An *Assessment Model* for the Mathematics Classroom

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THIS ARTICLE DESCRIBES A COMPOSITE OF the experiences of two teachers to illustrate how an assessment event might occur in a classroom. The composite is a result of multiple observations made during the 1994–95 school year of two sixth-grade mathematics classrooms (Moskal 1997). The scenario that begins this article was developed from a task created by the assessment team of a project called Quantitative Understanding: Amplifying Student Achievement and Reasoning (QUASAR) (Lane 1993).

Dana, a student in Ms. Lee's sixth-grade class, was asked to write all the numbers between 3.4 and 3.5 on the board. Dana wrote the following numbers: 3.41, 3.42, 3.43, 3.44, 3.45, 3.46, 3.47, 3.48, 3.49. "That's all the numbers between 3.4 and 3.5," Dana said. Nakisha disagreed, saying, "There are more numbers between 3.4 and 3.5." Lee saw an opportunity to help her class understand the concepts of infinity and density. She asked, "Who is correct? Dana or Nakisha?" Lee asked her students to write their answers on paper and explain their reasoning.

When Lee examined the students' responses, she saw opportunities to extend their knowledge of decimal numbers to the hundredths, thousandths, and, possibly, even the ten thousandths. As shown in **figure 1,** Jim had written that he thought Nakisha was right. Afwandi also agreed that Nakisha was correct, writing, "There are infinitely many numbers between 3.4 and 3.5." A third student, Juan, agreed with Nakisha, but his explanation was more complete. Juan wrote, "3.415 is between 3.41 and 3.42; 3.4155 is between 3.415 and 3.42; 3.41555 is between 3.4155 and 3.42. And it just keeps going."

Lee carefully reviewed Jim's and Afwandi's responses and the responses of the other students. She recognized that Juan had preliminary knowledge of the concept of infinity. Jim's response, however, caused Lee some concern. His response indicated that 3.410 was missing from Dana's list. Perhaps Jim did not realize that trailing zeros did not change the value of the number, even though Lee had discussed this concept several times in class. Afwandi's response seemed to be a memorized rule that did not necessarily indicate understanding. On the basis of Jim's response and the others, Lee decided that further instruction was necessary to ensure that her students understood that a trailing zero did not change the value of a decimal number.

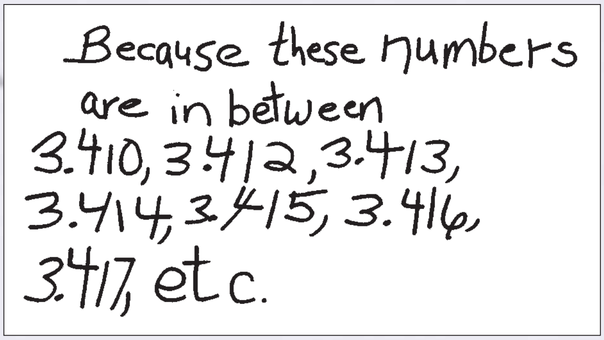

Fig. 1 Jim's response

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Because zeros may cause difficulties for students when they occur in a decimal number, Lee also decided that further assessment was needed. She developed the open-ended task shown in **figure 2.** Lee hoped that this task would help her students distinguish the various roles of zero in a decimal value and that their responses would give her a better understanding of her students' knowledge.

The sequence of assessment activities that Lee used is consistent with the recommendations of the *Assessment Standards for School Mathematics* (NCTM 1995), which identifies four phases of the assessment process: planning, gathering, interpreting, and using. Lee had begun the assessment process by selecting a task—write all the numbers between 3.4 and 3.5. Next, her students completed the task and she collected their responses. Lee then interpreted her students' responses and, finally, used the information she gathered to plan another assessment task for the students.

Identify the numbers below that are equal:

02.3 20.3 20.03 2.30 20.030 2.3

Explain how you know which numbers are equal.

Fig. 2 A short-response task

Figure 3 is a model of this assessment process. The vertical columns contain the phases of assessment, and the rectangles represent the outcomes. The circles indicate the main actor in each phase, which may be the teacher or the student. The arrows suggest that each phase of assessment influences the outcomes in the phases that follow. Of course, the event in each phase may vary, depending on the assessment technique, the mathematical topic, and the students involved. Actions and outcomes occur in each phase.

Each assessment phase influences the next

One of the uses of the information acquired through the assessment process is to make instructional decisions. For example, Lee could decide to question Afwandi further to assess her understanding of "infinitely many." Jim's response and similar responses from other students led Lee to review the role that zero plays in decimals and to develop another assessment task. As Lee's actions show, assessment often requires gathering information from several assessment events rather than just one. Lee's attention to each phase—planning, gathering, interpreting, and using—ensures that the phases of assessment are not treated as isolated events. Rather, each phase influences the next, and the outcome of the assessment sequence can play an important role in planning future instruction.

Lee's use of open-ended tasks in her classroom was a personal choice, but the assessment process advocated by NCTM (1995) can be applied regardless of the type of assessment task that the teacher prefers. Traditional assessment tasks, including computation exercises, short-answer questions, and word problems, are equally compatible with the model. The keys to successful assessment are planning, gathering, interpreting, and using information related to students' knowledge of mathematics to enhance learning. ☞

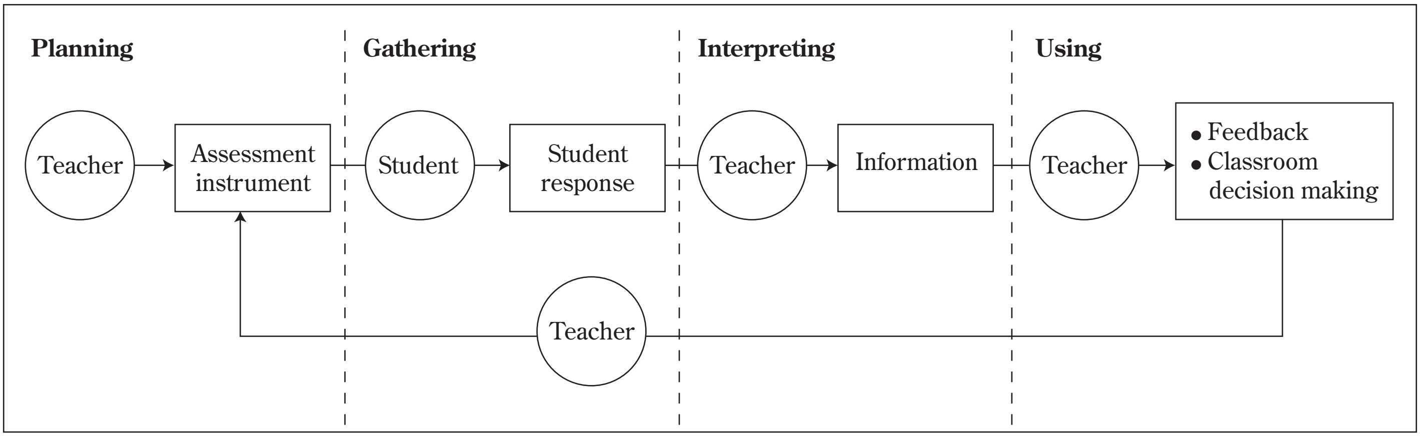

Fig. 3 The assessment process

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