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8, must have a valid California Teaching Credential in their subject. Therefore, a teacher with a General Credential lacking a math major or minor can't teach algebra or higher. A biology major who doesn't have chemistry as a minor cannot teach chemistry. If administrators allow this there are costly financial consequences for the school district.

I'm sorry Dr. Dancis' experiences with the public school of his choice has not been up to his standards. Before crying wolf, I suggest he spend a year of so actually teaching middle school children. It is an eye-opener.

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In his article "Middle School Math Teaching and How It Harms Our Children," Jerome Dancis (*HMNJ* 20, 1999) raised a number of pertinent issues related to classroom practice. In particular he identified a number of fundamental teaching practices that were not described in his local school system's teaching guides. I would like to elaborate on one of the issues, that of assessment in mathematics teaching. Dancis describes a disconcerting "all-or-nothing" scoring procedure used by a teacher to score an algebraic simplification question out of 25 points. Although we have no idea how many years this teacher had been teaching, there are clearly aspects of assessment practice that s/he needs to learn. I pose the following question: What do we as mathematics teacher educators forget to tell our preservice teachers about assessment?

To ensure that future mathematics teachers employ a diversity of assessment strategies, we expose our preservice teachers to journal writing, mathematics project work, portfolios and other alternate assessment strategies. These strategies have their place in the teaching of mathematics and should be encouraged because of their educative role. Also, many of our preservice teachers did not encounter these forms of assessment at school, hence the need to introduce them to the teachers. However, when practicing teachers (in the USA) are expected to have in excess of 20 grades per student in a 6 week reporting period, we understand why teachers resort to assessing homework, testing 2-3 times a week and collecting grades at every opportunity. Ensuring that the assessment procedures are reasonable, that tests are well constructed and scored fairly, would go a long way to alleviating some of the difficulties expressed by Dancis. Far too frequently we forget to inform our preservice mathematics teachers of the basics of sound test construction, implementation and grading. In the teachers' "real world" they will be required to test, test with traditional pencil-and-paper quizzes and tests, and unfortunately test frequently.

AN EXAMPLE

In figure one I depict one question from a 50 minute test to illustrate the characteristics of test construction discussed below. I have specifically illustrated my argument with a very traditional algebra test because it relates directly to the experiences of practicing teachers. Each question tests some aspect of factoring. Figure 2 gives, as an example, the scoring rubric for question 2.4. Two possible solutions are given to guide the teacher's assessment of possible student solutions. Points are allocated for specific steps in the anticipated solutions.

I turn my attention to addressing some basic issues of test design we neglect to tell our preservice teachers. What every teacher should know before constructing his or her first class test:

a. Not all test questions should be of equal weighting. Dancis describes how the teacher had four problems, each worth 25 points. Did each of the questions require the same amount of work to

Question 2: Factor fully

2.1) $12x^2 - 27$ [3]

2.2) $-2x^2 - 4x + 6$ [4]

2.3) $4x^3 - 2x^2 - 6x$ [3]

2.4) $(x - 4)^2 - (x - 4) - 6$ [4]

2.5) $4(a - b)^2 - a^2(b - a)^2$ [6]

2.6) $z^3 - 3z^2y + 3zy^2 - y^3$ [7]

(* Question 2.6 can be solved in one step by students who recognize this as the expanded form of $(z - y)^3$. The students who sat this test were not familiar with this expression and grouped terms to find a common factor.)

Figure 1
Question two from a 50 minute algebra test on factoring

solve? We want a test with a range of complexity. We can not then assign equal grades to each question. Figure one illustrates a range of questions with varying levels of complexity. For example, question 2.5 is more complex and requires more work than question 2.1.

b. Assign points to the amount of work and complexity of the problem (also Cangelosi, 1996). How do you assign meaningful partial credit when scoring a question out of 25? Rather, each test item should be scored according to the number of logical steps required to complete the question. This tells the student that the process is important. The solution of question 2.4 (figure two) illustrates the allocation of each of the 4 points to various steps in the solution process.

c. The points awarded to each question should be made clear to the student on the test. In figure one the points allocated to each question are indicated for students to see.

d. Test items should be developmental (also Nitko, 1996). Starting with simple problems and moving to more complex questions with at least 10% of the test requiring the students to apply their knowledge to new contexts.

e. Teachers must create a scoring rubric (memorandum, blueprint or answer key (Nitko, 1996)) for the test before they administer the test. This gives an opportunity to identify errors in the questions and assign appropriate points to each question. The rubric should anticipate various student solution strategies (see Figure 2). It is then used (flexibly) as a guide to assign points to students' work. This process improves the fairness and hence validity of a test.

f. Teachers should not only be grading for their grade book. Unfortunately the educative role of assessment has been neglected in most mathematics classrooms, leaving assessment simply a means to audit learning. Teachers should review the scored test with the students with the hope that some students may learn from their mistakes.

$$(x - 4)^2 - (x - 4) - 6$$
$$[1] \qquad [1] \qquad [1]$$
$$= ((x - 4) - 3)((x - 4) + 2)$$
$$[1]$$
$$= (x - 7)(x - 2)$$

1 point for seeing (x-4) as a common factor
1 point for each parenthesis
1 point for simplifying the two parentheses

$$(x - 4)^2 - (x - 4) - 6$$
$$[1] \qquad [1]$$
$$= x^2 - 4x - 4x + 16 - x + 4 - 6$$
$$[1]$$
$$= x^2 - 9x + 14$$
$$[1]$$
$$= (x - 7)(x - 2)$$

1 point for simplifying $(x - 4)^2$
1 point for simplifying $-(x - 4)$
1 point for simplifying
1 point for factored expression

Figure 2
Scoring blueprint for question 2.4.

I hope this discussion serves as a reminder of some of the attributes of test construction that we take for granted and assume preservice teachers know because they have been through 12 years of schooling. Dancis showed that in many cases this might be a flawed assumption. If the teacher depicted in Dancis's article taught one of your students, then you could be sure that the teacher does not know how to construct a test. Although reform efforts in mathematics education introduce assessment techniques that may be more suitable and more motivating than traditional tests, let us not neglect to pass on the simple principles of sound test construction.

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Another Response to Dancis

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The following is taken from an email message to Jerome Dancis.

I just read your paper "Middle School Math Teaching and How It Harms Our Children" in the *Humanistic Mathematics Network Journal*; I particularly liked your "sidebar" on the factoring problem. But you seem to think that the question would have been graded differently in some other school—who are you kidding?

I once taught in a school where the principal was considered to be a good principal if he had no riots in the school. When that happened, the principal was moved up to an even higher position. (That was at Crane in Chicago in the middle 60's). And how did the principal ensure that there were no riots? He **never** (not once) came out of his office when the kids were in the building. All doors were locked after 8:00, and there were uniformed cops in the halls. No one worried about the kids learning anything—teachers were only interested in getting through the day. Compared to Crane, your "magnet school" sounds like a haven for learning!

"No amount of experimentation can ever prove me right; a single experiment can prove me wrong."
--Albert Einstein