

TECHNOLOGIES' ROLE IN EDUCATION: MEASURING STUDENT
ACHIEVEMENT AND MOTIVATION

A Paper

Presented to

The Department of Instructional Design and Technology

EMPORIA STATE UNIVERSITY

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

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May 2007

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Chapter 1

INTRODUCTION

Background

If you were to ask elementary aged students their favorite part of school, many students would list activities including: experiments, working in the computer lab, making presentations, and using hands-on manipulatives. A common thread in all of these activities is that students are actively engaged in completing the “assignment.” “If you were to ask those same students to name their favorite teacher, it is likely that they would pick someone who teaches with kinesthetic activities on a regular basis or the teacher who incorporates a lot of technology into their classroom.

Do these answers mean that all learning should be hands on and use technology? The obvious answer may seem to be certainly not because not all students learn in the same way. Many educational institutes, however, are pushing teachers to incorporate more and more technology because of the belief that students learn more when technology is used.

Research Problem

Working in a district that strives to have the latest and greatest technology available to teachers, I decided to determine if the consistent and regular use of technology increased student achievement or motivation. I have a unique classroom setting. I teach fourth grade students. Our grade level is departmentalized, which allows me to teach four sections of science on a daily basis. I have each class for fifty minutes. The way our schedule is designed, I have two science classes in the morning and the other two in the afternoon.

If my research demonstrates using technology increases student motivation and achievement, it would help justify to district members the large amount of money that is spent on technology every year.

Project Outline

For my project, I am going to attempt to find a significant difference in learning and/or motivation in my students based on the use of technology. “To clarify a general misconception, motivation and ability are not equivalent. Motivation refers to what a person will attempt, yet ability is defined as what a person can do” (Heafner, 2004, p. 43). I have four classes of fourth grade science on a daily basis. My two morning classes will receive the majority of their instruction and assignments with the use of technology. The afternoon classes will continue to use the book and eliminate all technology activities from their class. On the first day of the chapter, all students will take the same pre-test. The technology students will take their test using CPS, a technology device that allows student answer various types of questions and records their scores, and the control group will complete the test using paper/pencil. Students will also complete a short survey before beginning the chapter on their interest, knowledge, etc. about science and simple machines (the science topic to be covered). After completing the chapter, which will last two weeks, students will take the same post-test in the same methods they took the pre-test, either CPS or paper/pencil. Students will also complete another survey about their interest in the subject and in science in general. Those students using technology, will also complete a second survey on whether or not they liked the technology that was used.

Chapter 2

REVIEW OF LITERATURE

Technology Integration

Technology has found its way into almost every aspect of our lives. From digital cameras and cell phones to video games and computers, technology is used by a majority of people every single day. Technology and its devices are also becoming more popular in schools. On a yearly basis, the Andover School District spends over \$1.0 million on implementing technology into our school district (A. Koenigs, personal communication, January 31, 2007).

Andover School District is not the only district that feels that money must be spent on technology. As teachers and administrators learn more about the way students learn, districts may find that they are not effectively supporting students and teachers.

Some argue that we are in the midst of a true paradigmatic shift regarding the nature of learning in general and that, regardless of the role technology plays, the networked collaborative learning model has changed the way learners learn and along with it the way teachers teach. Despite the popularity of these technologies, relatively little research has examined their relative influence on objective measures of student learning (DeNeui, 2006).

In 2000, Maine's governor Angus King decided to give laptops to all of Maine's 7th grade students. King's purpose was to do something different than what other districts were doing. However, this proposal was missing rationale related to school performance. "No evident thought had been put into how this major investment in new technology would make schools more efficient, produce future savings, or enhance the learning

process” (Hess, 2004, p. 1) While King’s proposal may appear to be a poorly thought out plan, it is typical of the way technologies are implemented in the public schools.

The tendency has been to sprinkle computers and Internet connections across classrooms in the pleasant hope that teachers will integrate them into their lesson. The purpose is seldom to make teachers more productive or to rethink the way in which lessons are delivered. Indeed, PCs often serve as little more than high-priced typewriters, sitting in the back of the classrooms unused for most of the school day (Hess, 2004).

Technology and Motivation

In my research, I have not found technology alone to be the sole difference in motivation or learning. Beyth-Marom, Saporta, and Caspi (2005) note that:

Hundreds of studies were conducted that compared conventional face-to-face instructional environments with different technology assisted instructional environments. Although their purpose was mainly to prove the effectiveness of learning technologies, this goal was not achieved. A frequent research result was “no significant difference was found.”

Beyth-Marom et al. (2005) also states that student learning is primarily about the student.

The effectiveness of a certain pedagogy or instructional method depends heavily on the student – his or her learning habits, learning styles, preferences, and characteristics are intervening variables that need to be taken into account. That is, there are no instructional methods nor educational technologies that are effective for all.

In contrast to the research above, Heafner (2004) found that “technology offers many benefits to enhance education. Most importantly, technology integration has the potential to increase student motivation” (p. 47). Heafner (2004) also notes that:

Students enjoyed working on the project with technology because they viewed technology as more engaging and entertaining. All students reported enjoyment in the task because technology made their work easier and more fun to do. Many students identified that technology made it possible for them to complete their work more quickly and efficiently. One of the most common reasons for enjoyment in the task was that computer use made students’ work neater, enabled them to add nice graphics, and made the overall presentations look professional.

As a caution to the recognized positive benefits of technology to increase student learning, Heafner (2004) found that “much research exists that challenges the use of technology as positively affecting student learning” (p. 49). Some of the negative outcomes of technology include social isolation, a misconception that all information is “good,” too much information being presented, and that technology is very time consuming. Heafner (2004) also noted that “technology is not the only method for instruction nor is it the only means of motivating students to learn. Technology alone is insufficient to ensure effective education” (p. 49). Becker (2004) also identifies four areas of concern in regard to various technical issues. These four items include: costs, logistical limitations, availability of technology and the reliability of the technology.

“Traditionalists insist that it is impossible to educate children more efficiently, that there is no way technology can be substituted for anything that educators do” (Hess, 2004, p. 2).

Technology's Future

While technology does not provide all the answers for successful education, it does offer opportunities to enhance lessons and instruction and increase student motivation while preparing students with skills, values, and knowledge necessary to become successful citizens. Heafner (2004) advocates the use of technology

As a means to motivate students by engaging students in the learning process with the use of a familiar instructional tool that improve students' self-efficacy and self-worth. If teachers build students' self-confidence, then students will more likely enjoy learning, which can greatly impact student achievement.

If technology does not motivate students, what does? According to Ben-Ari (2003) it would appear that "mastery orientation, whether at the classroom or personal level, might be a better predictor of adaptive motivational patterns compared to performance orientations" (p. 8). Complex instruction, where students worked in small heterogeneous groups of four, allowed students to exhibit more adaptive motivational patterns. "They would show a greater willingness to invest effort in learning, challenge seeking, persistence in the face of difficulties and more involvement in the learning process" (Ben-Ari, 2003, p. 8). The results of this study suggest that such strategies temper the competitive nature of the regular class by implementing learning tasks that have a large emphasis on positive interactions between students and focus on the completion of various tasks instead of the social comparisons (Ben-Ari, 2003).

As public schools continue to fund technology integrations into their schools, why is the technology not being put to good use? According to Hess (2004), public schools do not have the pressure of competition. "Thus they have no reasons to regard technology as

a tool to trim their workforce or to rethink the ways in which they deliver education”

(Hess, 2004, p. 1).

Chapter 3

DESIGN MODEL

Overview

The design model I chose to use for this project was the ADDIE model. This model offers great flexibility and provides continued fluidity during its use. The idea behind the entire project was to identify if students learning and motivation are altered when technology is implemented. All students were given a short survey to clarify their current feelings about science. Half of the students would then receive their instruction on simple machines with the use of technology. The second group of students would receive instruction in the traditional textbook/worksheet manner. Both groups took the same pre and post tests. The increase in student learning would be compared from the pre to post tests for both groups of students. Students would then complete the same survey they had at the beginning of the study. Those students involved in the technology group, would also complete another survey. My hypothesis was that student achievement gains would only be slightly increased with the technology group, but that motivation of students would be greatly increased for those students using technology.

Analysis

In analyzing the problem, I found that the needs assessment revealed a felt need that was solely mine. A felt need is a desire or want that an individual has to improve the performance of a target audience (Morrison, 2004). My desire was to increase student learning and motivation through the use of technology. I determined that the best way to identify an increase in student achievement was to compare pre and post test scores of both groups of students. By completing pre and post tests, it would eliminate the chance

of one group being “smarter” than another and their higher test scores not being correlated to technology. To identify motivation, I felt that student surveys would provide the most accurate data. All students completed a five question survey about their attitudes toward simple machines and science in general, before the study began and upon completion of the study. The technology group also completed a second survey at the end of the study to identify if they enjoyed using technology or felt that they learned more with technology. Both surveys were basic Yes/No/Maybe surveys. Students were not required to put their name on the survey and encouraged to be completely honest.

Design

With this basic background knowledge, I began to design the project. I split the students into two groups. The desired outcome of the entire project was to identify whether or not technology increases student achievement and motivation. In order to do this, as many outside factors as possible were controlled. Based on ease, I split the students into the two morning classes using technology and the two afternoon classes using textbook methods. I decided to give a pre-test to ensure that one of the groups did not have an advantage based on previous knowledge of the subject matter. The standards to be taught were identical for both groups of students. All students received the same amount of instruction time and took the pre and post tests on the same days. The pre and post test had the exact same questions placed in the same order. The difference between the two groups was the method of instruction. One group received all instruction with the aid of technology, while the other group received their instruction without the use of technology. The control groups method of delivery was mostly teacher centered and involved a lot of lecture and reading of the textbook.

Learner Profile. The population of the students involved in the project involved all fourth graders. The control and experimental group had approximately the same number of students. The control group had a total of 42 students, 20 girls and 22 boys. The experiment group had a total of 47 students, 20 girls and 27 boys. The control group had no students identified as special education students while the experiment group had seven. The age range of the two groups was the same. All of the students in the study were native English speakers.

Development

The first part of the development phase was to create the surveys and pre and post tests. Survey questions included finding if students liked science, were interested in simple machines, had studied simple machines previously, and if they had any previous knowledge about simple machines. The tests were multiple choice and based on the standards required of the chapter. Test dates were set and parents were notified. The control group daily instruction was determined first. For the experiment group, I started by determining the standards that needed to be taught each day. Using those standards, I then chose what technology method(s) would best teach each particular standard. From there, I was able to create or find the necessary teaching tools to complete the lesson.

Implementation

The timeframe for the project was two weeks. Classes met daily for approximately fifty minutes. Students completed the initial survey and pre-test on the first day of the study. All students were given the pre-test and survey and all were returned. The second part was to begin instruction with both groups. The control group continued throughout the lesson with paper/pencil assignments, readings from the text,

class discussion and teacher lecture. The experiment group used PowerPoint, videos, Word, and CPS (Classroom Performance System) along with class discussion for the remaining portion of the study. All students took the post-test on day ten of the project and completed the survey. The experiment group completed a second survey about technology on the day after the study ended.

I was very pleased with the effort both groups put into the chapter. Both the experiment group and the control group appeared to be very excited to come to science each day. My role as the teacher was greatly different between the two groups. For the experiment group, I did not feel as though I played an active role in the learning process of the class. They led class discussions based on their questions and many questions were answered by students. For the control group, I felt that I was a necessary component of their learning process. I directed class discussions, made sure assignments were done correctly, and read with the students from the text.

Evaluation

The post tests for both classes were significantly better than their pre tests. Overall, both groups demonstrated a higher level of understanding of simple machines. Both of the post tests were identical, the method of delivery was the only difference. Students were required to know vocabulary, identify parts of simple machines in a picture, and be able to explain how various simple machines made work easier. All questions were worth one point, with a total of nineteen points possible.

Chapter 4

RESULTS

I started this project with my own expectations and beliefs. My original hypothesis was that technology would increase student motivation and achievement. After completing research, I changed my hypothesis. I believed that technology may increase student motivation but that technology alone would not increase student achievement with any measurable gains.

While I thought I was going to be able to get some clear cut answers after completing this study, I found that I have more questions now than before I started. Is there a skew in the results due to the new way of presenting material and completing assignments and tests? If I were to teach numerous chapters this way, would the students become more adept at learning in this method? If students were to become more familiar with this method of learning, I would expect for their motivation to decrease as the newness wore off. Another possibility that may have affected the results is that I spent more time planning and making sure that the experiment group received instruction covering the same standards and all the standards that would be assessed than I normally would have.

There are multiple situations that might have skewed this data. Other factors that may have influenced the outcomes could be the topic that was covered. A topic of a different nature may have had different results. Another difference that could have affected the results is that the experimental group was able to visually see how simple machines worked and changed force. The control group was only able to look at still pictures.

The study presented some interesting results. The average score for the control group on the post test was 80 percent while the experiment group averaged 78 percent. These results would show that technology did not significantly affect students. The control group averaged 42 percent and the experiment group averaged 43 percent on the pretest. This would show that there was not significant prior knowledge for one class versus another.

The survey results also proved to be quite interesting. When I compared pre and post survey results, I found that the control group thought they knew more about simple machines after the study than the experiment group. The control group also showed more interest in simple machines than the experiment group on the post survey and that they liked science more than the experiment group.

The experiment group completed a technology survey that provided some detailed information as well. 85% of students liked learning about simple machines without their book and taking the test with technology. Only 78% would like to take another test using technology. Many students felt an added pressure when using technology to take the test, which may have changed their test score or altered their opinions on the surveys as well.

Chapter 5

CONCLUSION

I found the entire process to be very exciting even though I was disappointed in the results. I was very enthusiastic about putting together the chapter and lessons to be taught. Technology is continuing to grow as a teaching tool in my school district. Until this project, I had not really thought about the specifics regarding technology and learning. The results of my study have made me refocus my thoughts about technology and the best way to implement it in the classroom. After completing this project, there was no significant data to support teaching solely with technology nor was there significant data to support not implementing technology into the classroom. The data from this short two week study is not sufficient to change the way that schools are incorporating technology.

In looking at all the results from this study, it would appear that students can do just as well at learning material without technology as those that have technology heavily incorporated in their learning. Interestingly, the results found that students who did not use technology felt that they knew more about the topic than those students who used technology. Also, students liked learning with and without technology equally well and showed no significant higher motivation based on the use of technology. Finally, most students in the experimental group enjoyed the incorporated technology and would like to use it again.

Technology will continue to play a key role in education. Students will undoubtedly need to know how to use technology in the future. Technology will continue

to be an integral part of education. The essential component to technology's success may be teaching teachers the best way to incorporate it into the daily classrooms. Students need exposure to technology on a regular basis. Teachers need time and training to be able to incorporate technology to best help students. Teachers may feel frightened to try technology without the proper training due to a lack of familiarity with the technology. While many classrooms are full of the latest and greatest technology devices, there are many teachers and students who do not get the advantage of using them in the classroom.

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Appendix A

Simple Machines Survey

1. How much do you know about simple machines?

A lot

A little

None

2. Did you learn about simple machines last year?

Yes

No

3. If you learned about them, did you like learning about simple machines?

Yes

No

It was OK

4. Are you interested in simple machines?

Very

Some

Little

Not at all

5. Do you like science?

Yes

No

Appendix B

Technology Survey

1. Did you like learning about simple machines without your book?

Yes No

2. Did you like taking your test on the clickers?

Yes No

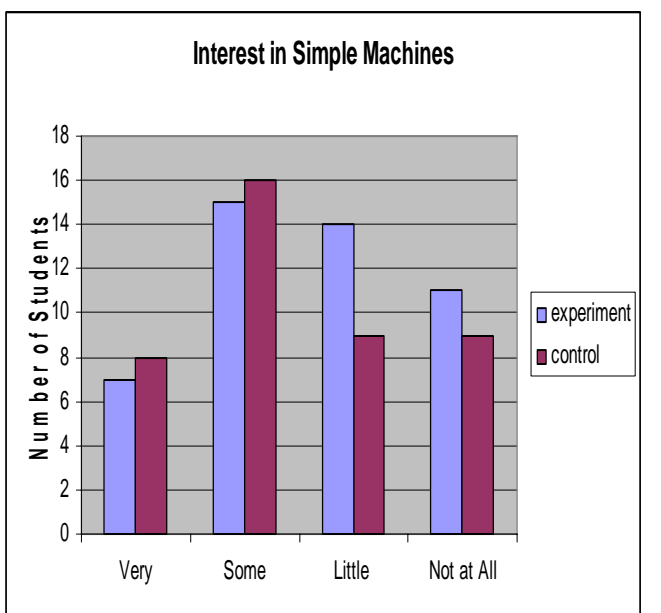
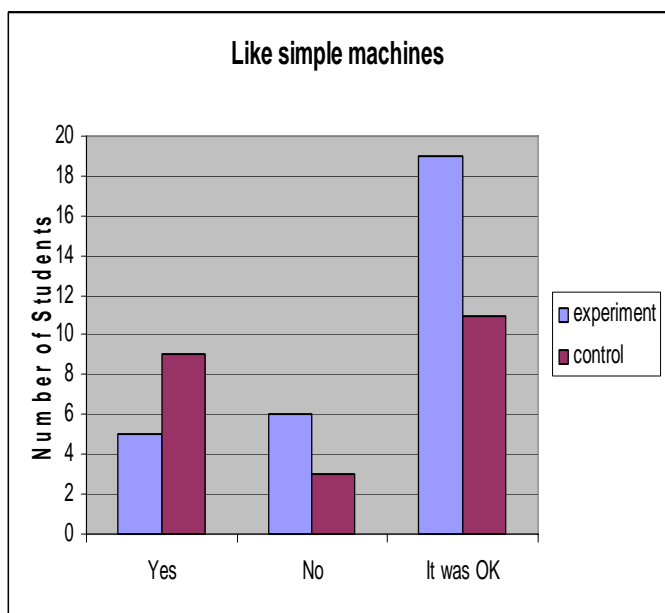
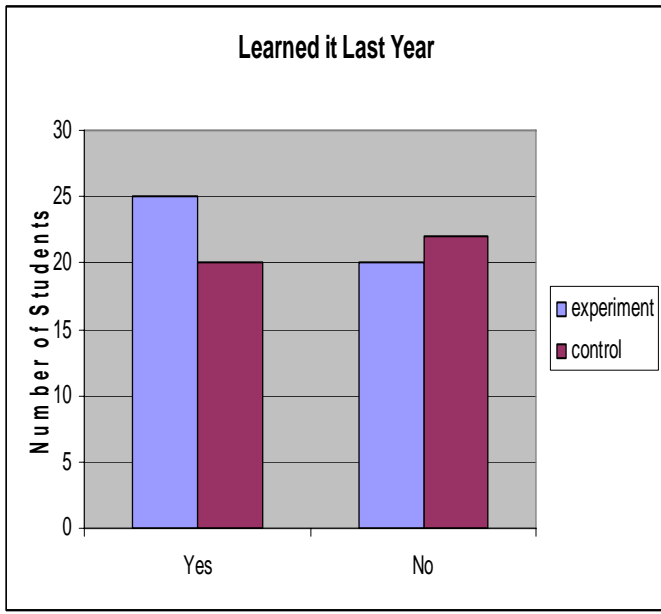
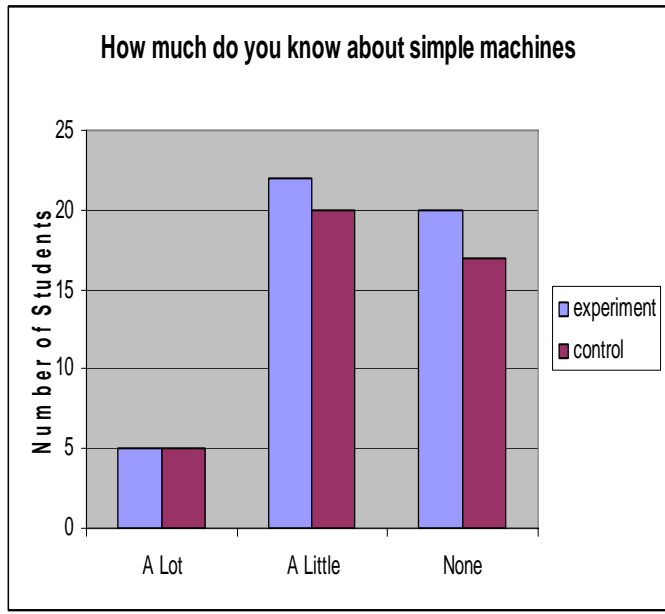
3. Would you like to take another test on the clickers?

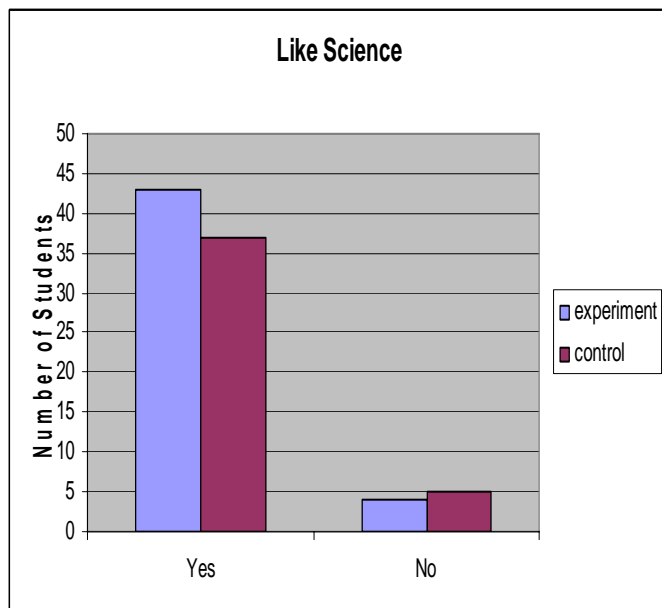
Yes No

Appendix C

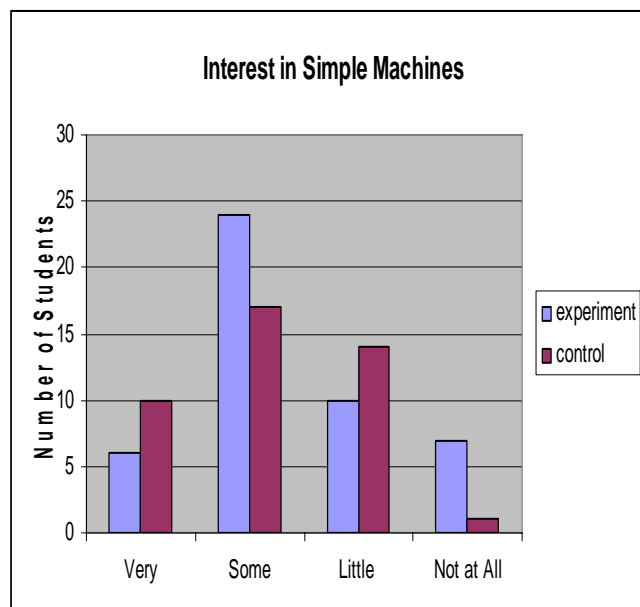
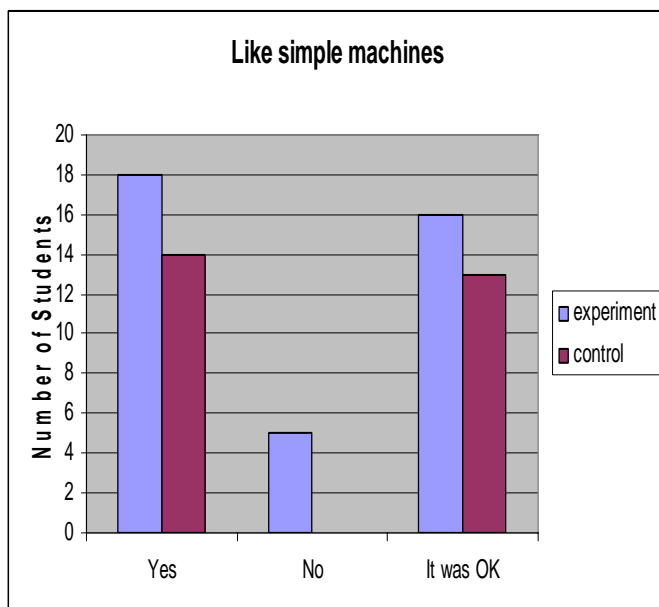
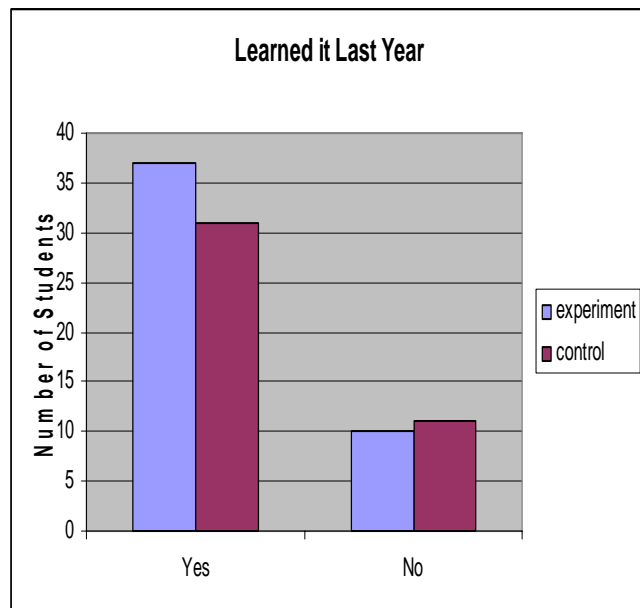
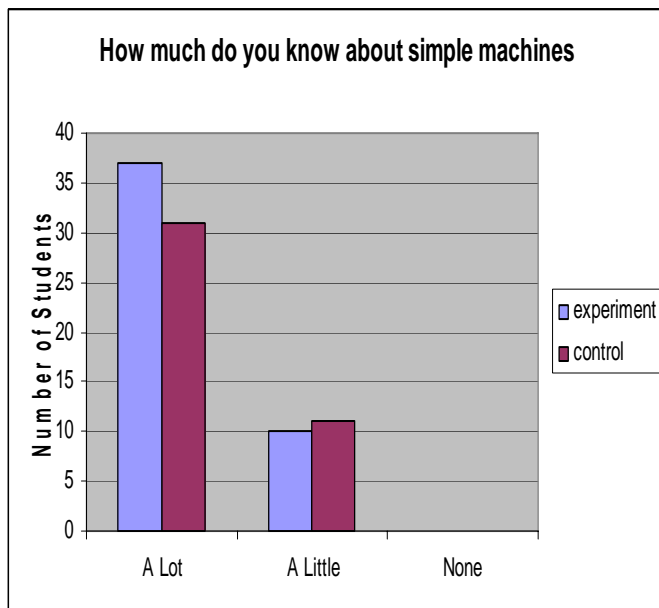
Survey Results

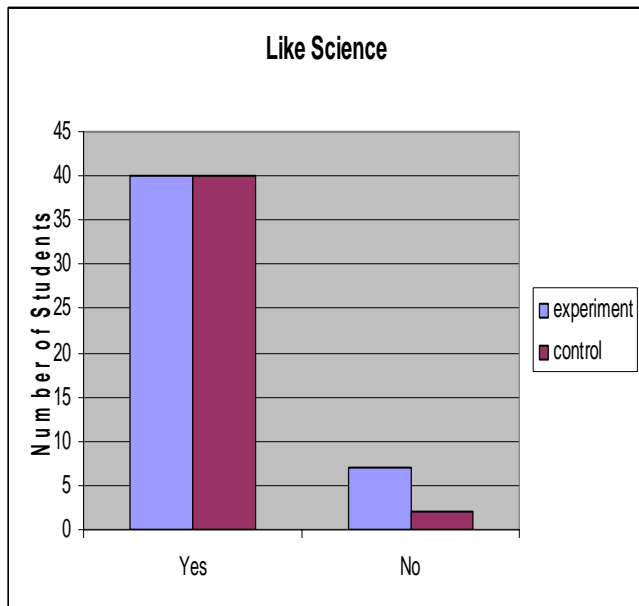
Pre Survey Results



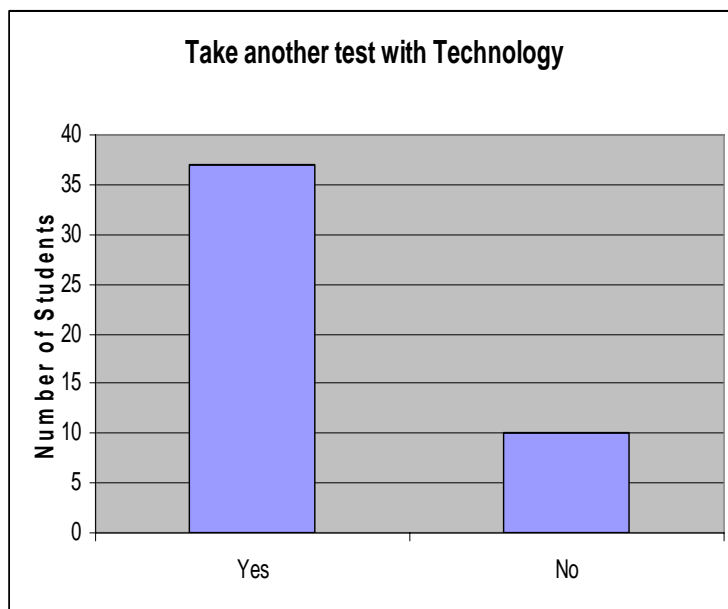
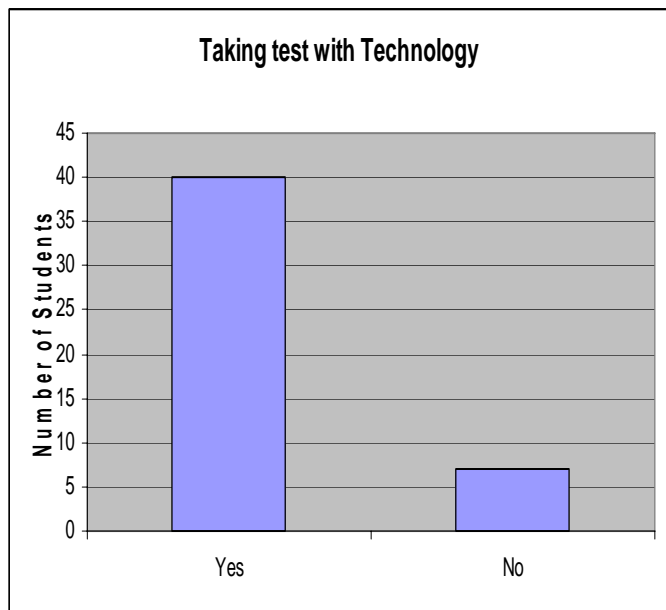
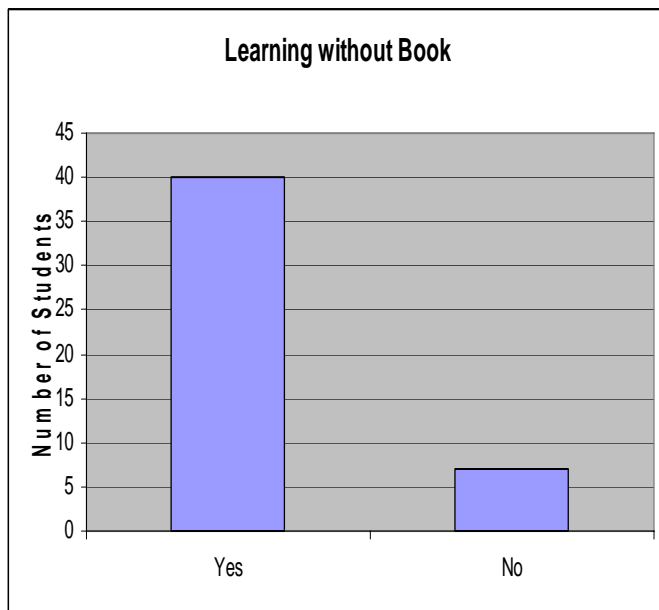


Post Survey Results





Technology Survey Results



Appendix D

Pre Test

1. A flat surface that has one end higher than the other
 - a. wedge
 - b. pulley
 - c. screw
 - d. inclined plane
2. A simple machine always does what?
 - a. doubles the lifting force
 - b. moves around a fixed point
 - c. moves and object in the same direction
 - d. changes the size or direction of a force
3. Inclined plane wrapped around a pole
 - a. wheel and axle
 - b. pulley
 - c. screw
 - d. wedge
4. When you use a lever to open a paint can, the outer rim of the can is the what?
 - a. fulcrum
 - b. resulting force
 - c. effort force
 - d. wedge
5. Fixed point of a lever
 - a. wedge
 - b. work
 - c. fulcrum
 - d. lever
6. Imagine a person holding a broom. Where their hand and the broom handle meet is called what?
 - a. fulcrum
 - b. effort force
 - c. resulting force
 - d. lever
7. Large wheel attached to a smaller wheel or rod
 - a. lever
 - b. wedge
 - c. screw
 - d. wheel and axle
8. Imagine a person holding a broom. The person's elbow would be what?
 - a. fulcrum
 - b. resulting force
 - c. effort force
 - d. lever

9. Basic machines that make up other machines
 - a. effort force
 - b. simple machines
 - c. efficiency
 - d. work
10. Imagine a person holding a broom. The bottom of the broom that touches the ground is called what?
 - a. fulcrum
 - b. effort force
 - c. resulting force
 - d. lever
11. Force you put into a simple machine
 - a. effort force
 - b. simple machine
 - c. work
 - d. efficiency
12. A fixed pulley is similar to a class one lever because it does what?
 - a. changes the size of the effort force
 - b. changes the weight of the effort force
 - c. changes the position of the fulcrum
 - d. changes the direction of the effort force
13. Rope of chain and the wheel it fits around
 - a. wedge
 - b. work
 - c. pulley
 - d. screw
14. A wheel and axle increase what?
 - a. resulting force
 - b. fulcrum
 - c. effort force
 - d. friction
15. Two inclined planes placed back-to-back
 - a. wedge
 - b. work
 - c. pulley
 - d. screw
16. A wedge does what?
 - a. reduces resulting force
 - b. decreases total work
 - c. pushes things apart
 - d. pulls objects
17. Result of a force moving an object through a distance
 - a. efficiency
 - b. work
 - c. fulcrum
 - d. pulley

18. Bar that turns around a fixed point

- a. lever
- b. fulcrum
- c. pulley
- d. wedge

19. How well a machine changes effort into work

- a. effort force
- b. efficiency
- c. pulley
- d. wedge

Appendix E

Post Test

1. A flat surface that has one end higher than the other
 - a. wedge
 - b. pulley
 - c. screw
 - d. inclined plane
2. Inclined plane wrapped around a pole
 - a. Wheel and axle
 - b. Pulley
 - c. Screw
 - d. Wedge
3. Fixed point of a lever
 - a. Wedge
 - b. Work
 - c. Fulcrum
 - d. Lever
4. Large wheel attached to a smaller wheel or rod
 - a. Lever
 - b. Wedge
 - c. Screw
 - d. Wheel and axle
5. Basic machines that make up other machines
 - a. Effort force
 - b. Simple machines
 - c. Efficiency
 - d. Work
6. Force you put into a simple machine
 - a. Effort force
 - b. Simple machine
 - c. Work
 - d. Efficiency
7. Rope of chain and the wheel it fits around
 - a. Wedge
 - b. Work
 - c. Pulley
 - d. Screw
8. Two inclined planes placed back-to-back
 - a. Wedge
 - b. Work
 - c. Pulley
 - d. Screw

9. Result of a force moving an object through a distance
 - a. Efficiency
 - b. Work
 - c. Fulcrum
 - d. Pulley
10. Bar that turns around a fixed point
 - a. Lever
 - b. Fulcrum
 - c. Pulley
 - d. Wedge
11. How well a machine changes effort into work
 - a. Effort force
 - b. Efficiency
 - c. Pulley
 - d. Wedge
12. A simple machine always does what?
 - a. Doubles the lifting force
 - b. Moves around a fixed point
 - c. Moves an object in the same direction
 - d. Changes the size or direction of a force
13. When you use a lever to open a can of paint, the outer rim of the can is the what?
 - a. Fulcrum
 - b. Resulting force
 - c. Effort force
 - d. Wedge
14. Imagine a person holding a broom. Where their hand and the broom handle meet is called what?
 - a. Fulcrum
 - b. Effort force
 - c. Resulting force
 - d. Lever
15. Imagine a person holding a broom. The person's elbow would be what?
 - a. Fulcrum
 - b. Resulting force
 - c. Effort force
 - d. Lever
16. Imagine a person holding a broom. The bottom of the broom that touches the ground is called what?
 - a. Fulcrum
 - b. Effort force
 - c. Resulting force
 - d. Lever
17. A fixed pulley is similar to a class one lever because it does what?
 - a. Changes the size of the effort force
 - b. Changes the weight of the effort force
 - c. Changes the position of its fulcrum
 - d. Changes the direction of the effort force

18. A wheel and axle increase what?

- a. Resulting force
- b. Fulcrum
- c. Effort force
- d. Friction

19. A wedge does what?

- a. Reduces resulting force
- b. Decreases total work
- c. Pushes things apart
- d. Pulls objects

Appendix F

Test Results