CHANGING VIEWS:

Fearless Families Conquering Technology Together

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"THAT'S CHEATING!" SAID A STUDENT, when I announced that calculators would be used to solve the problems we would be working on in class. When I asked him why, he said, "My teacher told me that using calculators was cheating in math."

This opinion seems to be the prevailing view of most middle school students and their parents. Yet the

Technology Principle in *Principles and Standards for School Mathematics* (NCTM 2000) states that "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p. 24). This conflict of views became the focal point for discussion in a group of classroom teachers, mathematics faculty, and mathematics education faculty as part of Title II grant activities. As a result, the authors decided to take action by offering three workshop sessions for the parents and guardians of middle school students to address how calculator technology is used appropriately in the middle school mathematics curriculum. (To simplify the text for this article, we will subsequently use "parents" to mean parents and guardians.)

Our first task in designing the workshops was to establish the following goals:

- Help parents understand the appropriate role of calculators in the mathematics curriculum
- Show parents how understanding this technology might help their child in standardized testing
- Assist parents in feeling comfortable using calculators and understanding basic keystrokes
- Give parents a way to support and help their child with mathematics
- Give parents and pre-adolescents an opportunity to find joy in doing mathematics together

Enhancing parents' understanding of ways that calculators are used appropriately in mathematics instruction can potentially increase parental support for the reform mathematics curriculum used in the middle school. Some standardized tests (e.g., American College Testing Program [ACT] and Michigan Education Assessment Program [MEAP]) allow the use of calculators and with the increasing amount of attention given to standardized testing, we felt it was important for parents to know how using calculators could be to their child's benefit. That is, students who are not familiar with the technology could be at a disadvantage when taking these tests compared with those who are comfortable using a calculator. We also wanted parents to feel comfortable using the calculators and thought it would be helpful to teach some basic keystrokes. We felt that the last two goals would happen naturally as part of the workshop experience. With these goals in mind, we offered a free workshop (three, two-hour sessions spread over three weeks) to middle school families.

We wanted to make this workshop as accessible as possible. The sessions were held at the middle school in the early evening on three consecutive Mondays. We decided not to charge a fee for attending and arranged for free child care using honors students from the local high school as volunteers. Directing invitations to parents through the usual school functions (e.g., Back to School Night and parent organization meetings) was more effective for registering participants than sending flyers home with students.

Workshop Descriptions

THE FIRST SESSION WAS FOR ADULTS ONLY. THE purpose of this session was to talk about the national and state standards in mathematics and technology. Time was spent discussing the standardized tests that their children would be taking and the role of calculator technology in those tests. We shared information about the district's mathematics curriculum and how technology was addressed. Two types of calculators were introduced: a fraction calculator (TI-Math Explorer) and a graphing calculator (TI-73). Instruction was provided for using unfamiliar keys and features, such as the FIX key on the Explorer and the constant feature on both calculators. Questions about different keys and what the calculators could be used for generated other explorations. The parents were eager to learn the keystrokes and were amazed at the calculator's ability to do more than just computation using the usual four operations. One of our expectations was for parents to be able to freely explore the calculators without having their children lean over their shoulders and punch the keys for them. A little bit of empowerment was evident the next session when their children were present.

"Bring on the kids!" was the rallying call for the second and third sessions. The general format of the next two sessions involved parents and children joining forces as they tried various activities that were set up around the room as warm ups. Some families tried all the activities, whereas others stayed with a single favorite. One favorite activity, based on an item from Family Math, involved figuring out the

value of words using dollar amounts assigned to each letter of the alphabet (Stenmark 1986, p. 33). The remainder of each session was spent with middle school mathematics teachers using lessons from the district's curriculum featuring the appropriate use of calculators. The focus was not only on using the technology but also on the mathematical concepts developed as a result of the calculator use. Parents could understand that by using a calculator, students could spend more time developing the mathematical concepts and less time on computation. Students liked using calculators and were comfortable with the technology. It was easy holding their attention and keeping them involved.

The second session focused on grade-level-appropriate activities for typical middle school concepts. The National Science Foundation funded four Standards-based projects with activities. Our first example used a group activity from a sixth-grade unit titled "Prime Time" from the Connected Mathematics Project (Lappan, Fey, Fitzgerald, Friel, and Phillips 1998a). This activity involved considering the cycles of locusts and finding the least common multiple. The constant feature of the Explorer calculator was used as a tool for thinking about multiples of numbers without getting bogged down with tedious computations. The second activity, "Do You See What I See?" from *Discovering Mathematics with the TI-73: Activities for Grades 5 and 6* (Nast 1998), used the TI-73 graphing calculator to plot points and create a line graph. This graph was then transformed in various ways by changing the *x*- and *y*-coordinates in specific ways. Parents and students could predict what would happen to the graph, then try it out to check their predictions. The graphing calculator facilitated many different transformations of the data within a relatively short time, encouraging thinking about what happens to a graph when manipulating the data points. This activity is similar to an activity used in the seventh-grade unit titled "Stretching and Shrinking" from the Connected Mathematics Project (Lappan et al. 1998b). Both of these activities showed important mathematical ideas while holding the attention of parents and students.

The third session continued to build on features of the calculators used in previous sessions. The first activity was an estimation game that could easily be adapted appropriately for any middle school grade level. One variation of this game involved choosing a target range (e.g., 445 to 455) and a starting number (e.g., 68); the task was to have the calculator display a number within the target range by only using the operation of multiplication. **Figure 1** is an example of a worksheet for keeping track of strategic guesses while playing the game with a single line calculator

Estimation Game
Start Number: 68
Target Range: 445–455

Number Displayed	Factor (Multiply By)	Product
68	5	340
340	1.3	442
442	1.1	486.2
486.2	.956	464.8072
464.8072	.98	455.51106
455.51106	.99	450.95595

Fig. 1 Keeping track of successive guesses and results during an estimation game

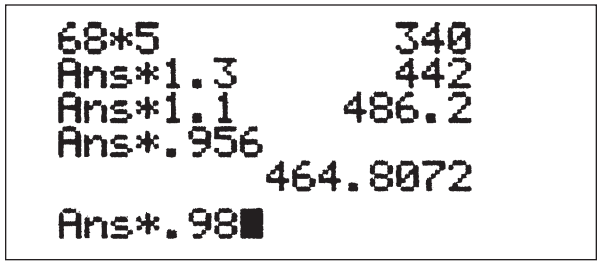

Fig. 2 An example of playing the estimation game on a calculator that contains a multiline display

(e.g., Math Explorer). However, with a multiline calculator (e.g., TI-73), players can scroll up and down the display for a record of the results of successive guesses (see **fig. 2**). This activity helps to build number sense by focusing on the effects of multiplying by numbers greater than or less than 1. At this point, parents indicated some level of comfort in using these calculators in new ways.

The second activity was adapted from the "Which Way" and "Match Me" activities in *Math and Science in Motion: Activities for Middle School* (Brueningsen, Brueningsen, and Bower 1997). This activity used the TI-73 graphing calculator with a motion detector (Calculator-Based Ranger) to see how movement shaped a graph. The focus of this activity was to decide how to walk (i.e., direction and speed) to match a given graph generated by the calculator. Both parents and students were amazed at the technology that they could hold in their hand, which allowed them to think about the relationship between time and distance. We had a hard time ending this activity because they were having so much fun matching a graph with specific walking. This activity provided clear evidence to us that it is possible to enjoy mathematics while learning. In addition, this popular activity led to a rich discussion about the role of technology in the mathematics curriculum.

Responses to the Workshops

WE ASKED PARENTS AND STUDENTS TO FILL OUT evaluation forms for feedback after each session to see if we were making progress toward our goals. **Figure 3** is an example of the evaluation form we used at the last session. We asked them to respond to these general questions about the workshop:

- Did the use of technology help in understanding mathematics concepts in tonight's activities?
- What would you like more information on?
- What did you enjoy?
- What suggestions do you have for the next workshop?
- Would you recommend this workshop to others?

More specific questions were asked about the appropriateness and usefulness of technology in particular activities from each session.

The evaluation forms for each session were copied in two colors so that we could separate responses of parents and those of students. In general, parents and students responded positively to the series of workshops. All the responses to the evaluation for the first session (parents only) indicated that information on the Standards, testing, district curriculum, and learning basic keystrokes on the calculators was "very informative" and "very helpful." About 40 percent of the responses indicated an interest in learning more about using the calculators, and about 40 percent of the responses specifically mentioned that participants enjoyed learning about the calculators.

This is it . . . one last time, tell us what you think!

Openers: What was your favorite?

Space Invaders Game Plus Puzzle Calculator Path

Did the use of technology help in understanding math concepts in tonight's activities?

Yes No

What did you enjoy about this workshop?

Would you recommend this workshop to others?

Why or why not?

Suggestions for next time.

Fig. 3 An evaluation form from the final session of the workshop

Responses from both parents and students in the second and third sessions indicated unanimous agreement that using the technology helped with understanding the mathematical concepts in the activities. When asked what they enjoyed during the second session, more than half of the comments from parents indicated that they enjoyed the interaction, as shown by such comments as "keeping the audience involved" and "the activities we did together." After the third session, parents' comments about what they enjoyed focused more on the experience of using the calculators, as captured by these comments: "[I enjoyed] learning to use the calculator to do different things" and "I enjoyed the hands-on experience with the calculators. I liked watching the children be successful." Half of the students' responses mentioned specific activities from each session that they enjoyed, and half of their responses included general comments such as "I enjoyed everything! It was very educational" and "I enjoyed using the calculators."

There were only a few comments written in response to the prompts for the request for more information and suggestions for the next workshop. The responses to both of these prompts, from parents and students, were very similar. These responses indicated interest in learning more about using the calculators (e.g., specific keys and functions on the calculators or for specific mathematics topics such as graphs) and having more time to "practice" (mentioned by parents) or "play" (mentioned by students) with the calculators.

A unanimous positive response was given by both parents and students to the prompt about recommending this workshop to others. Parents' responses included the following: "[It was] very helpful to see the latest technology that our children are using" and "This workshop stimulates your thinking process." Students wrote these comments about recommending the workshop: "Because you can learn different stuff," "Because it can help you on graphs and how to work a calculator," and "Because it helps you understand math better."

We learned that holding this workshop for parents and their children, in general, helped all understand the role that calculators can play in learning middle school mathematics; specifically, they helped make connections to the current curriculum used in the school district. We feel our goals were met through the written and oral feedback we gained from all participants.

Final Thoughts

IT WAS CLEAR FROM THE RESPONSES OF THOSE who participated in this workshop that they enjoyed the time working together and enjoyed the ways of

working on mathematical ideas using calculators. Parents generally wanted to help when their children struggled with mathematics homework but were unfamiliar with the current mathematics curriculum and the tools used with it. This workshop was a small but important step in helping parents understand what their children were working on in mathematics and to be a partner in solving similar problems. At the end of each workshop session, packets with activities and materials were given to each family so that they could continue to work together at home.

Parents and students who participated indicated that they were interested in continuing this workshop. They wanted more time to work on mathematics and more time to use the technology to think about mathematical ideas. Recognizing the value of using hand-held technology in these workshops helped change parents' and students' views from using such technology as cheating in mathematics to viewing it as a tool for enhancing mathematics learning.

References

Brueningsen, Chris, Elisa Brueningsen, and Bill Bower. *Math and Science in Motion: Activities for Middle School.* Dallas, Tex.: Texas Instruments, 1997.

Lappan, Glenda, James T. Fey, William M. Fitzgerald, Susan N. Friel, and Elizabeth D. Phillips. "Prime Time." In Connected Mathematics Project. Menlo Park, Calif.: Dale Seymour Publications, 1998a.

———. "Stretching and Shrinking." In Connected Mathematics Project. Menlo Park, Calif.: Dale Seymour Publications, 1998b.

Nast, Melissa. *Discovering Mathematics with the TI-73: Activities for Grades 5 and 6.* Dallas, Tex.: Texas Instruments, 1998.

National Council of Teachers of Mathematics (NCTM). *Principles and Standards for School Mathematics.* Reston, Va.: NCTM, 2000.

Stenmark, Jean, Virginia Thompson, and Ruth Cossey. *Family Math.* Berkeley, Calif.: Lawrence Hall of Science, 1986. □