

Beginning Algebra Students Show Deeper Understanding with TI-Nspire™ Technology

Case Study 19

Teacher/Researcher – Roberta Pardo
Chandler-Gilbert Community College
Maricopa Community College System
Chandler, AZ



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Teacher/Researcher	Roberta Pardo
Location	Chandler-Gilbert Community College, Maricopa Community College System, Chandler, AZ
Course	Beginning Algebra
Grade/Level	Developmental Mathematics
User(s) Profile	1 Teacher/Professor, 27 Students
Technology	TI-Nspire Learning Handhelds, TI-Nspire Computer Software (student version) and TI-Nspire Computer Software – Teacher Edition

Using (TI-Nspire) learning handhelds, students made connections quicker and seemed to understand the concept of how equations relate to lines and how they relate to the slope and vertical intercept.

Background: Located in the Arizona valley in Maricopa County, southeast of Phoenix, Chandler-Gilbert Community College serves the Phoenix area on three campuses.

The student body, comprised of 12,500, is predominantly white and Hispanic.

Ms. Roberta Pardo's Developmental Algebra population (beginning and intermediate) is approximately 56 percent female, with the majority being recent high school students, and most fluently speak English.

Ms. Pardo's class is equipped with TI-Nspire handhelds – one for each student – and a computer with TI-Nspire Computer Software – Teacher Edition. She presents to the class using a TI-Nspire Viewscreen™ panel on an overhead projector. TI-Nspire documents (activity and homework files) are distributed to-and-from students using TI Connect-to-Class™ Teacher Software. Ms. Pardo also has her students share documents with each other, from one handheld directly to another.

Curriculum & Teaching: Students are placed in a developmental class based on their performance on the ASSET or ACCUPLACER tests.

Ms. Pardo's choice of textbook is *The Consortium for Foundation Mathematics, Mathematics in Action: An Introduction to Algebraic, Graphical, and Numerical Problem Solving, 3rd Ed. Custom Edition. New York: Pearson Publishing*. Her 50-minute college mathematics class meets four times per week.

Ms. Pardo reports that approximately 75 percent of her classroom instruction involves the use of TI-Nspire handhelds and about 25 percent, TI-Nspire Computer Software (student use) in a campus computer lab setting. She draws on pre-made, classroom-ready TI-Nspire activities from three sources: TI's Web site (25 percent), the textbook (40 percent), and activities she may develop on her own (30 percent). Occasionally (5 percent), colleagues have been a source for receiving activities or suggestions.

Ms. Pardo uses TI-Nspire technology for classroom presentation and demonstration of material, and students use their handhelds for interactive learning activities.

She generally rates her comfort level with TI-Nspire technology as high – except in creating and handling documents. She also reports a large increase in student proficiency using the technology during the course of the semester. It was challenging at first, but she regarded learning it as “not necessarily a disadvantage, [but] a small hurdle” for her non-traditional students.

Ms. Pardo found that the dynamic representation of mathematical concepts to be a major advantage of using TI-Nspire technology.

TI-Nspire technology allowed students to visualize, in a dynamic way, tough to-learn concepts such as average rate of change and slope: the ability for students to also see slope as a fraction not only in the way it is entered into the calculator, but also in the subsequent answer. Another advantage is the technology's ability to evaluate and solve a function graphically by grabbing and moving a point. This allowed students to make the connection that the point is related to the algebraic evaluation or solution. Students were able to quickly make connections that would otherwise take more time.

It was useful for students to have the ability to visualize multiple and dynamically-linked representations of a problem on the TI-Nspire handheld screen, but also challenging to them. For example, Ms. Pardo reports:

I used the software and the handheld in combination for two activities. The students started the activity using the software and then were asked to finish the activity on their own, using the handheld ... The activity went very well in class while I was monitoring them and answering their questions. However, when they went home to finish the activity they were not as successful. Many students indicated that they weren't sure what to do, which steps to follow, or how to manipulate the calculator to finish the activity. We spent some time in class the next class period, and with some guidance they were able to complete the activity. About a quarter of the class didn't even attempt the at-home portion of the activity. With these students, I am not certain why they were unsuccessful.

The ability to create and save TI-Nspire documents on the handheld was helpful. Ms. Pardo reports on using a TI-Nspire activity downloaded from a TI Web site:

In one activity, I gave students the data for male and female life expectancy since 1900 and they were to find the line of best fit, then compare it to the linear regression equation only after looking at the least squares. I again had them do the activity for men on the computer in the lab, and then I had them finish it by doing the same process for women on their TI-Nspire handhelds. Before they left class that day, they were to connect to the computer and I used TI Connect-to-Class software to upload the information to their handhelds.

All in all, the activity went very well. By this point, they were very familiar with Movable Lines. They were unfamiliar with the squares, but didn't seem to have too much trouble with it on the computer. They were a little frustrated with the handheld since it was more difficult to manipulate the line. The next class period we discussed the differences and similarities between a Movable Line and a Linear Regression Equation.

Ms. Pardo observed increased interaction among students.

The students were not only helping one another use the technology, they were discussing why things were happening. I did have a couple of students discuss ideas in the classroom environment, but there was little discussion with the larger group.

Assessment Method: Ms. Pardo's grading system is based on tests (70 percent), and homework (30 percent).

Results: Ms. Pardo reports that she saw "a deeper level of understanding from those students that were successful." However, this wasn't reflected in greater measured achievement.

For the students that were trying to learn the material, the TI-Nspire learning handheld enhanced their comprehension. I believe that if it wasn't for some of the manipulations and the visualizations that the handheld allows for, the students would have had a more difficult time comprehending the concepts. Students generally have difficulty understanding rate of change and slope. I feel that through their abilities to make and manipulate a line of best fit, they understood the concept on a deeper level. Some students discovered the slope tool and used that to compare the slope with the average rate of change.

Students who draw lines of best fit on paper are unsure if their answers are correct, then they have little idea where the equations come from. By using the handheld, the students made the connections much quicker and seemed to understand the concept of [how] equations [relate] to lines and how they relate to the slope and vertical intercept. Even though these concepts can be done via paper and pencil, it was more practical to use the handheld and allow for more repetition and more trial-and-error to help with the connections.

Based on this experience, Ms. Pardo feels that TI-Nspire technology is well-suited to Beginning and Intermediate Algebra. She plans to use the technology as part of her instruction, as well as TI-Nspire activities downloaded from the Internet or those she can create herself rather than ones offered in a traditional textbook.

Next semester, I am planning on using TI-Nspire (technology) with the same group of students in their next course, Intermediate Algebra. The students are looking forward to using the handheld again. I am also not going to use the textbook assigned for the course. I am going to use my own activities and those I have found online to teach the same concepts.