Leveling the Playing Field Through Active Engagement

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Is it accurate to say that some students are "learning disabled" or could it be that traditional practices like lectures and worksheets make it more difficult for some students to learn? While we do not claim to have definitive answers to these questions, we would like to discuss insights and implications from our work in a sixth grade collaborative mathematics class which included "regular-education" and "special-needs" students in a team-taught scenario with both a regular education and special education teacher. In this article we will use the terms "special needs" and "learning disabled" interchangeably because the special-needs students in this class were classified as "learning disabled."

Together Cathleen and Marylin have explored use of portfolios since 1994 when the middle school, a Professional Development School, and the university joined forces to prepare for statewide implementation of portfolios. Professional Development Schools (PDS) are a specific type of school-university partnership in which school and university faculty collaborate to improve teaching, learning, and teacher education (Darling-Hammond, 1994; Holmes Group, 1990). In this particular collaborative effort a number of teachers, the assistant principal, and a university faculty member met regularly to read articles about portfolios, discuss potential approaches, and share insights from pilot projects. As a result of study group readings and discussions, Marylin and Cathleen conducted several collaborative inquiry projects which culminated in conference presentations and publications (e.g., Rafferty and Leinenbach, 1996; and Rafferty, Emmert, Helms, Herner, Jacobs, Leinenbach, Mallory, Pell, Smith, & Turner, 1996). Although the state has since modified an earlier mandate for portfolio use, Marylin continues to refine use of portfolios in her sixth-grade mathematics classes in which Cathleen is a frequent participant-observer, critical friend, and co-researcher.

It is important to note that Marylin recognized early on that using portfolios would significantly affect her teaching. In fact, her initial interest in portfolios was driven by a need to pull together the diverse and disjointed projects (e.g., fractals, tessellations, group problem solving projects) she had recently started to incorporate in her classroom along with traditional tests and quizzes. As our work has progressed, we have come to understand that portfolios and the types of projects best "showcased" therein actively engage students in their own learning and assessment.

Questions we had and how we sought answers

Previously we had learned that eighth graders are more than capable of making good decisions regarding portfolios—this included everything from the categories of evidence, to the types of evidence necessary, to items to include, to how it should affect their grades and why (Rafferty and Leinenbach, 1996). Once Marylin moved to sixth grade, however, we were uncertain about necessary modifications—particularly for using portfolios with the special needs students in the collaborative mathematics class which was team-taught with LeeAnn, the third author of this article. We had read a variety of books and articles (e.g., Herman, Aschbacher, & Winters, 1992; Kuhs, 1992, 1994; Perrone, 1991; and Stenmark, 1991) which convinced us that alternative or more performance-based assessments would give us

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Figure 1

End of Semester Reflective Essay

WRITING SITUATION: The purpose of your portfolio has been to show your progress in the four categories of Group Problem Solving, Connections, Skills, and Attitude. All semester you have **collected** your work in your working portfolio. You have also **selected** your work for your assessment portfolio. Now it is time to **reflect**. Use the following questions as a guide to complete your reflection.

1. From your portfolio, what would be an activity that shows your progress in each of these four categories: Connections, Group Problem solving, Skills, Attitude? Why or how does it show progress?
2. Do these kinds of activities help you learn math? Why or why not?
3. How do you know when you understand something in math?
4. How have you changed as a student in math because of these activities?
5. Besides getting a good grade on a test or quiz, how can you show your teacher that you understand math?
6. Besides helping you be organized, how else is your portfolio helpful?
7. In examining your portfolio, what would you say is your strength in math?
8. What do you still need to work on? What goal would you like to set for the next semester? **(project)**

Figure 2

Math Portfolio Framework

PHYSICAL: A three-ring binder with dividers will be used.

PURPOSE: Students will show progress in the categories:
1. Connections
2. Attitude
3. Group Problem Solving
4. Skills

CONTENT: Student reflections, comments, and physical evidence of the following categories:
1. Mathematical connections
   mathematical art project
   mathematical literature
   core subjects using math
2. Positive mathematical attitude
   journal entries
   student attitude assessment
3. Group problem solving
   group projects
   group work assessment
4. Growth in mathematical skills
   homework
   quizzes
   tests

ASSESSMENT: Students must have a minimum of five pieces of evidence in the four categories. Students will determine the % of grade.

deeper insights into student thinking and understanding while simultaneously engaging students in their own learning. As such, we drafted the following questions to guide our work during 1996-97:

- How do portfolios contribute to student empowerment regarding their learning?
- Do portfolios empower all students in similar ways? If so, how? If not, why not?
- In what ways do they help to inform students about their learning?
- How do portfolios interact with and support various NCTM standards (e.g., mathematical skills, attitudes and intellectual habits of mind, connections, problem solving) especially as related to student understanding?

In order to better understand the impact of portfolios on these sixth-grade students, we conducted both oral and written interviews to capture the students' insights regarding their use of portfolios in mathematics class. Questions included:

- What is mathematics? What is its purpose?
- How do you know when you understand something in math?
- Besides getting a good grade on a test or quiz, how can you show your teachers that you understand math?
- Besides helping you be organized, how else is your portfolio helpful to you?
- Examine your portfolio. What does it show are your strengths in mathematics? What are some things that you need to improve on?

Figures 1-5 show specific examples of portfolio assignments. We also analyzed sample portfolios, video-taped many class activities, used student journals, and kept our own reflective logs throughout the school year to help us puzzle through ideas and insights that resulted from our work with these sixth graders. By year's end we also had pretest/posttest results on the Brigance Diagnostic Inventory of Essential Skills (Brigance, 1980), a criterion-referenced test which the school administers to all students at the beginning and end of grades six through eight, and grade percentages from all four quarters of the school year. In other words, we had a mountain of both qualitative and quantitative data to help us answer our questions about using portfolios in the collaborative mathematics class.

What we learned

Most special-needs students scored at least as well on homework, tests, and quizzes as their regular-education counterparts. This was especially true during three of the four grading periods. However, for a short time during the third quarter when the topic was fractions, Marylin returned to more traditional teaching methods like lecture, drill and practice, memorization, and worksheets. This decision was primarily driven by her need to prepare students for the state-mandated proficiency test and the students' need for algorithms to calculate fractions. Only a few hands-on activities were used because Marylin had not yet located manipulatives to teach this skill. For most students the result was a lower grade percentage, but the special-needs students in particular showed the greatest decline. The class average declined from 90.6% during second quarter to 74% during the third quarter. Of course, we cannot be certain that this decrease was attributable to teaching methods alone—it is also possible that elements such as the topic (fractions), time of year (January - mid-March), or cognitive developmental levels of students were also mitigating factors. Nonetheless, this finding seems related to the question we posed at the beginning of this article because the special-needs students' scores were affected the most. This finding is also consistent with authorities who note that poor or traditional instruction is a major cause of math difficulties experienced by many students with learning problems (e.g., Carnine, 1991; Cawley, Fitzmaurice-Hayes & Shaw, 1988; Cawley, Miller & School, 1987; Kelly, Gersten & Carnine, 1990; Montague & Bos, 1986; Scheid, 1990).

When students worked collaboratively on projects and assignments, it was difficult to identify regular-education vs. special-needs students. As a specific example, near the end of the school year "Billy," a special-needs student, and his group were the first to successfully complete a difficult problem-solving activity. Figure 3 displays their work on this project and also serves as an example of "Group Problem Solving" for the portfolio. Note that they received all 5 points possible for this activity in which they used words and an illustration to explain their thinking and their solution. As their drawing indicates, four of the children received two donuts apiece while the fifth child held the two donuts which remained in the box.

LeeAnn, the special education teacher in this class observed that, "When students work in groups of 3 or 4, there aren't any distinctions between the students. In addition, students who had low self-esteem now feel better about themselves. They are actively participating in class and seem connected to their peers. Finally, portfolios give the special-needs students a choice—probably for the first time in their school career. They are included in the process of what, how, and why a skill is being learned."

Figure 3

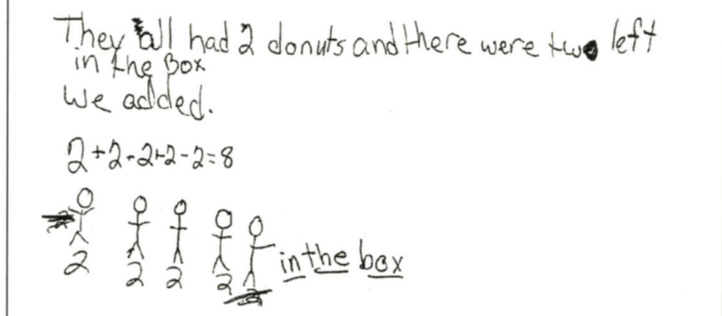
Donuts and Tinkertoys

PERFORMANCE TASK

PROBLEM: Josh, Ann, Wesley, Alex, and Carmen have a box containing ten donuts. How can they divide the donuts among themselves so that each person gets two donuts, and two donuts remain in the box?

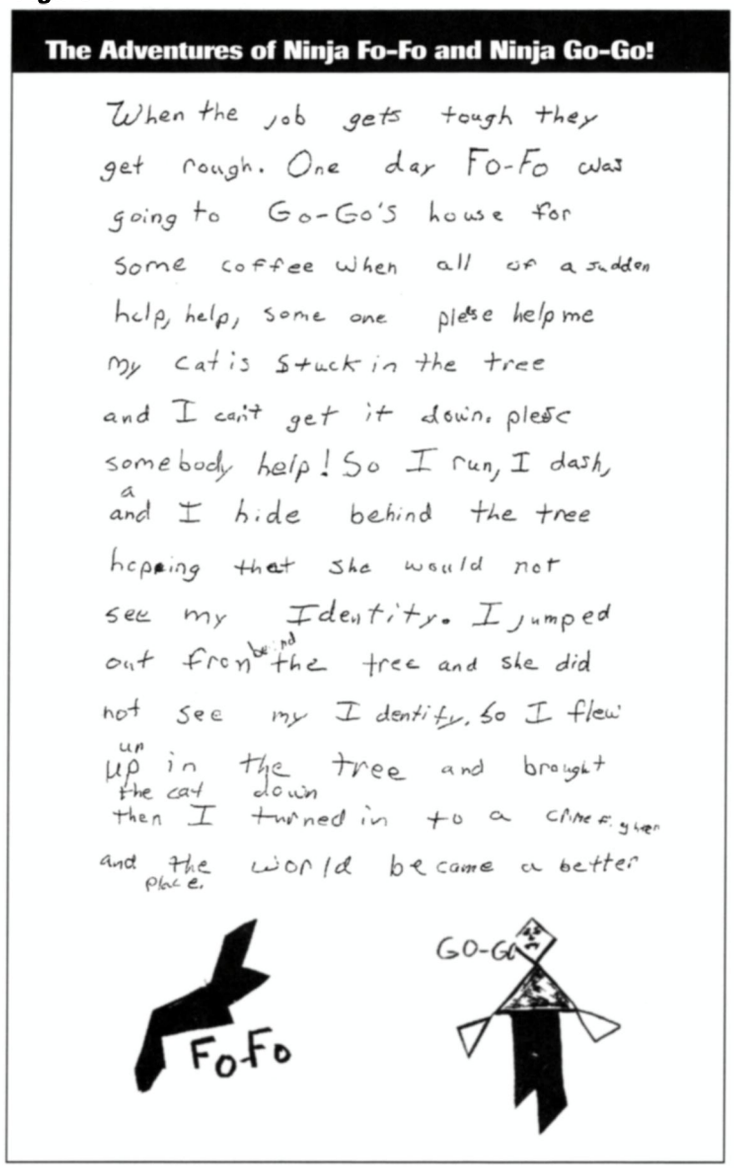
MATERIALS: Box and donuts and anything in the room that will help.

TASK:
Explain in writing your answer.
Explain the strategy you used to explain your answer.
Document your thinking.



Using portfolios helped these sixth grade students in a variety of ways. First, via their oral and written interviews, all of the sixth graders acknowledged that portfolios (both working portfolios and assessment portfolios) helped them to be better organized, an extremely important result for middle school students. In addition to providing opportunities to both *collect* (working portfolio) and *select* (assessment portfolio) samples of their work which demonstrated what was learned across the semester, students also indicated that portfolios allowed them to compile materials for later review. Such review sessions, known as "housekeeping" sessions, underscored the students' growth and progress, which in turn, often boosted their confi-

Figure 4



dence. It also helped these students to identify areas in which they still needed additional work.

Second, because the working portfolio also contained extra-credit or enrichment activities, several students noted that they used the portfolio as a way to manage their time and assume personal responsibility. As "Miriam" said, "My portfolio is there when I need something to do when I'm done with my work so I don't get into trouble."

Third, use of portfolios and complementary activities like group problem solving, manipulatives, and other projects that linked mathematics to classes such as art and literature helped a number of students to see interdisciplinary connections and to improve their math grades. An example would be Figures 4 and 5 which display stories and accompanying tangram illustrations created by student groups after they listened to *Grandfather Tang's story* (Tompert, 1990) and viewed its tangrams projected on the overhead. Tangrams or Chinese puzzles are comprised of seven standard pieces called tans. Used in storytelling, the tans are arranged to show the shape of a character in the story. In creating a picture students must use all seven tans by having them touch but not overlap, thereby reinforcing geometric shapes and spatial skills. These examples would be included in the portfolio section, "Connections."

The Figure 4 story has two main tangram characters, Go-Go and Fo-Fo, who not only help stranded cats but also aspire to improve the world. The Figure 5 story, although short, is carefully and elaborately illustrated regarding the main story features, the dog, the fox, and the house. This combination of turning mathematical shapes into art which is also connected to writing, storytelling, and literature enabled these special needs students to demonstrate different abilities and strengths as they worked with mathematical concepts.

Experts in teaching special needs students note that such incorporation of concrete experiences to teach and assess math skills can promote student understanding (Mercer, 1991) and our students' actions underscored this view. For example, "John" reported that he had "become more confident and found out how to do more" and "Will" indicated that "Last report card I had a D+, now I have a B. Now I understand."

Understanding that one understands is an important part of metacognition. Rather than assuming that learning disabled or special needs students are lacking in ability, research in metacognition has shown that they lack strategies (Torgesen & Licht, 1983). *A number of the sixth graders in the collaborative mathematics class demonstrated that they knew when they understood, what they understood, and how that they knew they understood (metacognition).* This finding is especially important because a common concern of teachers of learning disabled students is that these students often have difficulty working independently and being able to self-monitor their own understanding (Deshler, Ellis & Lenz, 1996). Too often students rely on the teacher to tell them whether they understand or not—usually in the form of a grade on homework, a quiz, or a test. In

other words, a good grade equals understanding; a poor one equals a lack thereof. Rather than merely using grades as an indicator of their understanding, these special needs sixth grade students expressed two broad categories that described their metacognitive awareness: physical manifestations and feelings of independence. For example, a physical manifestation of understanding was described as "something clicks in my head" or "I get a feeling in my stomach and feel confident." Feelings of independence contained two subsets of comments. The majority of students used phrases like "When I do not need help" or "When I can do it without help" to describe how they knew when they understood. Others, like "Robert," stated that "When you keep doing a problem over and over again and keep getting it right." or "Amy" who said, "When it sticks with me and when I can remember the math over long periods of time" seemed to understand the importance of long-term recall and application.

These special needs students demonstrated that they can self-monitor when encouraged to think about their own learning and understanding. This is particularly important for "special needs" students because too often they are not expected to be actively involved in their learning. When students reflected as they reviewed items selected for the end-of-semester portfolio, questions (Figure 1) pushed the student's thinking.

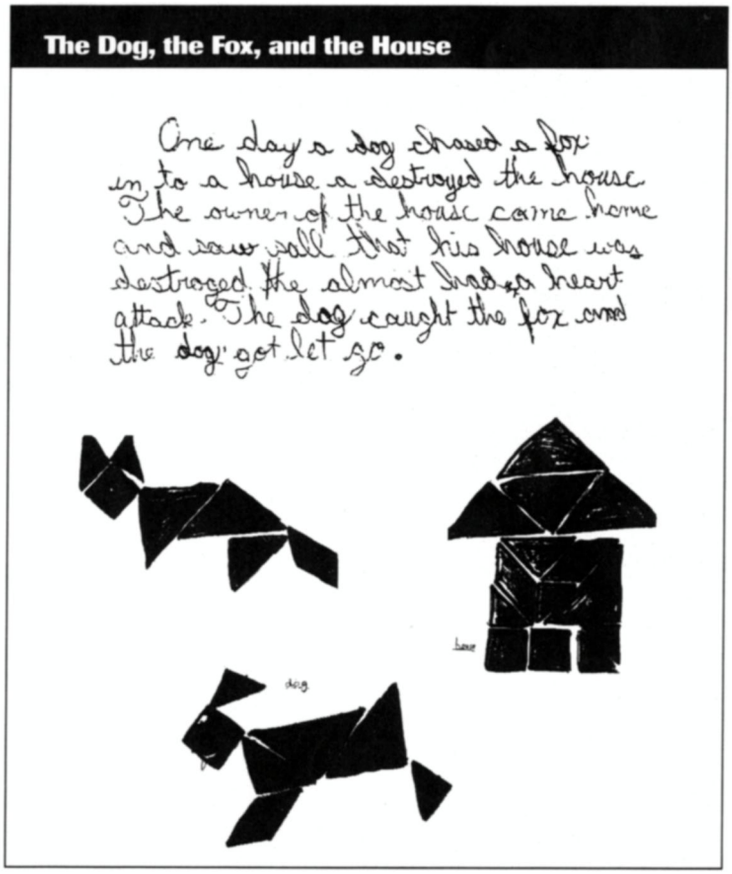
Portfolios also helped these students to develop and recognize alternative ways to show their understanding because using a portfolio required students to document their learning in a variety of ways (see Figure 2). Early in the school year many could think only of traditional ways to show their understanding like homework, texts, or quizzes. However, in oral and written interviews during the second semester, students revealed a growing range of possibilities:

- helping other students
- doing board work
- providing detailed explanations (both oral and written)
- displaying more positive attitudes toward math
- challenging the teacher to a math quiz contest
- connecting math to other classes
- applying math to daily activities
- looking the teacher in the eye.

To us, the last comment in particular, made by "Charlie," an extremely quiet and reserved student, really indicated the power of portfolios and related activities to "level the playing field." Too often, students, either special-needs or merely those experiencing difficulties, withdraw and develop various hiding-out tactics to avoid engagement. "Charlie's" words, as well as other ideas on the list, express recognition that learning is an active rather than a passive process. Given what some of these special-needs students had probably experienced previously (e.g., an over-abundance of worksheets, drills, and rote-memory exercises), these were very important student insights. It is also important to note that at least one of these students ("Billy"), upon learning that he was not scheduled to continue working with Marylin as a seventh grader, successfully petitioned to be moved to her class.

Figure 5

The Dog, the Fox, and the House



Conclusion

As noted previously, much recent research indicates that poor or traditional instruction contributes to math difficulties of many learning-disabled students (Mercer, l991), but we also have much new information

about instructional and assessment strategies that are successful with these same students (e.g., Deshler, Ellis & Lenz, 1996; Mercer, 1991). Whether students are really "learning disabled" or whether their "learning is disabled" due to ineffective or inappropriate teaching practices is not nearly as important as what we, as educators, do once we realize that our students are not being successful. Sixth graders like "Robert," "Miriam," "Billy," "Amy," "Charlie," and "Will" have helped us to understand the potential of approaches which actively engage students to "level the playing field" in a collaborative mathematics class. We are uncertain, however, about the long-range impact that use of portfolios and related activities will have on these students. Will they be placed with a seventh-grade teacher who will organize instruction in a similar way? If not, how will these students respond? Will there be any long-range carryover regarding their ability to be organized, their attitudes toward mathematics, their skill levels, their performance on problem-solving tasks, and their ability to see connections to other subjects regardless of the nature of instruction in future mathematics classes? These and other questions will provide direction for our future collaborative endeavors as we continue to refine our use of portfolios and related activities which actively engage students in their own learning. □

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