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The Need for Interviews in the Mathematics Classroom

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The following task was given as a warm-up activity by one of my student teachers (Lenny) to a group of eighth-graders:

A baker used two-thirds of the flour that he had to make a cake, and two-thirds of the remainder to make bread. If he then had two-thirds of a pound left, how many pounds of flour did he have at first?

The students were required to obtain a solution and be prepared to explain their solutions.

Two of the many solutions were as follows:

1. $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} = 2\text{x}3 = 6$

2. $\frac{2}{3} \text{x} \frac{2}{3} = 2\text{x}3 = 3\text{x}2 = 6$

"*To understand the thinking of children, teachers need to spend more time listening to children describe how they think and less time explaining to the children how the teacher thinks.*

Both results are correct (ignoring the unit in the answers). These solutions bring certain questions to mind. How many points out of five will you give for each? Would you follow-up these solutions with the students? How would you follow-up?

It may be a good idea to follow-up such situations with a 1-1 discussion with the student requiring him/her to explain his/her solution. While the work seems weird, the answers are correct. It is possible that the student might have used a trial-and-error approach and obtained the correct answer; the student then tried to justify the answer by showing some work (because the teacher requested it). How do we know what occurred? According to Rudnitsky et al. (1981), teachers' understanding of what a child knows is derived from dialogue with the child. Unless we talk with the students, asking Why? How? and What?, it is difficult to determine what thinking went into the solutions. "To understand the thinking of children, teachers need to spend more time listening to children describe how they think and less time explaining to the children how the teacher thinks" (Chambers, 1995, p. 380).

The claim in this paper is that by talking with the student, we probe into his/her mind to understand the thought processes; thus we are able to identify the student's specific difficulties and place ourselves in a better position to help the student. According to Huinker (1993), "Interviews are a method of assessment that allow us to gain insight into students' conceptual knowledge and reasoning during problem solving. With paper-and-pencil tasks, students' understanding is often hidden" (p. 80). The student benefits from the experience by being able to clarify and communicate his/her thoughts. Buschman (1995), for example, states that "When students write or talk about mathematics problems, they test, expand, and extend their understanding of mathematics" (p. 329). The National Council of Teachers of Mathematics [NCTM] (1989) makes similar claims by saying that "Communicating helps children to clarify their thinking and sharpen their understandings . . . [P]robing questions that encourage children to think and explain their thinking orally or in writing help them to understand more clearly the ideas they are expressing" (pp. 26-27).

Situations in which students give the correct answer for the wrong reason are not unknown. There is the well-known example

$$\frac{2\cancel{6}}{\cancel{6}5} = \frac{2}{5}.$$

[For more examples and a discussion on this see Thomas (1967); Carman (1971); Shaw & Pelosi (1983); Borasi (1986).] It is important for students to give the correct reasons for their answers. To ensure this we have to require them to explain their solutions. During our lessons we should ask them How? Why? and What? questions. These questions do not necessarily have to follow students' incorrect answers; it could be equally informative to follow-up correct answers with questions. Hollander (1977) feels that opportunities should be available to discuss the rationale for correct solutions.

Suppose a student is asked to reduce the expression

$$\frac{3a + 15}{4a + 20}$$

to its lowest terms and the student gives

$$\frac{3a + 15}{4a + 20} = \frac{3}{4}$$

as the answer; the teacher may not require an explanation from the student because (3/4) is the correct answer. However, it could be useful to ask the student to explain how (3/4) was obtained because it could have been obtained by incorrect work. ['Cancel' the *a*s, and 'cancel' 5 in 15 and 20; that leaves

$$\frac{3 + 3}{4 + 4} = \frac{6}{8} = \frac{3}{4}.]$$

Shaw and Pelosi (1983) discussed an interesting example involving arithmetical division. These examples also point to the inadequacy of written work to explain students' thought processes.

The practice among mathematicians to ask themselves and their students How? Why? and What? questions is not new. It dates to the time of the ancient Greeks who, as a result of asking these questions, developed deductive arguments. More recently, support for interviews, dialogue with students, and for requiring students to explain their work have come from Weaver (1955); Lankford (1974); Pincus et al. (1975); McAloon (1979); Schoen (1979); Rudnitsky et al. (1981); Brownell (1987); Liedtke (1988); Lampert (1988); Whitin (1989); NCTM (1989, 1991); and Huinker (1993). For example, according to NCTM (1991), "Paper-and-pencil tests, although one useful medium for judging some aspects of students' mathematical knowledge, cannot suffice to provide teachers with the insights they need about their students' understandings in order to make instruction as effectively responsive as possible . . . [I]nterviews with individual students will . . . provide information about students' conceptual and procedural understanding" (pp. 63-64). (For more supporting references see the February 1995 issue of *Teaching Children Mathematics*.)

Most of these writers have suggested that interviews can be used as a diagnostic technique. However, it can be used also as part of the teaching process to obtain feedback on students' progress. For example, during a lesson the teacher can ask students to explain how they arrived at their answers to questions. Based on their responses, the teacher can decide how to proceed with the lesson or what course of action to take. Diagnosis can be followed by the preparation of remediation and/or differentiated programs of instruction which would enable students to overcome their difficulties. In the United Kingdom, Booth (1984) studied, in great depth, through interviews of students, some of the errors in mathematics which had been identified by Hart (1981) and then designed teaching experiments to correct these errors. The experiments were successful.

The following are some of the purposes/advantages of interviews in the classroom:

(a) to identify students' difficulties and to ascertain the reason for the difficulties;
(b) to probe into the learners' thought processes to find out how they are thinking and reasoning;
(c) to obtain feedback on students' progress;
(d) to provide opportunities for students to communicate mathematics and for them to clarify their thinking about mathematical issues;
(e) to help students identify and correct their mistakes;
(f) to provide opportunities for students to justify/defend their arguments;
(g) to determine whether the learner has a correct reason for his/her answer;
(h) to find out what students know and understand;
(i) to obtain information which would direct the planning of remediation/differentiated programs.

The use of interviews in the classroom should not be misconstrued as being problem-free. Interviews may yield inaccurate information. The interviewee may give information that he/she thinks the interviewer is looking for and may also fail to recall information accurately. An interview is obviously a time-consuming activity and may require trained personnel to conduct it. When students are asked to explain their answers and solutions during a lesson, much time is utilized. The teacher runs the risk of not completing the lesson or program of work. The good things are that the teacher does not have to question every student, and some of this questioning can be done outside of class time. Also, a student may be interviewed while the others are working. Technology could be helpful in diagnosing students' difficulties (Ronau, 1986). It seems that the long-term benefits of interviews will outweigh the initial disadvantages. Huinker (1993) recognizes some of the difficulties associated with interviews but feels that these difficulties can be overcome with "careful planning and organization" (p. 81). She identifies some important points to consider before, during, and after an interview and provides useful ideas for conducting interviews.

Using interviews in the classroom is not an entirely new idea. This practice has been used in the past with some success but, for one reason or another, interest in it waned. Students' written work alone is inadequate to determine students' thinking. Dialogue with students is potentially efficient in diagnosing students' specific difficulties. Once these difficulties have been identified, appropriate programs of instruction can be planned for students. The objective of teaching is to optimize learning, and one way to achieve this objective is to understand the thinking of students. The time has come for us to renew our interest in the practice of using interviews in the mathematics classroom in order to make our teaching more effective and to encourage communication of mathematics, one of NCTM's Standards.

REFERENCES

Booth, L. R. (1984). *Algebra: Children's Strategies and Errors*. A Report of the Strategies and Errors in the Secondary Mathematics Project. Windsor, Berkshire: NFER-NELSON.

Borasi, R. (1986). Algebraic explorations of the error $\frac{1\cancel{6}}{\cancel{6}4} = \frac{1}{4}$. *Mathematics Teacher*, *79*(4), 246-248.

Brownell, W. A. (1987). Meaning and skill—maintaining the balance. *Arithmetic Teacher*, *34*(8), 18-25. (Republication)

Buschman, L. (1995). Communicating in the language of mathematics. *Teaching Children Mathematics*, *1*(6), 324-329.

Carman, R. A. (1971). Mathematical misteaks. *Mathematics Teacher*, *64*(2), 109-115.

Chambers, D. L. (1995). Improving instruction by listening to children. *Teaching Children Mathematics*, *1*(6), 378-380.

Corbitt, Mary K. (1984). When students talk... *Arithmetic Teacher*, *31*(8), 16-20.

Fowler, M. A. (1980). Diagnostic teaching for elementary school mathematics. *Arithmetic Teacher*, *27*(7), 34-47.

Hart, K. M. (1981). *Children's Understanding of Mathematics: 11-16*. London: John Murray.

Hollander, S. K. (1977). The effect of questioning on the solution of verbal arithmetic problems. *School Science and Mathematics*, *77*(8), 659-661.

Huinker, DeAnn M. (1993). Interviews: A window to students' conceptual knowledge of the operations. In N. L. Webb & A. F. Coxford (Eds.), *Assessment in the mathematics classroom: 1993 Yearbook* (pp. 80-86). VA: NCTM.

Lampert, M. (1988). Connecting mathematical teaching and learning. In Fennema, E., Carpenter, T. P. & Lamon, S. J. (Eds.), *Integrating research in teaching and learning mathematics* (pp. 132-165). Wisconsin: Centre for Education Research.

Lankford, F. G., Jr. (1974). What can a teacher learn about a pupil's thinking through oral interviews? *Arithmetic Teacher*, *21*(1), 26-32.

Liedtke, W. (1988). Diagnosis in mathematics: The advantages of an interview. *Arithmetic Teacher*, *36*(3), 26-29.

McAloon, A. (1979). Using questions to diagnose and remediate. *Arithmetic Teacher*, *27*(3), 44-48.

National Council of Teachers of Mathematics. (1989). *Curriculum and Evaluation Standards for School Mathematics.* VA: NCTM.

National Council of Teachers of Mathematics. (1991). *Professional Standards for Teaching Mathematics.* VA: NCTM.

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class, the harder it is to personalize it. The above procedure would need to be significantly modified for larger classes through the use of in class TA's and other mechanisms. A class of 500 would be very questionable. CL is not meant as a cure all for economic problems and solutions imposed by administrators. It is well established that smaller classes are better pedagogically.

The procedures described above have evolved over a long period of time through a process of trial and error. It not recommended that new teachers initiate this extensive a cooperative learning system without first participating in training programs and conferences dealing with cooperative learning techniques. It takes time for teachers to develop a comfort level and develop a degree of confidence with cooperative processes. A good approach to incorporating CL in math classes would be to initiate one or two new techniques each semester until a full repertoire of activities is available to chose from.

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Peck, D. M., Jencks, S. M., & Connell, M. L. (1989). Improving instruction through brief interviews. *Arithmetic Teacher*, *37*(3), 15-17.

Pincus, M., Coonan, M., Glasser, H., Levy, L., Morganstern, F., & Shapiro, H. (1975). If you don't know how children think, how can you help them? *Arithmetic Teacher*, *22*(7), 580-585.

Ronau, R. N. (1986). Mathematical diagnosis with the microcomputer: Tapping a wealth of potential. *Mathematics Teacher*, *79*(3), 205-207.

Rudnitsky, A. N., Drickamer, P., & Handy, R. (1981). Talking mathematics with children. *Arithmetic Teacher*, *28*(8), 14-17.

Schoen, H. L. (1979). Using the individual interview to assess mathematics learning. *Arithmetic Teacher*, *27*(3), 34-37.

Shaw, R. A. & Pelosi, P. A. (1983). In search of computational errors. *Arithmetic Teacher*, *30*(7), 50-51.

Thomas, R. B. (1967). A dialogue on $\frac{2\cancel{6}}{\cancel{6}5} = \frac{2}{5}$. *Mathematics Teacher*, *60*(1), 20-23.

Weaver, J. F. (1955). Big dividends from little interviews. *Arithmetic Teacher*, *2*, 40-47.

Whitin, D. J. (1989). Number sense and the importance of asking "Why?" *Arithmetic Teacher*, *36*(6), 26-29.

"God does not care about our mathematical difficulties. He integrates empirically."

--Albert Einstein