

The Impact of Technology in High School Classrooms

A Research Report

for

Texas Instruments

by

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and

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QUESTION: What is the effect on students' conceptual attainment when they are allowed unlimited access to the TI-83 Plus technology vs. when they are allowed classroom use only? Are these results valid for varied student populations within a district as well as student populations across districts?

Research by: Kathy Gillespie, Motley County ISD in Matador, Texas and
Nancy Trapp, Lyford CISD in Lyford, Texas

The teachers involved in this research have known each other for six years through the National Science Foundation funded Texas Rural Systemic Initiative and the National Science Foundation funded Leadership Fellows Academy. Their respective schools are 613.9 miles apart. Lyford CISD is in the Lower Rio Grande Valley of Texas while Motley County ISD is in the lower eastern part of the Panhandle of Texas. Despite the distance between the two schools, the teachers have discovered that they use many of the same teaching techniques and have, in fact, shared teaching materials and strategies with each other. They have developed a strong networking relationship. Confidence is high that the lessons taught for this research proposal will be taught in basically the same manner at both schools.

A cornerstone to the research is that the student populations in the two schools are similar. Both of the school systems are small, rural schools in counties without affluence. The SocioEconomic Status of the students in the two schools further serves to verify similarity; the SES numbers are Lyford CISD – 81.3% and Motley County ISD – 79.2%. The distance between the two schools will help to verify the results found in this research, as well, in that the results will truly show student achievement despite being in different areas of the state.

Both teachers agreed that their Precalculus classes would be used for the research. The students at Motley County ISD have been able to check out a graphing calculator for homework on a first-come-first-serve basis for the past two years. For benefit of this research, the initial phase of the research was to determine the availability of calculators in the homes of the students. A simple survey was administered to each student involved in the research. The survey is shown below.

Calculator Survey

1. Do you have access to a graphing calculator to use for homework?
2. Do you own a graphing calculator?
3. If the answer to question 3 is yes, what kind is it?

The results of the survey, shown in the table below, served to verify the accuracy of the teachers' ideas about the availability of calculators in the home.

Question Number	Lyford % Yes	Lyford % No	Motley Co. % Yes	Motley Co. % No
1	0	0	16.6	83.4
2	0	0	8.3	91.7
3			TI 81 / TI 82	

These results also served to delineate which group would have unrestricted access to the TI 83 Plus graphing calculators for this research. The researchers decided that the school with some familiarity with unlimited access should continue in this vein in order not to skew the data. Therefore, students in Motley County ISD would have unrestricted access and students in Lyford CISD would have classroom use only. Texas Instruments supplied thirty (30) TI 83 Plus Silver Edition Graphing Calculators to Motley County ISD in order to guarantee that each student involved would be able to have unlimited access for this research.

Students in Motley County ISD involved in the research were asked to sign a Calculator Loan Contract. A copy of this contract is found on pages 7-8. Note that the replacement cost in the contract is for a TI 84 Plus Silver Edition Graphing Calculator. This cost was included in order to impress upon the students the value of the calculator.

The teachers began the year with functions. Both agreed on the methodology to be used for the research. A Pre-Test was given at the beginning of the school year to determine the previous knowledge base of the students. The results were not totally unexpected, in that the students at Motley County ISD had a higher passing percentage than did the students at Lyford CISD. Both teachers thought that some previous ability to use calculators at home might improve retention of concepts previously taught. However, neither group retained the previously acquired knowledge at the level the teachers desired, a minimum of 50%.

The passing percentage at Motley County ISD for the Pre-Test was 33.3% while the passing percentage at Lyford CISD was 16.7%. A copy of the Pre-Test immediately follows.

Functions Pre-Test

1. If $f(x) = x^2 - 1$, find $f(0)$.
2. If $g(x) = \frac{1}{x+1}$, find $g(2)$.
3. Find a complete graph of $h(x) = 2x^3 - x + 3$.
4. Among the rectangles with perimeter of 100 feet, find the dimensions of the one with the maximum area.

Both teachers taught the unit in a similar fashion. Appropriate class work with calculators in the classroom was done. Appropriate homework was given, with the students at Lyford CISD unable to take calculators home with them and students at Motley County ISD having unlimited access to calculators. Since the students had “checked out” the calculators, they were free to use them at home as well as at school. The unit included defining functions, functional notation, graphing functions, and finding significant points of functions.

At the conclusion of the unit, the students were given a Post-Test. The Post-Test was similar to the Pre-Test in an effort to attain data that was comparative. The results of the Post-Test were more pronounced than anticipated by the teachers. Students at Lyford CISD had a passing percentage of only 58.3 % while the students at Motley County ISD had a passing percentage of 75.0 %. While neither teacher was truly ecstatic about the passing percentages, the results did serve to confirm that those students who had unlimited access to technology in the form of a graphing calculator grasped the concepts better and retained the information better than those students who did not have unlimited access to technology.

In order for the Post-Test to be viewed in its entirety, the copy of the Post-Test can be found at the top of the next page.

Functions Post-Test

1. If $f(x) = x^3 - x + 1$, find $f(1)$.
2. If $g(x) = \frac{2}{3x-1}$, find $g(-1)$.
3. Find a complete graph of $h(x) = x^3 - x + 1$.
4. A rectangular fence is to be constructed around a field so that one side of the field is bounded by the wall of a large building. Determine the maximum area that can be enclosed if the total length of fencing to be used is 50 feet.

Both teachers believed that the beginning of the school year probably had an impact on the results. Students and teachers must both return to the school mode of thinking and working after the summer holiday. Consequently, the teachers decided to do another unit for comparison. However, for this unit, both groups of students would be afforded unlimited access to the technology. Lyford CISD students would be allowed to “check out” calculators for the second unit. Texas Instruments supplied thirty (30) TI 83 Plus Silver Edition Graphing Calculators to Lyford CISD for use by students.

The second unit taught was on kinematics. Once again both teachers agreed upon teaching modality, with appropriate class work and homework assignments. Both groups of students had unlimited access to technology in the classroom and for homework. The unit included the dynamics and aspects of motion apart from consideration of mass and force.

Again, a Post-Test was given to both groups of students. Students at Motley County ISD had a passing percentage of 83.3 % while the students at Lyford CISD had a passing percentage of 75.0 %. The results, while not 100% for either class, were encouraging and did serve to substantiate the belief of both teachers at the beginning of the research. By this time, the students at Motley County ISD appeared to be more attuned to being back in the classroom and to their teacher. Unlimited access to calculators aided them in maintaining a high rate of passing. The students at Lyford CISD also appeared to be more attuned to the classroom and to the teacher. The results served to validate the belief that unlimited access to technology assists students in learning and retaining concepts as their passing percentage made a more definitive increase.

A copy of the Kinematics Post-Test can be viewed at the top of the next page.

Kinematics Test

1. Suppose a baseball is thrown straight up from ground level with an initial velocity of 80 feet per second. When will the baseball be at least 64 feet above the ground?
2. Suppose an object is propelled upward from a tower 200 feet tall with an initial velocity of 100 feet per second. For how long will the object be above the ground?
3. If a baseball is thrown straight up from a platform 120 feet above the ground with an initial velocity of 32 feet per second, when will it hit the ground?

Kathy Gillespie and Nancy Trapp concluded that an unlimited access to technology, in this case the graphing calculator, proved to be a substantial benefit to students' conceptual attainments. The results were valid for both school districts despite the distance between the two. The fact that both school systems have a large SES percentage served to prove that students from any background benefit from unlimited access to technology. Both teachers feel that the continued unlimited access to technology will enhance conceptual attainment by the students in the future. Additionally, they feel that this research can be used as proof that students in any environment benefit from such unlimited access to technology.

Furthermore, both teachers feel that the unlimited use of technology by high school students will improve the TAKS scores for said students. TAKS is the Texas Assessment of Knowledge and Skills test that is administered by state mandate for accountability purposes. They feel justified in this belief due to the fact that students at Motley County ISD have previously had more access than students at Lyford CISD, as mentioned previously in this report. Past TAKS results for the schools indicate that even the first-come-first-served basis was of some benefit as evidenced by the past two years passing percentages of students on the mathematics and science portions of the TAKS assessment.

CALCULATOR LOAN CONTRACT 2005 - 2006 SCHOOL YEAR
Motley County ISD

In an effort to guarantee that all students have equal access to technology insuring ample opportunity to complete homework assignments and prepare for exams, Motley County Independent School District will issue a TI-83 Plus Graphing Calculator upon completion of the calculator loan contract for use throughout the school year.

The calculator loan contract will contain the following conditions:

- Students will be issued the calculator named above that is in good working order, after the signed contract has been returned to Mrs. Gillespie.
- The issuance of the calculator is like the issuance of a textbook in that the student is responsible for the calculator for the duration of the school year.
- Students will be required to maintain the calculator in good working order, which includes installing new batteries if needed, and return it by the designated date: May 19, 2006. Students needing the calculator for semester exams will have access via their teacher.
- Students who fail to return the calculator in good working order by the due date will be required to reimburse the school district for the cost of a new, replacement calculator, (\$135.00).
- A student who leaves the school district before the end of the school year is required to return the calculator in good working order before leaving. Failure to do so will result in the student paying the aforementioned fee (\$135.00) before records will be released.
- Students who are issued a calculator will abide by the district's technology acceptable use policy for the duration of the loan.
- Students are required to bring the calculator to the teacher one day prior to TAKS, ACT, or similar tests so that the memory may be properly cleared per each test's administration guidelines.

Students and parents must understand the conditions of the contract and must abide by these conditions. Signatures of both the student and the parent are required to validate the contract. A calculator will not be issued to the student until the contract is returned to the Mrs. Gillespie.

I, _____, a student of MCISD, have read the contract and understand the conditions of the loan program. I agree to comply with these conditions and understand that failure to do so will result in a charge of \$135.00.

Signature: _____ Date: _____

I, _____, the parent or guardian of the above named student, have read the contract and understand the conditions of the loan program. I understand that the failure of my child to follow the conditions of this contract will result in a charge of \$135.00.

Signature: _____ Date: _____

Date Contract Returned: _____

Calculator Number: _____

Date Calculator Issued: _____

Condition of Calculator: _____

Date Calculator Returned: _____

Condition of Calculator: _____

We do not wish to participate in the calculator loan program at this time.

Parent/Guardian: _____

Student: _____

Date: _____