Research Evaluation and Results

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Topic: Increased student learning in Circles, Area and Perimeter, and Volume for a regular heterogeneously grouped high school geometry class.

Research Question: Will student achievement, as measured by classroom chapter tests, increase with the availability of calculators in the classroom?

Equipment Used: TI-Navigator and TI-83+ Silver Editions for the entire class.

Software Used: Cabri Jr. Application, Navigator 2.0 software, and the GeoMaster Application.

Student Population: The student population is approximately:

- about 50% Caucasian,
- 15% American Indian,
- 20% Hispanic, and
- 15% other.

Research Timeline and Activities:

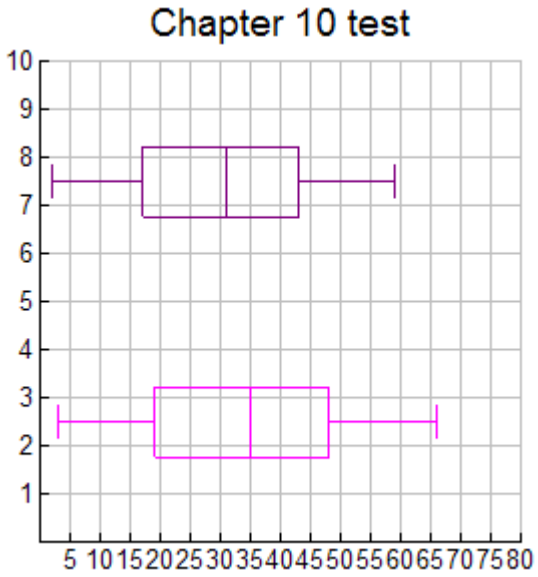
Dates	Activity Result
April 6, 2005	Calculators arrived for classroom research.
April 8, 2005	Introduced calculators to students in geometry classes and worked with the programs. Students worked with Cabri Jr. application for sine, cosine, and tangent.
April 12, 2005	Students worked with GeoMaster application for vector sums.
April 14, 2005	Students worked with Cabri Jr. application on geometric mean, and Pythagorean theorem.
April 18, 2005	Student assessment on Chapter 9 concepts with right triangles.
April 20, 2005	Students began Chapter 10 on circles. Students worked with Cabri Jr. application on circle concepts.
April 22-May 2, 2005	Students worked with Cabri Jr. application on angles in circles and segments of circles.
May 2, 2005	Student assessment on Chapter 10 concepts of circles.
May 4, 2005	Students worked with Cabri Jr. application on equations of circles.
May 6-June 13, 2005	Students worked with calculators on formulas for finding the area, surface area, and volume of various geometric figures and solids. Students also learned how to store variables for future use.

During the entire research timeline, the quick poll was used to assess retention of prior knowledge with the “Daily Homework Quiz”. This quiz was an overview of the previous night’s homework, focusing on key concepts from the homework. Then the quick poll was used get the students’ focused on prior learning through a warm-up activity.

In the last chapter of the book I began collecting homework by learning checks. I wrote a learning check to collect answers for 4 random problems from the homework. The slide show was used to check for understanding.

Results of Assessments:

CHAPTER 10 TEST RESULTS



The graph represents the scores for the Chapter 10 test in my geometry classes. The top graph is from the 2003-2004 school year. The bottom graph is from the 2004-2005 school year.

Below are the statistics for the two years.

2003-2004 Geometry Classes

One-Variable Statistics
$\bar{x} = 31.0702$
$\Sigma x = 1771.$
$\Sigma x^2 = 70753.$
$Sx = 16.7586$
$\sigma x = 16.611$
$n = 57.$
$minX = 2.$
$Q1 = 16.$
$Median = 35.$
$Q3 = 43.5$
$maxX = 59.$

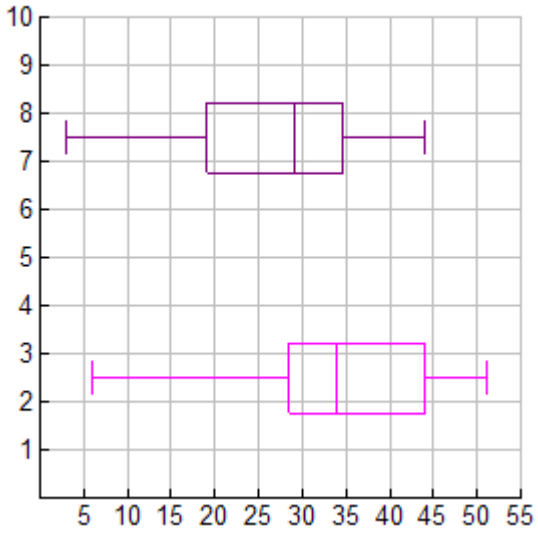
2004-2005 Geometry Classes

One-Variable Statistics
$\bar{x} = 34.1892$
$\Sigma x = 2530.$
$\Sigma x^2 = 110470.$
$Sx = 18.1211$
$\sigma x = 17.9983$
$n = 74.$
$minX = 3.$
$Q1 = 19.$
$Median = 35.$
$Q3 = 48.$
$maxX = 66.$

The results clearly show an increase in the mean score between the two years and an increase in the maximum score for the two years. While the median score remained the same, both the Q1 and Q3 values increased. The mean score increased 10.0% between the two years.

CHAPTER 11 TEST RESULTS

The above results represent the scores for the Chapter 11 test in my geometry classes. The top graph is from the 2003-2004 school year. The bottom graph is from the 2004-2005 school year.



Below are the statistics for the two years.

2003-2004 Geometry Classes

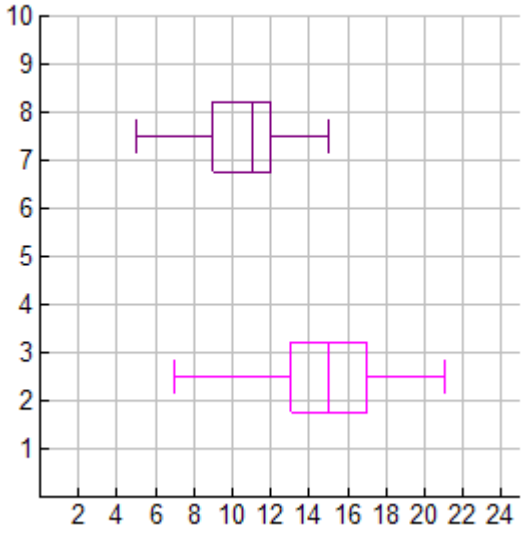
One-Variable Statistics
$\bar{x} = 26.8$
$\Sigma x = 804.$
$\Sigma x^2 = 24816.$
$Sx = 10.6168$
$\sigma x = 10.4384$
$n = 30.$
$minX = 5.$
$Q1 = 20.$
$Median = 28.5$
$Q3 = 35.$
$maxX = 40.$

2004-2005 Geometry Classes

One-Variable Statistics
$\bar{x} = 31.$
$\Sigma x = 1395.$
$\Sigma x^2 = 50729.$
$Sx = 13.0419$
$\sigma x = 12.8962$
$n = 45.$
$minX = 4.$
$Q1 = 22.5$
$Median = 34.$
$Q3 = 40.5$
$maxX = 51.$

The results for the chapter 11 test clearly show an increase in the mean, median, Q1, Q3, and maximum scores. However the minimum score was lower for this test. The mean score increased 15.7% between the two years.

CHAPTER 12 TEST RESULTS



The above results represent the scores for the Chapter 12 test in my geometry classes . The top graph is from the 2003-2004 school year. The bottom graph is from the 2004-2005 school year.

Below are the statistics for the two years.

2003-2004 Geometry Classes

One-Variable Statistics
$\bar{x} = 10.8431$
$\Sigma x = 553.$
$\Sigma x^2 = 6295.$
$Sx = 2.44436$
$\sigma x = 2.42028$
$n = 51.$
$minX = 5.$
$Q1 = 9.$
$Median = 11.$
$Q3 = 12.$
$maxX = 15.$

2004-2005 Geometry Classes

One-Variable Statistics
$\bar{x} = 15.1094$
$\Sigma x = 967.$
$\Sigma x^2 = 15263.$
$Sx = 3.2176$
$\sigma x = 3.19236$
$n = 64.$
$minX = 7.$
$Q1 = 13.$
$Median = 15.$
$Q3 = 17.$
$maxX = 21.$

The results for the chapter 12 test show an increase in all measured areas. The mean increased by 39.3% between the two years. This is a significant increase. Part of the increase is due to the fact that in the previous year I was unable to adequately cover the material.

The mean increase from all three tests is 21.7%, demonstrating that the addition of technology into the classroom made a significant difference in the learning outcome of the class as demonstrated on classroom tests.

Student Comments:

A female American Indian student wrote: "…we can use tools such as the calculator to help us achieve our goal in problem solving."

A male Hispanic student wrote: "Ms. Solomon let us use(d) computer and calculator that showed us how a therom (theorem) or a point would work. When we would use the calculator to do out homework their (there) would be polls to see who got the right answer."

A female Caucasian student said: "You will love Ms. Solomon's class; we used calculators every day and in all kinds of different ways. It really helps you to understand how things work."

Researcher Reflections:

In observing the classroom while students are engaged in activities related to the topics covered in the lesson.

- American Indian students are more actively engaged in the activities and the classroom in general.
- Lower academically achieving students were more actively engaged in the learning process.
- Participation through the quick polls is increased to better than 95% in all classes being researched. Students who didn't get the poll were quick to speak up and request the poll be sent to them.
- Students began offering suggestions to incorporate more technology into other activities. One student suggested using the quick poll to play Jeopardy.
- Visual learners were more actively engaged in the learning process when the calculators were used on a regular basis.
- Basic housekeeping chores such as attendance were stream-lined due to the Navigator software.
- Students were very attentive to keeping the hardware in the classroom and working properly so they became advocates for care of the hardware components used.

Conclusions:

The results are significant in that the average increase in test scores after the introduction of technology was 22%. I feel this result and might be in part due to the fact that students enjoyed using the technology more as time went by and became more actively engaged in learning as time progressed. Students also expressed disappointment when the technology was not there for them upon

entering the classroom. There was an increase in participation for Hispanic, American Indian, and low achieving students over the course of the research.

Though technology is not the perfect solution to increased student participation and increased test scores, used properly, it can significantly increase the positive outcome of the classroom experience. I personally will continue to perfect my use of technology as time goes on and will strive to continue to improve my methods of instruction so NO CHILD IS LEFT BEHIND.