four or five months, observed what the teachers were up to, made suggestions, videotaped some of their individual and group activities, and discussed their work. We all did our best to develop the activities that they found interesting and felt were promising.

Teachers within schools exchanged ideas, and on several occasions we held meetings for teachers from different schools. Some teachers were particularly talented and threw themselves into the work. Some, we think, did not really believe us when we said at the outset that we did not know how to conduct interviewing in class-

rooms and would therefore rely on their expertise. They seemed to expect us to tell them what to do and were disappointed, and somewhat at a loss, when we did not. Some teachers contributed more than others, but that is true of any joint endeavor, and all made contributions for which we are grateful. At the end of the project, the teachers took the time to share with us evaluations of their experience. These evaluations and our own impressions are the only "evidence" we collected concerning the success of the project. We have no "objective" measures of the ways in which interviewing improved teaching; we do not know how the use of flexible interviewing affected the children's long-term achievement. That sort of research remains to be done.

The result of the collaboration is that we can describe some very practical ways in which you can conduct flexible interviewing in your classrooms. That is what the rest of this book is all about. Is it hard to learn these methods? Our experience has shown that with a bit of practice you can learn the basics of interviewing in the classroom, and that with further experience you may become adept at it. In any event, you can explore the methods we describe and decide for yourselves whether they are difficult to learn and whether they contribute to your teaching. Please let us know what you find by contacting us on the Internet at **hpg4@columbia.edu.**