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Integrating the TI-83 Plus calculator into the classroom: a workshop for teachers

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INTEGRATING THE TI-83 PLUS CALCULATOR INTO THE CLASSROOM
A WORKSHOP FOR TEACHERS

by
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A Thesis

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Abstract

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Integrating the TI-83 Plus Calculator into the Classroom
A Workshop for Teachers
2002
Dr. Ted Johnson
Educational Leadership

The purpose of the study was to evaluate the impact of a technology workshop involving the TI-83 Plus graphing calculator on an existing math curriculum and on teaching methodology. The workshop was developed with three goals in mind: 1) to inform teachers of the many functions of the TI-83 Plus, 2) to inform the teachers of how it could be integrated into their classroom, and 3) to promote student-based classrooms instead of teacher-based classrooms.

The entire math department was used as a sample for this project. The intern administered surveys both before and after the workshop was implemented to see if these three goals were accomplished. The survey included both opened ended questions and a closed-ended section, which used a Likert scale. The "before surveys" were compared with the "after surveys" using their averages and T-tests. The intern also conducted a one-on-one interview with each workshop participant after the implementation of the workshops. This allowed the intern to ask further questions about the workshops and about the teachers' perceptions of using the TI-83 Plus in the math classroom.

The statistical results showed that there was no significant change in curriculum or teaching style after the implementation of the workshops. However, the teachers were more aware of the functions and uses of the TI-83 Plus in the math classroom.

Mini-Abstract

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The purpose of the study was to evaluate the impact of a technology workshop involving the TI-83 Plus graphing calculator on an existing math curriculum and on teaching methodology. The results were that the teachers did become more familiar with the TI-83 Plus, but did not integrate it into their existing curriculum or change their teaching methodology.

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My parents who raised me to be the person that I am today.

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Table of Contents

Chapter Number 1

Introduction

Focus of the Study

Technology has changed education. However, many educators and students have not changed with the technology. At one point, using a slide ruler in math class was considered to be cheating. Nowadays, students are not only allowed, but also encouraged, to use graphing calculators on standardized tests. Educators and students must utilize this fact and become familiar with calculators by using them in the classroom. The technology is there to assist students and it is time that teachers utilize that technology to improve the educational process.

The TI- 83 Plus calculator came with a manual that is over 600 pages long. Very few people have the time to read about all of its features. It is possible to use a graphing calculator for computation, but there are so many more functions for which it can be used. Many functions are programed into the TI-83 Plus, and students and teachers are unaware of them. The capabilities of the TI-83 Plus are limitless. In order to use any graphing calculator in the classroom, teachers must be educated about it. The teachers must learn about many of the functions that the calculator can perform. Then, they must be educated about how the calculator can be integrated into the curriculum to improve the students' thinking skills. Graphing calculators have the ability to change mathematics education. They can perform functions in minimal time without error. This allows students to focus

on the higher level thinking skills without worrying about the tedious mistakes that can be made with the mathematic computations. In order to do this, teachers must be knowledgeable about the many functions of the graphing calculator and the ways that it can be integrated into today's mathematics curriculum.

Purpose of the Study

The purpose of this study was to increase the use of the TI-83 Plus calculator in the classroom. The study resulted in a curriculum that can be used to instruct teachers on how to use the TI-83 Plus and how to implement it as part of the existing curriculum of their courses. The TI-83 Plus has many functions and uses in any math class. It provides the students with answers accurately and quickly which reduces the number of mathematical errors that a student typically performs in the course of solving a problem. The calculator allows teachers to redirect their primary focus in math classes. Teachers that are skilled in using the TI-83 Plus can use it effectively in their classrooms and improve their students higher level thinking skills.

A school administrator is an educational leader who promotes the success of all students by advocating, nurturing, and sustaining a school culture and instructional program conducive to student learning and staff professional growth. The intern will provide a program for teachers that will show the functions and computations that the TI-83 Plus has to offer. This program will encourage teachers to re-evaluate their current curriculum and see how the TI-83 Plus can be used in their classroom.

Significance of the Study

The calculator changed the math classroom. Teachers need to be aware of

technological advances as well as educational changes. However, they are not provided a time or an easy forum to investigate these advances. Learning about the TI-83 Plus should be considered part of every math teacher's professional improvement plan. This workshop will give teachers the time to explore the uses of the TI-83 Plus and how it can be integrated into their daily curriculum. Once teachers are aware of the capabilities that the calculator has to offer, they will implement them in the classroom.

The educational philosophy in math classrooms has changed dramatically over the past few years. In the past, students have been forced to perform mathematical computations and churn out the answers. The grade was based on the final answer to a problem. In today's educational society, technology provides us with means that can churn out the answers. This allows math classes to change their focus from churning out answers to higher level thinking skills. Teachers should still teach students how to come up with answers by hand, but also show the students how technology can be used to find answers easily and without error. This would allow teachers to teach more about problem solving, rather than mathematical computations.

Most standardized tests allow students to use graphing calculators. Many teachers have not adjusted their classes to prepare the students to use the calculator on standardized tests. As technology is implemented in the "real world", it should also be implemented in schools. Teachers must accept the technological changes that are taking place and adjust their classroom appropriately. The workshop will provide teachers with an opportunity to learn about the TI-83 Plus and suggestions about how it can be implemented in the math classroom.

Definitions

TI-83 Plus - The Texas Instruments graphing calculator.

Professional Development Plan - Teachers in New Jersey must perform 100 hours of professional development every five years

Answer By Hand - This is the process of performing a mathematical computation without a calculator

Limitations of the Study

The graphing calculator workshop will use the TI-83 Plus calculator. This is the standard calculator for Timber Creek High School. The entire calculator curriculum is based on this calculator. There are many other graphing calculators that students may choose to use. Other high schools may not have access to graphing calculators or they may not have TI-83 Plus. This workshop will only work for schools that have access to TI-83 Plus.

The number of TI-83 Plus calculators is also important. If teachers are to implement graphing calculators into the classroom, then the school must be able to provide classroom sets of the calculators. Students should be encouraged to buy their own TI-83 Plus, however, they should also be given an opportunity to use them in the classroom even if they do not own the calculator. It cannot be mandatory that every student buy his/her own calculator. Therefore, this program will only be successful in schools where there are classroom sets of the TI-83 Plus. It is also necessary to ensure that all teachers have access to the calculators. It is suggested that every two teachers share a classroom set. This project will only work in schools that have access to

classroom sets of TI-83 Plus.

Another limitation is the number of teachers that attend the workshops. Most of the workshops will be held after school. Many teachers designate this time as preparation time for the next day or for extra help for students. Therefore, the teachers may not place a high priority on attending the workshops. It is necessary to run this program after school and throughout the school year so that teachers may ask questions and follow up with the material that they learned in the previous workshops. Teachers will be encouraged to attend the workshops. They will be given an outline about the topics and which topic will be taught on specific dates. The teachers will also be asked for their input to make the workshops meaningful and timely for their lessons and curriculum. But, since the teachers are not being paid and have many important issues to attend to, it will be difficult to have the entire math department attend every workshop.

It is very difficult to measure the effectiveness of the study in such a short period of time. If time permitted, data could be gathered about standardized test scores of the students that were taught without the aid of the TI-83 Plus and scores of the same students using the TI-83 Plus. Unfortunately, time is a factor in this study. Therefore, the best measurement tool is a survey for the teachers before and after the implementation of the workshops.

Setting of the Study

The Black Horse Pike School District is a regional school district. It services students from three municipalities: Bellmawr, Runnemede, and Gloucester Township. These three municipalities are located in Camden County. They are all suburbs of

Philadelphia which are just a few miles from the Delaware River. These three municipalities make up the student population for the three high schools in the Black Horse Pike Regional School District. The three high schools in the district are Triton High School, Highland High School, and Timber Creek High School.

Bellmawr is slightly over 3 square miles of land. There have been changes in the Bellmawr population of the years. In the 1970s, Bellmawr peaked in its population with over 15,000 people. At that time, the average age of the population was 26. The school age population was 28% and the senior population (over 65) was only 4%. The numbers have changed dramatically over the years. Currently, the average age of the Bellmawr population is 36. The school age population has dropped down to only 16% and the senior population has increased to 10%. The town of Bellmawr is predominately white. Under 4% of the population is any other race. There are many different households in Bellmawr. There are 4,679 households in Bellmawr. Housing growth in Bellmawr is limited because of the lack of empty land.

Runnemede is only 2 square miles of land. It is located between Bellmawr and Gloucester Township. Runnemede, too, peaked with its population in the 1970s with approximately 10,500 people. At that time the average age of Runnemede was 27. The school age population was 27% and the seniors were 6% of the town. As times have changed, so have the population statistics of Runnemede. The population has decreased to under 9,000. The average age has increased to 34. Again the school aged children have decreased to 16% of the population, while the seniors have grown to become 14% of the population. Runnemede is also predominately a white population. Just over 4% of

the population make races other than white. There are 3,420 households in Runnemede. As with Bellmawr, the developable land is limited, very little new construction takes place in Runnemede.

Gloucester Township is the largest municipality in the district in many ways. It is over 25 square miles of land. Unlike Runnemede and Bellmawr, Gloucester Township is still growing. The population of Gloucester Township started off at under 18,000 residents in 1970. At that time the average age of the population was 28. The school aged population made up 26% of the town and seniors comprised 7% of the town. Gloucester Township has exploded in its population, but the statistics remained relatively constant. The population of Gloucester Township was last estimated at over 58,000. The average age of the population has stayed constant at 28. The school age population has decreased down to 22%, while 7% of the population is still the senior population. While Gloucester Township is predominately white, 9% of the population is formed by minorities. Gloucester Township is not growing as fast as it was in the 1980s and 1990s. There is still some available land to develop, but land is becoming more scarce.

The economic status of the three towns are relatively similar. The approximate family income in Bellmawr and Runnemede is $40,000. Gloucester Township's average family income is slightly over $45,000. The unemployment percentages of all three municipalities is under the Camden County unemployment average of 5.9%. Bellmawr's unemployment percentage is 5.2%, while Gloucester Township's is 5.1%, and Runnemede's is the lowest rate of 4.8%. All three municipalities have predominately blue collar workers.

The difference in the three communities is the support of the school district. Very often the Black Horse Pike Regional School District's budget is defeated. An overwhelming majority of the Bellmawr and Runnemede voters defeat the budget on an almost yearly basis. However, Gloucester Township residents are more likely to approve the budget. The Bellmawr and Runnemede contingency usually defeat the budget over the Gloucester Township voters. The budget has been defeated approximately 90% of the time in the schools existence.

Bellmawr, Runnemede and Gloucester Township are the three municipalities that send their students to the Black Horse Pike Regional School District. The district has Triton High School which services all of the students from Runnemede and Bellmawr; they also serve a part of Gloucester Township. Both Highland and Timber Creek serve students from Gloucester Township exclusively. Timber Creek first opened its doors in the Fall of 2001 to alleviate the over-crowding at both of the other schools. The three schools are the only three schools in the 9 through 12 district. Each of the municipalities has its own elementary district that feeds into the Black Horse Pike School District.

Organization of the Study

This project contains information in integrating the TI-83 Plus calculator into the classrooms at Timber Creek High School. Chapter one contained background information about the schools and the importance of the project. Chapter two is comprised of the research and findings about the integration of graphing calculators. Information that shows how calculators have changed mathematics education was researched. Implementing a program that promotes calculator use in a school was

explored. This information was used to increase the intern's knowledge of past studies. Chapter three discussed the design of the study. The surveys that were handed out to students and faculty are shown in the Appendix. A description of how the surveys were used to measure the effectiveness of the program is given. The research instruments was described in depth in this chapter. Chapter four presented the workshop findings. This section described whether or not the calculator workshops were effective in changing teachers attitudes and integrated the calculator into the classroom. Chapter five concluded the thesis. The implications of the TI-83 Plus workshop were described. Any further study that should be performed are given in this chapter.

Chapter Number 2

A Review of the Literature

Introduction

The purpose of this project was to integrate the TI-83 Plus into the current math curriculums at Timber Creek High School. Technology has made tremendous advances and education has yet to catch up with the current times. Schools are a microcosm of society. Therefore, when society takes advantages of new technology, schools should follow suit and teach students how the technology is useful in society. The TI-83 Plus calculator is a useful tool in aiding math education. It can perform many functions that non-graphing calculators cannot. When used properly, it can perform math computations and many other important mathematical function in a fraction of a second, without error. The integration of the TI-83 Plus would change the way that math classes are run and how students learn. It would allow teachers to focus on higher level thinking skills and rely on the calculator to perform the tedious math computations that are involved in complex math problems.

The most important factor in integrating the TI-83 Plus into the classroom is educating the teachers about the calculator. When the teachers are given the time and instruction about the graphing calculator, they will be more likely to integrate it into their classroom. A workshop will be designed to teach the teachers about the TI-83 Plus. This workshop will have two purposes. First, the workshop will focus on informing the

teachers about the TI-83 Plus functions. Second, the workshop will show exactly how the calculator can be integrated into every math classroom. In providing these workshops, the teachers will become more knowledgeable about the TI-83 Plus and integrate it into their current curriculum.

Research Findings on Graphing Calculators

The use of calculators in math classrooms has been debated for years. Some feel that students should have to churn out the answers by hand and solve all problems without a calculator which will increase their mathematical computations skills. While other proponents for using calculators believe that when students are in the "real world" they will use calculators, and, therefore, they should use them in schools. As technology becomes more and more advanced, this issue must be resolved so that all students are getting the same education.

There have been many research findings on the impact of graphing calculators in the math classroom. According to Simonsen and Dick (1997), calculators provide "immediate feedback" for students. When working with computation problems, students are able to use the calculator to come up with answers quickly and without error. This allows students to concentrate on the problem concept and ideas as opposed to the basic computations. The graphing part of the calculator allows the students to visualize graphs. Instead of focusing on plotting the graph, students can immediately see the graph and draw conclusions from it. The graphing calculator "increases the level of understanding in algebra and pre-calculus classes." (Milou, 1999, p. 134) The level of understanding is increased because students can focus on how the problem was solved, instead of the

mathematical computations that come along with many math problems. This would allow teachers to focus less on the number crunching of math classes and provide more varied and flexible approaches for problem solving, observes Smith (1997).

The goal of math classrooms has changed over the years. Math classes used to be a place where students would crank out answers to problems. Nowadays, students are asked to evaluate the data and answers to problems and to think about how the answer was achieved. The focus has changed from math computation skills to problem solving skills and data analysis. Calculators can help improve these high level thinking skills.

Graphing calculators also provide students with a better attitude toward math classes. Overall student confidence increases in math classes due to graphing calculator use. (Tharp, 1997) Students feel more comfortable when they have the security of having a calculator on their desk. It allows them to worry less about making mathematical computation mistakes and to focus on the problem. They know that the calculator will not make a mistake, and, therefore, their overall confidence increase. Harskamp (2000) found that the use of the graphing calculator helped the weaker students the most. Students that made computation mistakes by hand benefitted most from using the graphing calculator. Very often students understand the concepts that were taught in the class, however they perform math mistakes on the test. These students were able to demonstrate that the understood the material by performing the problem without mathematical mistakes. Finally, students have a better attitude toward math classes when they can use the graphing calculators (Smith , 1997). The graphing calculator allows the students to see how technology is used to solve problems. Students are interested in

technology and enjoy using it whenever they can. The graphing calculator provides students with a comfortable feeling that they do not have to worry about math mistakes. When the students feel comfortable in the classroom, they enjoy the class more and are more likely to learn.

The Importance of Teachers' Perceptions about Graphing Calculators

The teachers' perceptions about the graphing calculator are very important in integrating them into the curriculum. The teacher's philosophy directly affects the way that they teach math, found Tharp (1997). There are two major philosophies that teachers follow in math classes. The first philosophy is a rule based philosophy. In this situation, the teacher is considered to be the expert in the classroom (Simmt, 1997). Since the teacher is the expert, they must focus on covering the material as quickly as possible without allowing the students to discover the formulas and answers. The typical rule based philosophy classroom has the teacher lecturing and instructing the students about the formulas and math concepts. The students need to listen to the teacher for most of the period. In a non-rule based classroom, the students are encouraged to discover the concepts on their own with guidance from the teacher. The students are to focus on the inquiry method of learning. This method typically encourages the students' creativity. These two classroom philosophies are extremely different. "Teachers often resist change in their classrooms." (Tharp, 1997, p. 558) The graphing calculator will force rule based teachers to change. Teaching about the graphing calculator and its functions is not enough. Instead, teachers need to learn how the TI-83 Plus will change the way that they teach.

The goal of the project is to integrate the graphing calculator into the current curriculum. According to Doerr (2000), it is important to distinguish between "adding" and "integrating" the graphing calculator into the curriculum. Adding it to the curriculum would force teachers to teach about the calculator as a separate topic from the rest of the curriculum. Integrating it into the curriculum would mean that the teachers use the calculator with lessons on a daily basis. When the calculator is integrated into the classroom, teachers must use the non rule based teaching philosophy. It is very important to inform the teachers about how the graphing calculator is used to increase higher level thinking skills. Teachers that integrate the TI-83 Plus without changing to the non rule based classroom, will be doing a disservice to their students. Students will not learn problem solving skills, which is a major advantage to using the TI-83 Plus.

Teachers' Concerns or Problems with Graphing Calculators

There are many concerns that teachers have about integrating graphing calculators into the current curriculum. Doerr (2000) lists these concerns: time constrain, economical factors, lack of training, fear of the unknown, and the radical change in teaching technique. One concern is that teachers are often pressed for time in order to complete the syllabus as it is; adding technology to the curriculum will only take away time from other topics. Money also plays a role in the implementation of graphing calculators. Not all students can afford graphing calculators. Schools must provide class sets of graphing calculators. Another concern is that teachers are not prepared to teach students about graphing calculators because the teachers themselves are uninformed about the functions and uses of it in the math classroom. Along with that is the fear of the unknown. Many

teachers like to be known as the expert in the classroom. However, very often when it comes to technology, the students know more about it than teachers. Some teachers are threatened by this unknown. Finally, teachers that integrate the TI-83 Plus will have to alter their classrooms to non rule based classes. Teachers resist change and want to teach the way that they were taught because it is familiar. These concerns must be addressed in the project.

How Teachers Can be Reached

Integrating the graphing calculator into math classrooms is a large task. Teachers must become informed about the graphing calculator. Many must also change their teaching philosophy to encourage higher level thinking skills as opposed to straight mathematical computation. Teachers must be provided with a "variety of prolonged explorations to increase their level of comfort". (Tharpp, 1997, p. 552) Teachers must be taught in the same way that the students should be taught. Teachers should be guided through the TI-83 Plus. They must be given the information in a variety of different ways so that they can convey the information to their students. The teachers must also assess their current assessment techniques. Instead of focusing on the computations that were performed, students should be judged on their problem solving skills. Tharpp (1997) observed that teachers must be given time to reflect on their own instructional practices. Teachers should look at how they can best implement the TI-83 Plus into their classroom effectively. If the teachers learn the information, they should also learn how it can best be implemented into their class. Finally, teachers need to be taught about how to deal with a less structured environment. Too often, teachers believe that if the students are not quiet

and the teacher is not at the front of the room, learning is not taking place. This perception must be changed. In order to effectively integrate the TI-83 Plus into math curriculums, teachers must be given a chance to learn about the different functions it can perform and how it can change their classroom philosophy to a non rule based classroom where higher level thinking skills are emphasized.

Keys to a Successful Classroom

Classes that encourage higher level thinking skills have certain characteristics. Simonsen (1997) lists many characteristics of a successful classroom with graphing calculators: less teacher centered, open ended questions, discussion, cooperative learning, discovery learning, curriculum that integrates the calculator. Classes need to be less teacher centered, the teacher does not have to be the only leader in the classroom. Discussions about problems should take place more often. The teacher should allow students to add their input into the problems. This allows students to lead the class and take more responsibility for their education. Open ended questions must be asked more often. Instead of focusing on coming up with a number answer, teachers should ask questions about the process of problem solving. This will force the higher level thinking skills to improve. Cooperative learning and discovery learning should take place more often in math classes. Students should not be spoon fed the information. Instead they should find the information with peers. When the students "find" the information, it is retained better than information that is given directly to them. The curriculum should also integrate the calculator into every lesson as opposed to it becoming a separate section to be taught. If students are taught how to use the graphing calculator throughout the

year, the information will be retained better than if it is fed to them for one section and then never used again. Teachers need to show the students how the TI-83 Plus is useful in many different mathematical areas. These are key components to a successful classroom.

In addition to these concepts in the classroom, teachers must do thing outside of the classroom. The first is training. Teachers must be trained throughout the year as opposed to a single workshop that disseminates all of the information. A network should also be formed for the teachers to discuss their findings. When teachers use the inquiry method, different classes will discover different things. Teachers need to be able to share this information with other teachers. Teachers should be given more preparation time to learn about the calculators and alter their teaching methods. The teachers are the key to implementing graphing calculators into the classroom.

Conclusion

Teachers need to learn about the graphing calculator and about the different teaching techniques that should be used to integrate the calculator into the curriculum. By educating teachers about the calculator, they will become more comfortable with it and be more likely to use it in their classrooms. However, they need to be prepared to shift away from teaching computation and focus on problem solving skills. These are large changes in mathematics education. However, they address the current needs of society. Educating the teacher is the most important aspect of integrating TI-83 Plus calculators into math classrooms.

Chapter Number 3

Design of the Study

General Description of the Research Design

The research project revolved around instructing teachers how to use and integrate graphing calculators into the curriculum. The intern conducted TI-83 Plus graphing calculator classes after school. All math teachers in the high school were invited to attend. The purpose of this class was to familiarize the teachers with the TI-83 Plus and to discuss how it can be integrated into the curriculum. The goal of this project was to change the way teachers teach. When the graphing calculator is integrated into the curriculum, teachers can focus more on higher level thinking skills as opposed to focusing on the tedious mathematical computations that need to be performed. The graphing calculator is a tool for teachers to use to enhance their students' learning.

The research study was a Before-and-After Treatment. A baseline measurement was made from all of the teachers in the mathematics department. The baseline measurement was a survey. This survey gave the intern insight as to how teachers taught classes without the use of the graphing calculator, how competent the teachers were with the TI-83 Plus, and their thoughts and attitudes towards integrating the TI-83 Plus into the current curriculum. The treatment was the calculator class. The class tried to change any negative perceptions that the teachers may have had towards using graphing calculators in class by educating them about how it is used and how it can be integrated into their

classroom. The curriculum could shift away from mathematical computation and more towards higher level thinking skills. After the class was completed, another measurement was taken to see if the class changed the way teachers thought about the graphing calculator and see if they integrated it into their curriculum. This measurement was taken using two different tools. The first tool was the same survey that they were given before the class began. This survey, again, measured their current classroom setting, their competency with the TI-83 Plus, and their attitudes and thoughts about using the TI-83 Plus in the classroom. In addition to the survey, each teacher was interviewed. The goal of the interview was to ascertain a qualitative measurement about their thoughts about the graphing calculators. The before-and-after treatment was used to see if the calculator class had changed the views of teachers, and, therefore, changed their teaching methods.

Development and Design of the Research Instrument

There were three instruments that were developed in order to implement the before-and-after treatment. The first was the actual treatment, the TI-83 Plus calculator class. The second was the survey that was used to gauge attitudes and competency in the TI-83 Plus. (Appendix A) The third was the interview questions that the volunteers were asked after they completed the calculator class. (Appendix A) These three instruments were all key to the development of the research project.

The calculator class was the treatment. The goal of the class was to familiarize teachers with the TI-83 Plus. The intern looked at the curricula of many different math classes offered at the school. As curricula approached certain topics, the workshops dealt with using the TI-83 Plus with these topics. Teachers learned the topics that pertained

directly to their class instruction. The intern designed worksheets that the teachers used to become more familiar with the TI-83 Plus. Teachers were then encouraged to use the same worksheets in their class to teach their students how to use the TI-83 Plus. As the teachers asked questions in the calculator class, they were learning how to use the calculator and how to answer students' specific questions pertaining to that topic. At the end of each lesson, the intern discussed how the calculator should be integrated into that chapter or lesson. The teachers discussed the importance of both knowing how to do the math by hand and the importance of being able to focus on higher level thinking skills. The class allowed teachers to discuss the higher level thinking skills that could be applied to the lesson or chapter. Teachers were also encouraged to ask the intern to cover topics that were not scheduled, but that they felt were necessary. The class continued throughout the entire year. The TI-83 Plus classes allowed teachers to learn about the calculator and how it could be directly integrated into their curriculum.

The survey was used before and after the treatment. The survey was a combination of open ended questions and a five-point Likert scale. The scale ascertained the teachers' thoughts about graphing calculators and the teachers' comfort level about using the TI-83 Plus in the classroom. Teachers were asked to choose the best answer that corresponded to a number in the Likert scale section of the survey. The open ended section of the survey was used to have the teachers write the advantages and disadvantages of using graphing calculators in math classes. Certain questions were classified into categories to gauge general information about a specific topic or category.

The first statements on the survey were used to find out how each math class was

run. The statements were: 1) When introducing a topic, I do at least five problems on the board as examples. 2) I lecture/demonstrate problems on the board for at least 25 minutes of the period. 3) The students work in groups or individually for at least 10 minutes of every period. 4) When introducing a formula, the students derive the formula in groups. 5) I spend the majority of the period at the front of the room. The answers to these statements gave the intern some insight into the individual teacher's classroom setting. The goal of these questions was to determine whether the class is teacher centered or student centered. Teacher centered classrooms have the teachers disseminating information and students receiving the information. Whereas, student centered classrooms have the students deriving formulas and working on problems to get the formulas and solutions on their own or in groups of their peers. These statements were all part of a five point Likert scale with the statements: Always, Very Often, Sometimes, Seldom, and Never. A numeric value was assigned to each response: one was Always, two was Very Often, three was Sometimes, four was Seldom, and five was Never. These statements made it clear whether the class was teacher centered or student centered.

The next set of statements were about each individual teachers competency and training with the TI-83 Plus graphing calculator. Timber Creek High School was a new school. In order to staff the faculty, people from the existing two high schools were asked if they wanted to work at Timber Creek. The math department had exactly half of the staff from each of the existing high schools. Since the teachers came from different schools, they had different training on the TI-83 Plus. This set of statements was design to see how competent the teachers were with the TI-83 Plus. The six statements were: 1)

I am familiar with the capabilities of the TI-83 Plus. 2) I can perform basic math computations on the TI-83 Plus. 3) I can graph equations on the TI-83 Plus calculator. 4) I am familiar with the ways that the TI-83 Plus can be used in my classroom. 5) I feel comfortable teaching students how to use the TI-83 Plus. 6) I have been sufficiently trained in using the TI-83 Plus. These statements, again, had a set of five appropriate choices for each one with a number correlating to each statement. These statements gave the intern insight into each teacher's TI-83 Plus competency and training.

There were three statements on the survey that showed the intern the perceptions that the teachers held towards calculators. In order to integrate the calculators into the classroom, teachers had to have a positive perception of how they could help in the teaching of students. These statements gauged how valuable the TI-83 Plus could be to each teacher's curriculum. These statements were: 1) I feel that the TI-83 Plus is a valuable teaching tool. 2) I can integrate the TI-83 Plus into my daily classroom lessons. 3) I feel that the TI-83 Plus should be integrated into the curriculum throughout the year. Again, teachers were asked to choose and appropriate number that corresponded with an answer to the statement. These statements showed whether the teachers felt that the TI-83 Plus was a useful tool for the math classroom.

The last two statements of the survey gauged the general attitudes towards calculators. These statements were: 1) Students have become too dependent on calculators. 2) Calculators should only be used to calculate or verify numbers. These statements showed whether the teacher had a traditional view of calculators or a more contemporary view of calculators. The traditional view was that students should have to

crank out the answers mathematically by hand. Whereas, the more contemporary view was that students can use a calculator to solve the mathematical part of the equation. These statements allowed teacher to choose where they stood in the middle of this debate.

The last part of the survey contained an open ended section where teachers listed the advantages and disadvantages to using the TI-83 Plus in their classroom. Using graphing calculators in math classrooms had its advantages and disadvantages. Teachers were asked to write down all of the possible items that fell under these categories. These lists allowed teachers to express their own views on graphing calculators and whether they were beneficial, harmful, or a mix of both.

The interview was used after the class only. The intern was able to ask questions about each teacher's specific curriculum and how they integrated the TI-83 Plus into their curriculum, if at all. The interview allowed the teachers to express their views that were not able to be conveyed in a Likert scale. The teachers were asked about the TI-83 Plus class and whether it changed their attitude toward calculators. Since the goal of the class was to change teaching techniques to focus on higher level thinking skills, teachers were asked if they had changed their methods and whether their students were thinking more and computing less. The interview allowed teachers to express their views qualitatively.

Description of the Sampling and Sampling Techniques

The sample was a sample of convenience. All of the teachers from the math department were invited to attend the TI-83 Plus graphing calculator class. The sample was taken from the intern's high school setting. Since the class was offered after school, the math teachers that participated in the TI-83 Plus class were all volunteers.

Unfortunately, due to the teachers' schedules, they were not able to attend every class. Many teachers volunteered their time when they could; however, not everyone could attend every class.

Description of the Data Collection Approach

The survey was given twice. The first time that it was administered was before the first TI-83 Plus calculator class. Teachers took time to fill out both the Likert scales and the open ended section. The teachers were told not to put their names on the survey and that it would be completely anonymous. The intern made sure that every teacher from the math department was present for this meeting and the final class. Therefore, every teacher filled out a survey before the treatment was administered. The second time that the survey was given was after the last calculator class. Again, teachers took time to fill out both the Likert scale and the open ended section. Any teachers that were not able to attend this meeting were approached by the intern and asked to fill out the survey. Again, the survey was filled out anonymously. The intern ensured that every math teacher filled out a survey before the treatment and after the treatment. The Likert scale part of the survey gave the intern quantitative data. This data was all in the form of forced responses. The open ended section allowed the teachers to give qualitative data. The surveys were given out so that the intern could match the "before surveys" with each "after survey" to gain a sense of individual change. Both types of data were necessary to get a full picture of how the TI-83 Plus workshop changed their classroom and their view of graphing calculators.

An interview was conducted by the intern with each member of the math

department. The intern asked that all math teachers fill out a form that gave a time where the intern could meet with each teacher. After collecting these times, the intern scheduled the interviews with the teachers. Every teacher's interview was one-on-one with the intern. The intern asked the same questions to each teacher and recorded the answers. The interviews gave the teachers a chance to qualitatively answer question. This was the teacher's opportunity to expand upon any of the statements that were given earlier and to expand upon their view of the TI-83 Plus.

Description of the Data Analysis Plan

The intern analyzed the data that was collected. The data that was collected was the survey, both before and after the treatment, and the interview. The survey was quantitative data, whereas the interview was qualitative data. The survey was broken down into five sections. Each set of questions was categorized into one of these sections and was used to come up with a mean score for that topic. All of the data was used to see if the TI-83 Plus calculator class changed the attitudes and teaching techniques of the math teachers that took part in the program.

The first section of the survey was the explanation of how the teachers' classes were run. The goal of this section was to find out if each classroom was more teacher centered or student centered. In order to come up with a mean score, the intern needed to adjust the scale. For the first, second, and fifth statements the lower the score, the more teacher centered the class was. Whereas, the third and fourth statements indicated that a lower score meant that the class was more student centered. The intern had to reverse the third and fourth statement answers so that a score of five was converted to a one, a score

of four was converted to a two, a score of three remained the same, a score of two was converted to a four, and a score of one was converted to a five. After the conversion was made, the intern found the average of this entire section. All five questions were averaged together for all six participating teachers. This gave a mean score for that section which determined whether the classes were more teacher centered or more student centered. The lower the mean, the more teacher centered, and the higher the mean, the more students centered. The mean for the before treatment and after treatment were compared to each other to see if there was a difference in teaching style after the teachers learned more about the TI-83 Plus.

The second section involved six statements that revolved around the training and competency that each teacher had regarding the TI-83 Plus. These statements were numbers six, seven, eight, nine, ten and twelve on the survey. In this section, a low score meant that the teacher was comfortable and sufficiently trained in using the TI-83 Plus in the classroom. A high score meant that the teacher was not comfortable and did not receive adequate training. All six statements were averaged together for all of the participating teachers to come up with a mean score for that section. The before treatment mean score was compared to the after treatment mean score. The intern analyzed this information to see if the teacher's comfort level with the TI-83 Plus changed after taking the calculator class.

The third section of the survey questioned the usefulness of graphing calculators in the classroom. The three statements that correlated to this section were statements eleven, thirteen, and fourteen. In this section, a low score meant that the graphing

calculators were useful to students in math classrooms. A high score meant that the graphing calculators were detrimental to students education. The intern found the average of these three statements for all of the participating teachers. The before treatment and after treatment means were compared to see if the teachers changed their view on the usefulness of graphing calculators in math classrooms.

The last two statements on the survey gauged the teachers' attitudes toward calculators in general. The lower the score the more traditional the view, which meant that they believed that students were too dependent on calculators and should only use them to check answers. The higher the score the more contemporary the view of calculators, which was to integrate them into the curriculum and have students depend on them to churn out answers. An average was found using these two statements from all of the teachers' surveys both before and after the calculator class was implemented. The intern compared these means to see if a change in attitudes took place.

The final section on the survey was the open ended section where teachers were asked to make two lists. One list was the advantages to using the TI-83 Plus in the classroom and the other list was the disadvantages to using the TI-83 Plus in the classroom. The intern compiled this information to find out how many advantages and disadvantages there were. The intern kept a list of all of the advantages and disadvantages that were listed. Then, all of the responses were read through again and a tally mark was given to each advantage or disadvantage that was stated. The intern then counted up the total number of advantages and total number of disadvantages listed by the teachers. After the treatment was administered, the intern did the same for the open

ended section of the after treatment survey. The intern then compared the number of advantages and disadvantages from the before and the after treatment surveys. If there were more advantages, then the teachers had learned how to integrate the TI-83 plus into their classroom. If there were more disadvantages, then the teachers found that the TI-83 Plus was not productive in their classroom. These numbers were compared to see if the class had an effect on the teachers.

The interview was administered one-on-one with the intern and each member of the math department. The interview allowed the teachers to express their views about the graphing calculator and its role in the math classroom. They were asked if they felt that the class had changed their views, trained them adequately, and influenced them to use it in their classrooms. These statements were qualitative data that allowed the intern to see if the class affected each teacher one-by-one. It was important to see if any teachers felt that the class had changed their view not only numerically, but qualitatively.

The survey and interview were used to collect information from the teachers. By comparing the before treatment responses with the after treatment responses, the intern was able to see if a significant change took place in the teachers, classroom, attitude, training and view of the graphing calculators.

Chapter Number 4

A Presentation of the Findings

Introduction

The research project revolved around instructing teachers on how they could integrate the TI-83 Plus graphing calculator into their curriculum. The intern conducted a series of workshops that showed teachers many of the uses and functions of the TI-83 Plus. After each workshop the teachers were led in discussion by the intern about how the calculator could be integrated into the curriculum so that the students still understood the concepts and could complete the problems by hand. These workshops were optional to all members of Timber Creek's math faculty.

The workshop had many goals. The first goal was to familiarize the faculty with the new technology that could be use in the classroom. The TI-83 Plus calculator was the calculator that Timber Creek chose to be the school's graphing calculator. Many teachers were not familiar with many of its functions and how even basic math computations could be performed on it. Another goal of the workshops was to change the way that teachers taught. Math classrooms were all too often teacher centered classrooms. Many teachers did not focus on the derivation of formulas and the importance of understanding why problems are solved in a certain way. Using the TI-83 Plus forced teachers to teach in a classroom that was more student centered. The TI-83 Plus calculator also allowed teachers to focus on the underlying concept without worrying about the tedious

mathematical computations that come along with many math problems. These workshops were designed to educate teachers about the many functions of the TI-83 Plus and to inform teachers how their educational philosophy and teaching style needed to change in order to integrate technology into the classroom.

A survey and interview were used to measure the effectiveness of the workshops. A survey was given to the entire math faculty both before and after the workshops were conducted. The survey was used to measure: 1) The teachers' competency with the TI-83 Plus, 2) Whether his/her classroom was more teacher centered or student centered, 3) The teachers' perceptions as to whether graphing calculators are beneficial or detrimental to education, and 4) Whether the TI-83 Plus should be integrated into the current curriculum. Teachers were also asked to list the advantages and disadvantages to using the TI-83 Plus in class. This survey was used to see if the workshops changed the teacher's training, the classroom teaching techniques, and the perceptions about the TI-83 Plus. An interview was conducted that allowed teachers to express their views about the workshops afterward to see if they had any suggestions as to how it could have been improved. These research instruments were used to see if the workshop had any effect on the teachers.

Research Findings

The first section of the survey was used to gauge the teaching techniques that were used by the teachers. There were five questions and a Likert scale (1 - 5) for each question. A lower number indicated that the classroom was more teacher centered, whereas the higher the number the more student centered the class. As mentioned in

Chapter 3, question's #3 and #4 results were reversed to match the results described above. An average was found for each of the five questions, and then a total average was found for the entire section. The average that was found for the first section before the workshops was 2.4. After the workshops were administered, the average came out to be 2.76. Therefore, there was a slight change in the teacher's teaching techniques. The math classrooms became slightly more students centered.

Comparing each teacher's answers to the survey allowed the intern to perform a T-test to see if there was any significant difference. The results from this section were $t(5) = 1.65$, $p < .10$, one tailed, which indicated that the results approached significance. Although the results did not support the hypothesis that the calculator workshop would directly impact teaching techniques, the statistics show that the workshops were approaching significance.

The second section of the survey measured the teacher's training on the TI-83 Plus. There were six question on the survey that the teachers were asked to respond to, again using a Likert (1 - 5) scale. In this section, a low response indicated that the teachers were not sufficiently trained in using the TI-83 Plus. A higher response showed that the teachers were trained in many of the functions of the TI-83 Plus. Again, an average was found by finding a mean for each question and then finding the average of all of those means. Before the workshops, the teachers average response was 3.27. After the workshops the teachers' response average was 2.305. Therefore, the workshops did train the teachers because their response jumped almost a full response.

A T-test was performed to see if there was any significance to the results. The

results were $t(5) = -1.78$, $p < .10$, one tailed which indicated that the results approached significance. Again, the results showed that the graphing calculator workshops did not directly impact the teachers' knowledge of the TI-83 Plus, however, the statistics again showed that the workshops approached significance.

The third section of the survey measured the teachers' perceptions of graphing calculators on students' education. This sections was made up of three questions based on a Likert scale (1 - 5). A lower response suggested that graphing calculators were useful to students in math classrooms. A higher response implied that graphing calculators were detrimental to students' education. The mean was found by averaging all of the responses to each questions and then finding the average of those results. Before the workshop the average was 3, after the workshop was administer the average changed to 2.44. This showed that the teachers changed their view of calculators slightly. After the workshop they did not think that graphing calculators were as detrimental as before the workshops or they found them to be useful tools for the math classroom.

Another T-test was performed to see if the results of the teachers' perceptions were significant. The results were $t(5) = -1.44$, $p > .10$, one tailed, which implied that the results were not significant. This showed that the workshop may not have been the primary reason why teachers' perceptions changed about students using graphing calculators.

The teachers' perceptions about the integration of the TI-83 Plus into the classroom was also measured. There were two questions that were asked using a Likert scale (1 - 5). In this section a low score indicated that the students have become too

dependent on calculators, and the TI-83 Plus should not be integrated into the curriculum. A higher score meant that the teachers thought that the TI-83 Plus should be integrated into the curriculum. The averages were found for these questions. Before the treatment was administered, the average was 2.5, whereas after the treatment, the average changed to 2.583. This was a minimal change in the teachers' thought for the integration of the TI-83 Plus.

These responses were used to perform a T-test to see if the findings were significant. The teachers responses before and after the workshops were compare. The result was $t(5) = .33$, $p > .25$, one tailed, which indicated that there was no significance for this section.

An open-ended section was also included on the survey. This section allowed the teachers to list the advantages and disadvantages of using the TI-83 Plus in math classrooms. The intern counted the total number of advantages and disadvantages, both before and after the treatment. Since the teachers were asked to fill out the surveys separately, there were some overlapping answers. If a response was listed multiple times, it was counted multiple times. Before the workshops, the teachers totaled 8 advantages. Whereas after the workshops, the teachers listed 12 advantages. The advantages increased in number by 50%. The total number of disadvantages listed was 14 before the workshop and that number dropped down to 10 after the workshops. The disadvantages dropped 29%. There was a drastic change in the teachers' lists of advantages and disadvantages before and after the workshops.

The final research instrument that was used was an interview with each teacher of

the math department. The intern asked them three questions: 1) What would need to be done in order to integrate the TI-83 Plus into the math curriculum at the school? 2) What needs to be included in the teacher training, in order to implement graphing calculators into the curriculum? 3) What is the biggest obstacle in integrating the TI-83 Plus into the math curriculum?. The answers to these questions were recorded by the intern.

The same two response reoccurred to the first interview question "What needs to be done in order to integrate the TI-83 Plus?". The first was that the curriculum would need to be changed completely. The teachers felt that integrating the technology would mean that some topics would need to be cut from the curriculum in order to find time to teach technology. The second response that transpired from the interview was that every student would need to have access to a graphing calculator at all times. With a limited supply of calculators, students cannot take them home to work on problems at home. The teachers felt that either the calculators needed to be a mandatory requirement or the school should provide every student with one.

The teachers want more time in order to explore the many functions on the graphing calculator. The biggest complaint about the workshops was that there was not enough time for each topic and that there were not enough topics covered in the short time period. The teachers want more time to explore all of the functions and possibilities that the TI-83 Plus holds. Teachers would need to be in-serviced on each chapter that they teach and how the TI-83 Plus can be directly used in that chapter. Teachers wanted to learn more.

The largest obstacles in integrating graphing calculators into the curriculum were

time and money. The school needed to provide every student with a calculator in order to successfully integrate them into the curriculum. The teachers felt that it was unfair to force all students to purchase a $100 calculator and that the school should provide one for each student if the curriculum demands it. Even if the school provided the teachers with enough calculators, the time factor still impedes the education process. The teachers reported that the time it takes to distribute the TI-83 Pluses takes away from instruction time. If the school provides calculators, then the teachers must be held responsible for ensuring the safe keeping of them. To distribute and collect the calculators takes over 5 minutes total which more than 10% of the class period. These were the two biggest obstacles mentioned by the teachers.

The two instruments used to collect data gave the intern the information that was needed. The survey showed that there was no significant difference on the teachers' teaching style and techniques. However, their knowledge of the TI-83 Plus did increase slightly. The interview confirmed these findings. The teachers pointed out the obstacles that needed to be overcome in order for them to change their teaching techniques. The survey showed that the teachers need more than just workshops in order to integrate the TI-83 Plus into their classrooms.

Chapter Number 5

Conclusions, Implications, and Further Study

Conclusion

There were two purposes of the TI-83 Plus calculator workshop that was administered. The first objective was to increase the teachers knowledge of the TI-83 Plus graphing calculator. Many of its functions were unknown to teachers because the instruction manual is over 600 pages long. Since standardized tests allow many graphing calculators, teachers needed to know the many functions that could have been used in the classroom. The second goal of the workshops was to change the teaching techniques of the teachers. Technology forces teachers to change their educational philosophy. Graphing calculators placed the emphasis on the derivation of formulas and how the formulas could be used in real world applications. The workshops were designed to teach the teachers how to use the TI-83 Plus and how they could be integrated into the existing curriculum. After the instructional portion of each workshop, a discussion was held to discover how the TI-83 could add to each classes curriculum.

The workshops were run throughout the 2001 and 2002 school year. The final results were reviewed in March of 2002. The instruments used to measure the effectiveness of the workshops were surveys and personal interviews. These instruments showed that one of the goals was obtained, while the other was not.

The teachers did increase their knowledge of the TI-83 Plus. The section on the

survey that dealt directly with the teachers' training of the TI-83 Plus changed the most of any section. On a five point scale the average difference was almost one full point. This showed that the teachers had learned many concepts on the graphing calculators. The statistics showed that the workshops approached significance in this area. The interview also showed that the teachers had learned many topics on the TI-83 Plus. Every teacher indicated that they learned about new functions on the calculator. The first goal of teaching the teachers about the many functions of the TI-83 Plus was achieved.

The second goal of changing the way that teachers teach was not achieved. The surveys showed a slight change in each category.. However, none of these sections were statistically significant. The interview also confirmed these results. Many teachers stated that they used the calculators after they taught the original concepts using paper and pencil. The calculator was merely a way of showing how technology had advanced. Instead of changing the curriculum, teachers merely added an addendum to the end of a section or chapter showing how the calculator could be used for each topic. These findings were fairly universal with all of the teachers. Although their views of the calculator had changed for the better, the use of the graphing calculators in the classroom had not changed. Teaching techniques were not affected by the graphing calculator workshops.

The teachers were not receptive to changing their teaching styles because of a plethora of reasons. These reasons were all brought up throughout the interviews. Distributing the TI-83 Plus calculators takes up valuable class time. To distribute and collect the calculators cost the teachers 10% of their class time. Many teachers also

complained that not every student had full access to a graphing calculator. Students were able to use them in class, but could not take them home. The teachers stated that in order to change the curriculum, every students would need to own their own TI-83 Plus. However, even if every student had their own graphing calculator, some teachers did not believe it was a good idea to convert the math curriculum to integrated graphing calculators. Some teachers felt that it was important for the students to be able to perform the basic computation skills on paper as opposed to using a calculator. They were opposed to teaching using any type of calculator fully.

As shown in the literature review, it is necessary for schools to integrate technology into their classrooms. Teachers need to be informed of the technology that can be used in their classroom. The TI-83 Plus will be available for teachers to use as a teaching tool in their classrooms. The message from the teachers was clear to the intern. Every student needs to have access to a graphing calculator at all times in order to change the curriculum to fully integrate them into the curriculum. As the world changes, so must education. However, every student must be on a level playing field in order to change classroom teaching styles.

Leadership Skills

The intern exhibited many leadership qualities throughout the workshops. Before each workshop, the intern examined the curriculums of many of the different classes. With that knowledge, he constructed a curriculum for the TI-83 Plus. At each workshop, the intern took on a leadership role. Many different communication skills were demonstrated by the intern, both written and oral skills were used. As topics were

brought up by the teachers, the intern researched each answer and gave them the proper responses. The intern also gathered feedback from the teachers throughout the interviews. This showed that the intern could interact on a one-on-one basis with each teacher. The intern demonstrated his communication skills, his willingness to adapt to the teachers needs, and his ability to lead a discussion on educational topics.

Further Studies

Schools are a microcosm of society. As society advances, schools must advance, too. Technology will be used in the classroom. In order to see how technology affects education, studies should be done to see if graphing calculators have an effect on students test scores. A study can be performed by allowing student to take the SAT's with a regular calculator, followed by a course in teaching the students how to use the TI-83 Plus, and ending with the students taking another SAT test. If the scores increase dramatically, then there is a need to integrate the technology into the curriculum.

The intern will continue to educate his fellow teachers about the graphing calculator. As teachers want to learn certain topics, the intern will provided workshops and discussions on how these topics can be integrated into the existing curriculum.

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Appendix A

Research Instruments

TI-83 Plus Survey

1) When introducing a topic, I do at least five problems on the board as examples.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

2) I lecture/demonstrate problems on the board for at least 25 minutes.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

3) The students work in groups or individually for at least 10 minutes of every period.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

4) When introducing a formula, the students derive the formula in groups.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

5) I spend the majority of the period at the front of the room.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

6) I am familiar with the capabilities of the TI-83 Plus calculator

1	2	3	4	5
Extremely Familiar	Very Familiar	Somewhat Familiar	Slightly Familiar	Not Familiar

7) I can perform basic math computation on the TI-83 Plus

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

8) I can graphing equations on the TI-83 Plus calculator

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

9) I am familiar with ways that the TI-83 Plus can be used in my classrooms.

1	2	3	4	5
Extremely Familiar	Very Familiar	Somewhat Familiar	Slightly Familiar	Not Familiar

10) I feel comfortable teaching students how to use the TI-83 Plus.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

11) I feel that the TI-83 Plus is a valuable teaching tool.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

12) I have been sufficiently trained in using the TI-83 Plus.

1	2	3	4	5
Extremely Trained	Very Trained	Somewhat Trained	Slightly Trained	Not Trained

13) I can integrate the TI-83 Plus into my daily classroom lessons.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

14) I feel that the TI-83 Plus should be integrated into the curriculum throughout the year.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

15) Students have become too dependent on calculators.

1	2	3	4	5
Extremely Dependent	Very Dependent	Somewhat Dependent	Slightly Dependent	Not Dependent

16) Calculators should only be used to calculate or verify numbers.

1	2	3	4	5
Always	Very Often	Sometimes	Seldom	Never

Benefits and Disadvantages of using the TI-83 Plus in class

1) What are the benefits to using the TI-83 Plus in the math classroom?

2) What are the disadvantages to using the TI-83 Plus in the math classroom?

Interview Questions

1)) What would need to be done in order to integrate the TI-83 Plus into the math curriculum at the school?

2) What needs to be included in the teacher training, in order to implement graphing calculators into the curriculum?

3) What is the biggest obstacle in integrating the TI-83 Plus into the math

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