The Influence of Technology-Based Instruction on Student Learning, Motivation and Teacher Perceptions Toward Science Instruction

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Finally, I give the glory of this paper to God. Without God’s guidance and strength and love, I would never have finished this program…to God, give the glory.
Abstract

The purpose of the research study was to determine the impact of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction on student achievement. Student and teacher perceptions of the use of technology resources to learn the science objectives were also examined. Three research questions were posed: (a) How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student achievement? (b) How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student motivation to learn science? (c) What are the teacher perceptions about the use of technology, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction? Participants in this research study included 19 seventh-grade students ranging in age from 12-14. The research study extended over a three-week period. Science achievement tests, attitudinal surveys, and a teacher journal were analyzed to determine the influence that the various technologies had on student achievement, student perceptions of science and teacher perceptions of using technology to teach a unit of study. Data show that the use of varied technology greatly improved student achievement and their perceptions toward science. The teacher perception was also improved based on the observations used throughout the process. Information was presented to the learning community and discussions were held to create a dialogue to enhance the use of technology in the classrooms through the use of WebQuests, streaming videos, and laboratory manipulatives.
The Influence of Technology-Based Instruction on Seventh-Grade Student Achievement and Motivation to Learn Science:
An Action Research Proposal
Janet S. Gaddy
Valdosta State University
The Influence of Technology-Based Instruction on
Seventh-Grade Student Achievement and Motivation to Learn Science:
An Action Research Proposal

Introduction and Area of Focus

As a middle school teacher for the past 19 years, I have observed a changing trend in science education during the last few years. Unlike the earlier part of my teaching career, when students entered middle school with prior knowledge of science content acquired during the elementary school years, students are presently entering middle school with limited science knowledge due to minimal science instruction in the elementary schools. Less time is being spent on science instruction in the elementary schools due to an increased emphasis on reading and mathematics to address Annual Yearly Progress (AYP) initiatives; thus, students begin middle school without the science content and skills needed for middle school science instruction. In addition to a lack of adequate science knowledge, students appear to be more interested in making good science grades, than in actually learning science.

Once students are in the middle school, the students are expected to take their limited science knowledge and extend it further with every science unit studied. Middle school students find that using prior knowledge and applying the knowledge to something new is a challenge. A focused emphasis on the Georgia Performance Standards (GPS) and the integration of technology should assist me in preparing my students for the attainment of knowledge throughout the year.

The focus of this action research study is to determine the influence of technology, specifically the use of WebQuests, streaming video, and laboratory
manipulatives for seventh-grade science instruction on student motivation and student achievement. To address the need to improve middle school student science knowledge and student motivation to learn science, this research study will focus on the integration of the Georgia Performance Standards (GPS) and technology, specifically the use of WebQuests, streaming videos, and laboratory manipulatives for implementing seventh-grade science instruction.

The GPS refer to specific academic standards, which are mandated by the Georgia Department of Education to be taught at each grade level, kindergarten through twelfth grade. The standards include content knowledge and skills to be acquired by students. By integrating technology and GPS, science instruction will become more project-based and student-centered.

Learning has changed from a passive to an active activity. Many educational systems are encouraging active, student-centered instruction, rather than passive, teacher-directed instruction for teaching academic content (Leung, 2003). One teaching strategy, which focuses on student-centered learning, is the use of computer-based instruction. Computer-based instruction refers to the use of instructional computer programs, either web-based or disk-type for learning academic content and skills. Swan, Van t’ Hooft, Kratcoski, and Unger (2005) reported that there is evidence of student learning when technology is involved.

Science lessons, which are computer-based and student-centered, actively engage students in the learning process. With the integration of technology into the science classroom, students tend to be more motivated and willing to learn new information. The students become involved in the learning process and takes charge of their own learning
The Influence of (Frederick & Shaw, 1998). Students are more motivated to learn when they given a goal. Motivation is enhanced when individualized instruction is a focus of the learning environment. Therefore, individualized instruction enhances student motivation and the perceptions toward science and the concepts taught (Swan, Van t’ Hooft, Kratcoski, & Unger, 2005).

Integrated Literature Review

Computer-based instruction refers to a teaching strategy, which incorporates the use of Internet-based programs or disk-type programs to teach content knowledge or skills. Two Internet-based resources, which can be accessed for computer-based instruction, include WebQuests and streaming videos. WebQuests refer to inquiry-oriented, Web-based activities, in which students work independently on academic tasks (Sandars, 2005). Those activities focus on specific content information. Students are required to analyze, synthesize, and evaluate the content information. Streaming video refers to video clips and short videos that can be seen over the Internet. The streaming videos allow students to investigate concepts through the use of short video lessons that help to illustrate the concepts and give examples.

According to Jackson (2002), computer-based instruction, such as WebQuests and streaming video, is an ever-changing teaching strategy that is helping education and educators change. This type of technology instruction allows teachers a “presentation style or a medium that is used to present information and encourage the acquisition of knowledge or learning” (p. 5) to a wide spectrum of students (Jackson, 2002). Web-based or on-line instructional classes, technology and computer-based instruction allow educators to incorporate information and activities into classroom activities that deal with
The Influence of real-world issues and to individualize instruction (Bradford, 2005). Another important aspect of WebQuests and other web-based activities is that it elicits higher order thinking skills as it engages learners in a task (Sandars, 2005).

Another important part of teaching science is the inclusion of manipulatives in science experiences. The use of manipulatives in a science classroom has been around since the 1950’s (Fredrick & Shaw, 1998). Bilgin (2006) explains that students need to experience science and should take part in activity-based lessons. Laboratory manipulatives are an integral part of activity-based learning in the science classroom. Involving the student in the learning process with the use of manipulatives and exploration is an important progression from learning about science to truly experiencing science (Fredrick & Shaw, 1998).

When students are involved in the learning process, they are more likely to assume responsibility for their own learning (Martens, Gulikers, & Bastiaens, 2004). One strategy for involving students in their own learning of subject matter is through the use of computer-based instruction. In addition, computer-based programs such as website-based learning, WebQuests, and on-line learning classes can assist teachers in motivating students (Bradford, 2005). Students are more motivated to use technology when they can collaborate with others and have the ability to communicate findings and discoveries to interested parties (Swan et al., 2005). Using technology, as well as, manipulatives increases positive attitudes toward science (Frederick & Shaw, 1998).

Motivation can be classified as either intrinsic or extrinsic (Martens, Gulikers, & Bastiaens, 2004; Alessi & Trollip, 2001). Intrinsic motivation is an internal function with a self-driven aspect. There is a sense of control with intrinsic motivation. Extrinsic
motivation has an external function and is reward or outwardly stimulated. The learner expects something for completing the task such as a reward, grade, or some other type of payment that is important to the learner to accomplish the goal (Xiang, Bruene, & Chen, 2005).

Intrinsic motivation is the motivation needed for most on-line learners to succeed (Xiang, Bruene, & Chen, 2005). Researchers have found that intrinsically motivated learners are more persistent and are more likely to set and achieve goals (Martens, Gulikers, & Bastiaens; Sungar & Tekkaya, 2006). Many researchers have reported that when student motivation increased, productivity as well as the quality of work increased (Swan et al., 2005). Halawah (2006) also found correlations between student achievement and intrinsic motivation. The earlier a student found success in using intrinsic motivation to meet academic success, the more successful the student became in the future (Halawah, 2006).

A correlation exists between self-regulated students and motivated learners (Sungar & Tekkaya, 2006; Zimmerman, 2002). In a study of self-regulated learners, researchers found that self-regulated learners have strong motivational goals. Self-regulated students set goals and plan and use strategies to attain their goals (Sungar & Tekkaya, 2006). Self-regulated learners will constantly adjust their goals depending on the situation (Zimmerman, 2002). Zimmerman further states that self-regulation is an important part of education because it leads to life-long learning skills.

Using computer-based instruction requires self-regulation from the learners. Self-regulation includes behavior, self, and environment (Hodges, 2005). The behavior aspect is associated with the student’s willingness to try a new learning tool. Learners need to
give the new tool a chance, ask questions, and become an active learner (Leung, 2003).
The self aspect deals mainly with attitude. Hodges (2005) stated the learner needs to attempt the computer-based instruction with a positive attitude or an open mindedness that is necessary when a new situation occurs. The location of the learning tool deals with things that can be difficult to control such as scheduling and rescheduling time to work on the computer-based instruction, troubleshooting possible technology glitches, creating enough space for everyone to have their own personal space, or using time wisely (VanDusen & Worthen, 1995; Langone, 1998). Additionally, self-regulation is related to self-direction. As a student matures, self-direction and self-regulation improve (Hodges, 2005).

Further research to examine the use of technology, specifically WebQuests, streaming videos and science manipulatives, for student science achievement and motivation for learning is needed. Findings from research may benefit computer-based designers and educators for the development of science-based curriculums.

Description of Setting and Participants

The action research project will be conducted in a middle school, which is located in a suburban area of Augusta, Georgia. The middle school has approximately 856 students. Students come primarily from a middle-class community with a combination of one- and two-parent household incomes. The school population consists of 75% Caucasian, 12% African-American, 5% Asian American, 4% Asian-Indian, 3% Hispanic-American, and 1% is classified as other. Twenty-six percent of the students participate in the free and reduced lunch program.
Participants in this research study will include 24 seventh-grade students ranging in age from 12-14. Two of the students will turn 15 years old during the school year. All of the students belong to a science class, which is heterogeneously grouped according to science achievement. Five of the students are on a Student Support Team (SST); three are currently enrolled in English as a Second Language (ESOL); and two have special modifications based on their Individual Educational Plan (IEP). This intervention will take place in a regular seventh-grade science lab and a computer lab classroom that is designed for a class of 30. The lab has a sign-up procedure that must be followed in order to use it for the designated time.

Proposed Intervention

A 3-week *Eubacteria* and *Protista* science unit, based on Georgia Performance Standards, will be presented to seventh-grade students (Appendix A). Technology, specifically WebQuests and streaming videos will be integrated into the unit. In addition, science manipulatives such as microscopes, magnifying glasses, Petri dishes with agar (a growth medium) and measurement tools will be included in the lessons in order to conduct science investigations.

The science unit will consist of approximately 15 lessons. These lessons will be conducted during 65-minute class periods and will include many activities. At the beginning of the lessons, the teacher will introduce the main concepts of the lessons in a lecture format. Also, the directions for laboratory investigations will be discussed. During the middle of the classes, students will work together in small groups to participate in science investigations. Finally at the end of the classes, the results of the laboratory
activities will be discussed. Also, the students will complete WebQuests and view streaming videos to extend the learning about related science topics.

Research Questions

1. How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student motivation to learn science?

2. How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student achievement?

3. What are the teacher perceptions about the use of technology, specifically, WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction?

Defining the Variables

In this action research study, the main variables are WebQuests, streaming videos, and laboratory manipulatives for science classroom, student motivation, student achievement, and teacher perceptions of the use of technology. Descriptions of the main variables follow.

WebQuests refer to an inquiry-oriented learning activity in which most of the information used by the students is taken from the Web. It is designed to allow learners to focus on specific information and to support the learners’ ability to analyze, synthesize and evaluate the information. Streaming videos refer to video clips and short videos that can be seen over the Internet. The streaming videos allow students to investigate concepts through the use of short video lessons that illustrate the concepts and provide examples.
Science laboratory manipulatives that will be used include a variety of hands-on activities refer to the science equipment such as use of microscopes (digital and compound light), magnifying glasses, Petri dishes, agar (growth medium), and measurement tools (balance scale and metric ruler).

Membership of the Action Research Group

I will be working with one of the seventh-grade science classes at the middle school where I currently teach. Students in this action research study will need to have consent from parent and self to participate (Appendix B and C). The results of this action research study will be of interest to the other science teachers in the school because the teachers are always investigating ways to incorporate technology into classroom lessons to improve student learning. The administration and technology committee will also be interested in this study since our school improvement plan states that we are to implement more technology in the core classes.

Negotiations to be Undertaken

The negotiations that will need to be discussed include notifying my school administrators about the study and the class involved (Appendix D). I will need to adjust the computer lab or mobile lab schedule so that my class has the opportunity to use the computers when needed. Each seventh-grade student involved will be given a consent form that will need to be signed and approved by a parent in order to participate (Appendix B). The Valdosta State University Review Committee personnel will notify me if I am allowed to complete this action research study as stated on the timeline.
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Timeline

<table>
<thead>
<tr>
<th>Beginning Date</th>
<th>Completion Date</th>
<th>Description of Event</th>
</tr>
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<tbody>
<tr>
<td>October 31, 2006</td>
<td></td>
<td>Submit DARP for approval</td>
</tr>
<tr>
<td>November 2006</td>
<td></td>
<td>Revise DARP into final ARP</td>
</tr>
<tr>
<td>January 8-12, 2007</td>
<td></td>
<td>Submit Action Research Proposal (ARP) to committee chair</td>
</tr>
<tr>
<td>January 15, 2007</td>
<td>January 15, 2007</td>
<td>Sign up for computer lab or mobile lab usage through the media center for three weeks (2/5/07-2/23/07)</td>
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<tr>
<td>January 22, 2007</td>
<td>January 28, 2007</td>
<td>Revise ARP as needed and resubmit</td>
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<tr>
<td>January 29, 2007</td>
<td>January 29, 2007</td>
<td>Submit final ARP</td>
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<tr>
<td>January 30, 2007</td>
<td>February 2, 2007</td>
<td>Complete all required consent forms for participants</td>
</tr>
<tr>
<td>February 2, 2007</td>
<td>February 2, 2007</td>
<td>Collect all required consent forms</td>
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<tr>
<td>February 5, 2007</td>
<td>February 23, 2007</td>
<td>Begin Action Research</td>
</tr>
<tr>
<td>February 5, 2007</td>
<td>February 5, 2007</td>
<td>Administer pre-intervention opinion survey and pretest in intervention and non-intervention class</td>
</tr>
<tr>
<td>February 24, 2007</td>
<td>February 25, 2007</td>
<td>Evaluate assessment and post-intervention surveys. Analyze data from test results</td>
</tr>
<tr>
<td>February 24, 2007</td>
<td>March 5, 2007</td>
<td>Write article manuscript and submit draft of the Journal Ready Article (JRA)</td>
</tr>
<tr>
<td>March 5, 2007</td>
<td>March 9, 2007</td>
<td>Revise draft if needed</td>
</tr>
<tr>
<td>March 19, 2007</td>
<td>March 23, 2007</td>
<td>Revise JRA as directed by committee chair</td>
</tr>
<tr>
<td>March 26, 2007</td>
<td>March 30, 2007</td>
<td>Re-submit JRA</td>
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Resources

The resources, that will be used for this action research study include, the textbook, *Life Science* by Holt, Rinehart, and Winston, 28 computers with Internet access, computer printers, digital projector with laser pointer, paper, pencil, markers, colored pencils, various objects, Petri dishes with agar, cotton swabs, safety goggles, microscopes, FLEX Cam microscope, digital camera, and a journal to record any changes that may occur. The

Data Collection

Prior to this action research study, the participants’ science scores from the Criterion-Referenced Competency Test (CRCT) will be recorded on the data form (Appendix E). Then, I will begin the study by administering an attitude survey pretest (Appendix F) to all student participants. The survey will be used to determine students’ motivation for learning science. The survey results will be recorded on the data collection form of student perceptions (Appendix G). Student participants will also be given a science achievement pretest (Appendix H) based on the Georgia Performance Standards of science for the study of Eubacteria and Protista. The individual student pretest scores will be recorded on the data collection form on student achievement (Appendix E). Research question 1 and 2, respectively, will be answered through the use of these instruments.

During the action research study, I will be using a journal to record thoughts and observations for each of the day’s activities (Appendix I). Specific journal topics will be provided for each day’s journal entry. Those topics will be related to the WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction. Research question 3 will be answered through the use of this journal.

At the conclusion of this unit of study, a science achievement posttest (Appendix H) will be administered to the students. The posttest is the same instrument as the pretest.
The posttest will allow measurement of the objectives taught during the action research study. The scores from the posttest will be compared with the pretest. The students will also be scored on a rubric to measure student science knowledge acquired from a WebQuest assignment (Appendix J). The rubric will be used along with the science achievement posttest to assist in answering research question 2.

All participating students will complete the attitude survey posttest (Appendix F) and the results will be compared with the attitude survey pretest. Changes in perceptions will be noted and discussed at the conclusion of this study. Ten out of the 27 participants will be interviewed with open-ended questions (Appendix K) and the responses will be noted on the form. The information gathered throughout this process will be used to answer Research questions 1, 2, and 3, as previously outlined in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Before Intervention</th>
<th>During Intervention</th>
<th>After Intervention</th>
<th>Instrument Location</th>
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</thead>
<tbody>
<tr>
<td>1. How does the use of technology resources, specifically WebQuests, streaming</td>
<td>a. Attitude survey pretest</td>
<td>b. Attitude survey posttest</td>
<td>c. student interviews</td>
<td>a. CRCT data sheet for student achievement Appendix E</td>
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<td>videos, and laboratory manipulatives for science classrooms instruction, influence</td>
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<td>b. Attitude survey pre/posttest Appendix F</td>
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<tr>
<td>student motivation to learn science?</td>
<td></td>
<td></td>
<td></td>
<td>c. Science achievement pre/posttest Appendix G</td>
</tr>
<tr>
<td>2. How does the use of technology resources, specifically WebQuests, streaming</td>
<td>d. Obtain CRCT science scores on participants</td>
<td>f. Rubric</td>
<td>g. Administer science achievement posttest</td>
<td>d. Journal Topic Sheet</td>
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<td>videos, and laboratory manipulatives for science classrooms instruction, influence</td>
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<td>student achievement?</td>
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</tbody>
</table>
3. What are the teacher perceptions about the use of technology, specifically, WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction?

Data Analysis and Interpretation

For research question 1, which addresses the influence of technology on student motivation to learn science, mean scores for each item on the attitude survey pretest and posttest will be determined for every student. In addition, mean scores for the overall class responses on the attitude survey pretest and posttest will be identified. Mean differences between the attitude survey pretest and posttest items, as well as, mean differences for the overall attitude survey pretest and posttest will be calculated. In addition, data from student interviews will be gathered, culled, and categorized. Themes and sub-themes will emerge. Percentages will be determined for the themes and sub-themes.

Data for research question 2, which addresses the influence of technology on student achievement, will be gathered from CRCT science scores, science achievement tests, and a rubric to measure student achievement of a science Web-Quest. The CRCT science scores will be used as baseline data. For the science achievement tests, individual student pretest and posttest scores will be converted into percentages. Percentage differences between individual student performances on pretest and posttest will be determined. Also, percentages will be calculated for the overall class performance on the pretest and posttest; percentage differences between those tests will be calculated. In
addition, student achievement will be determined by the use of a teacher-made WebQuest rubric. Individual student scores will be determined for the completion of the WebQuest. Percentages will be determined. A narrative comparison of student achievement as measured on the CRCT, science achievement tests, and the rubric will be made.

For research question 3, which focuses on the teacher perceptions of technology for science classroom instruction, data will be collected from a daily journal. Data will be culled and categorized. Themes and sub-themes will emerge. Percentages will be determined for the themes and sub-themes.

Communication of Findings

The action research results will be presented in the school media center at Lakeside Middle School (LMS). The school administrators, LMS science teachers, the technology committee, the media/technology support personnel, and all Valdosta State University Review Committee personnel will be invited. A copy of the study and the results will be provided to the guests, including all survey results, observational checklists, journal entries, and comparisons of pretest and posttest averages. The researcher will present a brief PowerPoint presentation discussing the findings and their implications. Questions will be answered throughout the presentation. All results and findings will be published for any interested parties review. A digital camera will be used to record the event and the results, pictures, questions with answers will be compiled for the VSU Review Committee.
References


Jackson, S. H. (2005, April). Translating on-ground courses into effective web-based
The Influence of  


Appendix A

3-Week Unit Plan for *Eubacteria* and *Protista*

**Objectives:**

S7L1: Students will investigate the diversity of living organisms and how they compared scientifically.
   a. Classify organisms based on a six kingdom system and dichotomous key.
S7CS1a. Honest, clear, and accurate records
   b. Value of a hypothesis
S7CS2b. Appropriate lab techniques

S7L2: Established Goal: Students will describe the structure and function of cells, tissues, organs, and organ systems.
   a. Explain that cells take in nutrients in order to grow and divide to make needed materials.
   b. Relate cell structures (cell membrane, nucleus, cytoplasm, chloroplasts, and mitochondria) to basic cell functions.
S7CS8a: Trivial or significant differences in results
S7CS8c: Theories may change with new knowledge
S7CS10c: Building Vocabulary

**Enduring Understandings:**
1. All organisms can be classified into one of the six Kingdoms (internal and external structures are more important than general characteristics).
2. The structures in a cell (unicellular or multicellular) has a direct relationship with its function.
3. The classification system and science is constantly changing and updating with new information.

**Essential Questions:**
1. What makes *Eubacteria* and *Protista* similar and different?
2. Why are *Eubacteria* and *Protista* alive?
3. How would we survive without *Eubacteria* and *Protista*?

**Skills and Knowledge:**

- **Skills (SWBAT):**
  - Investigate/Compare *Eubacteria* and *Protista*
  - Create a sample and a slide of a *Eubacteria* and *Protista* specimen.
  - Use a microscope to identify the specimen’s name and group.
  - Create a Venn Diagram using the notes from the WebQuests and video streaming.

- **Knowledge (SWK):**
  - The differences and similarities between a *Eubacteria* and *Protista*.
  - The classification of the *Eubacteria* and *Protista* and why the specimen is in that classification group.
  - Why *Eubacteria* and *Protista* have been moved from one classification kingdom to another over the years.
Discuss the changes over time that has occurred with the kingdom system.

Use the laboratory correctly, observing all lab and safety rules.

Vocabulary:
Classification                           Kingdom
Linneaus                                  Phylum
Scientific Name                           Class
Taxonomy                                  Order
Family                                    Genus
Prokaryotic                               Dichotomous key
Eukaryotic                                Archaeabacteria
Species                                   Observation
Binomial nomenclature
Protista
Eubacteria

Stage 2: Assessment Evidence
Performance Based Assessment:
• Construct Venn Diagrams comparing and contrasting *Eubacteria* and *Protista*
• Draw and label a diagram of bacterial cell and a Protist cell
• Create a specimen of a *Eubacteria* and *Protista*.
• Use a microscope to identify the *Eubacteria* and *Protista*.
• Using pictures and explanations found on the various Web Quests, create a mobile of the different types of Eubacteria and Protists
• Create a crossword puzzle of facts about Eubacteria and Protists

Direct Instruction:
Lecture-Notes will be given using graphics and PowerPoint to introduce *Eubacteria* and *Protista* and examples of each. Explanation and discussion will include explanations of vocabulary and basic facts needed for background knowledge.

Group Discussion:
• Why some organisms have moved from one kingdom to another
• Connection of the *Eubacteria* and *Protista* kingdoms
Labs:

- **Growing Eubacteria**- Students will create a specimen of Eubacteria. A Petri dish with agar (a growth medium) will be used. The students will swab different areas around the school. The Petri dish will be labeled and sealed. Observations will be made each day of the Petri dish. Observations will be recorded in on their log sheet. Discussion will happen when growth starts. The students will then use the Flex Cam microscope or the compound light microscope to observe the structure of Eubacteria. Students will sketch the structures, paying close attention to the shape of the bacteria. They will make an attempt to identify the shape and the name of the Eubacteria.

- **Identifying Protista**- The students will use prepared slides to identify a variety of protists. Students will sketch the protists, paying close attention to the structures. They will make an attempt to identify the type of protists that are seen.

Large Group Work:

- The students will view and take notes from the video-streaming video segment from Discovery Education titled Life in a Drop of Water. Discussion of notes will follow the viewing of the video.
- The students will view the video-streaming video segment from Discovery Education titled Biology: The Science of Life: The Microscopic World. Discussion of notes will follow the viewing of the video.
- The students will view the video-streaming video segment from Discovery Education titled The World of the Protozoa. Discussion of notes will follow the viewing of the video.

Small Group Work:

- **Creation of a Venn Diagram**: Students will work with partners in creating a Venn diagram based on information found on Web quests and the video streams.
- Revisit various streaming videos for review and enrichment [http://www.gpb.org/videostreaming](http://www.gpb.org/videostreaming)

Individual Work:

- Vocabulary Development
- Creation of Crossword Puzzle of facts about the subject
- Venn Diagram of the similarities and differences of Eubacteria and protists
- Make a smear of bacteria in a Petri dish filled with agar
- Identify different bacteria slides and put them into categories
Creation of a Eubacteria/Protist Mobile

Formative/Summative Assessment:

- **Investigation: Which is which?** (Problem-Based) As a laboratory assistant at the Medical College of Georgia, doctors have given you a large amount of slides that have been misidentified. Students are asked to identify each of the slides and are to place them into the correct category.
- **Activity Rubric**—Students will complete WebQuests and will be graded on a rubric.
- **Protista Mobile**—Students will construct a three-dimensional mobile using information from the Web Quests and video streaming on protists. The mobile will illustrate different protists from each group studied.
- **End of Unit Test**—Students will take an end of unit test over the unit on Eubacteria and Protists. The scores will be compared with the pre-test.
Appendix B

The Influence of Technology-based Instruction on Student Achievement and Motivation

Your child is being asked to participate in a project as a graduate class assignment under the direction of Dr. Verilette Hinkle and conducted through Valdosta State University. The University in accordance with its policy regarding the Protection of Human Research Subjects asks that you give your signed agreement to have your child participate in this project.

Please ask the student researcher, Janet Gaddy, any questions you have to help you understand this research project. A basic explanation of the research is given below.

The students will be participating in a unit on *Eubacteria* and *Protista*. During the unit, we will be using a variety of technology components. I will be asking your child’s opinion on the components and their ability to understand the information using the technology. They will be asked to take a pretest, posttest, and a survey. Some of the students will be interviewed by me about the unit and the technology used.

Your child's name will remain confidential at all times. He/She will not be identified in the research report.

Valdosta State University is an equal opportunity educational institution. It is not the intent of our institution to discriminate against any person based on sex, race, religion, color, national origin or handicap of the individual.

Questions regarding the conduct of this research may be directed to me, Janet Gaddy, at 706-855-6900, ext. 341 (jgaddy@ccboe.net), or my instructor, Dr. Verilette Hinkle, at (229) 333-5927.

Refusal to participate in this study will have no effect on any future services your child may be entitled to from the University. Should you and your child agree to your child's participation in this study and decide later that your child wishes to withdraw, he/she is free to withdraw from the study at any time without penalty. If you agree that your child may participate at this time, please sign and date this statement and return it to your child’s teacher. You may keep a copy of this consent form for your records.

Thank you very much for your willingness to have your child participate in this research project.

My Child's Name (printed): __________________________

Parent/Guardian Signature: __________________________ Date: _____________
Appendix C

The Influence of Technology-based Instruction on Student Achievement and Motivation

Mrs. Janet Gaddy

I, ___________________________________________, understand that my parent has given permission for me to take part in a project about Eubacteria and Protista and the use of technology under the direction of Mrs. Gaddy. I am taking part because I want to. I have been told that I can stop at any time I want to and I will be given an alternative assignment to be completed in the media center.

Signature of participant: ________________________________ Date: ___________
Appendix D

Evaluation Project Approval Request

Janet Gaddy, a teacher at Lakeside Middle School, enrolled as a specialist candidate in the College of Education at Valdosta State University request that she be given permission to perform an evaluation study at your facility. Her study would be undertaken during a period of about three weeks in February. The general purpose of the evaluation will be to determine the relationships between the use of technology components and learning/performance and perceptions in a unit in science. More specifically, Janet Gaddy proposes to evaluate the effects of the use of technology on the motivation and achievement of seventh-grade science students.

One of the project goals is to provide a useful evaluation report to you and any other stakeholders at Lakeside Middle School who might benefit from this information.

The director of the Institutional Review Board at VSU met with the instructor of this course and has determined that a human subject’s research review is not required for this type of evaluation project. Nevertheless, the student team will follow commonly accepted ethical procedures for human subject’s research. The student team (1) will not place any of the participants at physical or emotional risk, (2) will maintain confidentiality of all participants (names and other personal identifiers will be excluded from reports), and (3) will explain to participants that participation is voluntary, with no negative consequences for refusal to participate.

A signed informed consent form will be required of each participant (as well as parents of any children/minors participating) before participant involvement. The form will provide a basic description of the evaluation project and the ethical procedures listed above.

If you have any questions for the instructor, I can be contacted by telephone at (229) 333-5927. Thank you for your assistance.

Dr. Verilette Hinkle
Assistant Professor
Curriculum and Instructional Technology
Valdosta State University
Appendix E

DATA COLLECTION SHEET FOR STUDENT ACHIEVEMENT

<table>
<thead>
<tr>
<th>Student Number</th>
<th>CRCT Science Test Score</th>
<th>Science Pretest</th>
<th>Science Posttest</th>
</tr>
</thead>
</table>
Appendix F

Attitudes Toward Learning Science Survey
Pretest/Posttest

Directions: Indicate to what extent you agree with the following statements by placing an X in the corresponding box:

1. I try my hardest to learn the science concepts, even if they are difficult to me.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

2. Science is a challenge to me and I give up easily when it becomes too difficult.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

3. When I am learning new material, I try to understand the information.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

4. I think science is important because it deals with information that can be used in my lifetime.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

5. I will participate in a science lesson when it is exciting and changeable.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

6. I learn more from a science class when there is a variety of teaching methods.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

7. I work hard at learning the material and feel satisfied with a good grade.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree
8. I am more motivated to learn the science concepts when there is a grade attached to the assignment.
Strongly Agree    Agree    Disagree    Strongly Disagree

9. Science is important to me and I participate to show others that I am smart.
Strongly Agree    Agree    Disagree    Strongly Disagree

10. Science will help me reach my goals.
Strongly Agree    Agree    Disagree    Strongly Disagree

11. Using technology and other sources of information allow me to learn the most information.
Strongly Agree    Agree    Disagree    Strongly Disagree

12. I will ask questions of the teacher and the students, during discussion, to understand the information better.
Strongly Agree    Agree    Disagree    Strongly Disagree
Appendix G

Eubacteria and Protista Pretest/Posttest

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

_____ 1. Bacteria are important to the planet as
a. decomposers of dead organic matter. c. makers of medicine.
b. processors of nitrogen. d. All of the above

_____ 2. Which of the following is NOT a common shape of bacteria?
a. crystals c. spirilla
b. cocci d. bacilli

_____ 3. A cell with no nucleus is called a(n)
a. virus. c. endospore.
b. prokaryote. d. bacillus.

_____ 4. Which of the following statements best describes bacteria?
a. Bacteria are single-celled organisms that do not have nuclei.
b. Bacteria are single-celled organisms that have nuclei.
c. Bacteria are multi-celled organisms that have nuclei.
d. Bacteria are multi-celled organisms that do not have nuclei.

_____ 5. Prokaryotes do NOT
a. use cellular respiration. c. reproduce.
b. move around. d. have nuclei.

_____ 6. Bacilli are bacteria that are
a. spherical. c. spiral-shaped.
b. rod-shaped. d. cubic.

_____ 7. Which shape of bacteria allows for easier movement?
a. bacilli c. spirilla
b. cocci d. crystal

_____ 8. While looking at some bacteria under a microscope, you see that they do not have cell walls. What type of bacteria are these?
a. archaebacteria c. cyanobacteria
b. parasitic bacteria d. eubacteria

_____ 9. Today, many bacterial diseases can be prevented with
a. antibiotics. c. vaccines.
b. insulin. d. endospores.

_____ 10. Which of the following statements does not correctly describe bacteria?
a. Bacteria have no nuclei. c. Bacteria are invisible to the naked eye.
b. Bacteria are single-celled organisms. d. all of the above

_____ 11. Bacteria obtain energy through
a. photosynthesis.
b. "feeding" on dead animals, plants, and wastes.
c. their host organisms.
d. All of the above

_____ 12. Plantlike protists include
a. euglenoids and ciliates. c. spore-forming protists and smuts.
b. lichens and flagellates. d. dinoflagellates and diatoms.
13. Funguslike protists
a. are consumers or decomposers.
b. are made of chains of cells called hyphae.
c. are divided into four major groups.
d. are always parasites.

14. Animal-like protists
a. are also known as protozoa.
b. include amoebas and Paramecium.
c. may be either free-living or parasitic.
d. All of the above

15. A contractile vacuole
a. is a food passageway.
b. pumps out excess water.
c. is the location of food digestion.
d. can be found in any animal-like protist.

16. All protists are
a. eukaryotic.
b. single-celled organisms.
c. producers.
d. consumers.

17. Most of the world's oxygen is produced by
a. protozoa.
b. fungi.
c. lichens.
d. phytoplankton.

18. The word pseudopodia means
a. "jellylike."
b. "false feet."
c. "whips."
d. "propellers."

19. Amoebas capture their food by surrounding it with their
a. pseudopodia.
b. flagella.
c. contractile vacuoles.
d. cilia.

Completion
Complete each sentence or statement.

20. Rod-shaped bacteria are called ____________________. (bacilli or cocci)

21. Most bacteria reproduce by ____________________. (endospores or binary fission)

22. A(n)____________________ is a thick protective membrane that contains an inactive bacterium. (coci or endospore)

23. Most bacteria are ____________________. (eubacteria or archaeabacteria)

24. Spherical bacteria are called ____________________.

25. Protists that get energy from photosynthesis are ____________________. (algae or amoebas)

26. Animal-like protists are also called ____________________. (protozoa or algae)

27. _________________ obtain their food from dead organic matter or the body of another organism. (Phytoplankton or Funguslike protists)

28. _________________ cells have a nucleus.
Short Answer

29. Draw and label the three main shapes of bacteria.
30. Describe some of the problems humans would face if there were no bacteria.
31. Describe some of the problems you think bacteria might face if there were no humans.
32. Name the three main groups of protists, and give the characteristics of each.
33. Explain how protists are classified.
34. What are three major differences between eubacteria and protists?
35. What are three similarities between eubacteria and protists?
Appendix H

Daily Focus Questions Form

Date ________________________________

1. What science topics were introduced in today’s lesson?

2. Describe how students interacted with technology (WebQuests, streaming videos, and laboratory manipulatives) to learn science content and skills.

3. How did students interact with other students when the technology resources were being utilized?

4. Were the students faced with any particular challenges regarding the use of the technology for the science lesson?

5. Did I encounter any particular problems in using technology for teaching the science lesson?

6. What were some of the positive outcomes of using technology for teaching science?

7. How did the use of technology for teaching the science lesson influence classroom management?
Appendix I

**Eubacteria and Protista WebQuests Rubric**

Name: _________________________________________________________

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td></td>
</tr>
<tr>
<td>All questions answered</td>
<td></td>
</tr>
<tr>
<td>All questions</td>
<td></td>
</tr>
<tr>
<td>were not clearly</td>
<td></td>
</tr>
<tr>
<td>stated.</td>
<td></td>
</tr>
<tr>
<td>Not all questions</td>
<td></td>
</tr>
<tr>
<td>were answered</td>
<td></td>
</tr>
<tr>
<td>completely, or</td>
<td></td>
</tr>
<tr>
<td>greater than 2</td>
<td></td>
</tr>
<tr>
<td>rationales for the</td>
<td></td>
</tr>
<tr>
<td>all the answers</td>
<td></td>
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<tr>
<td>were not clearly</td>
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<tr>
<td>stated.</td>
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</tr>
<tr>
<td>All questions</td>
<td></td>
</tr>
<tr>
<td>were not answered</td>
<td></td>
</tr>
<tr>
<td>completely.</td>
<td></td>
</tr>
</tbody>
</table>

| **Task**               |        |      |      |       |
| All tasks (6/6)        |        |      |      |       |
| assigned were          |        |      |      |       |
| addressed.             |        |      |      |       |
| It is apparent that    |        |      |      |       |
| great effort went      |        |      |      |       |
| into the development   |        |      |      |       |
| of the tasks.          |        |      |      |       |
| Completed at least 4   |        |      |      |       |
| of the 6 tasks assigned.|        |      |      |       |
| It is apparent that    |        |      |      |       |
| much effort went       |        |      |      |       |
| into the development   |        |      |      |       |
| of the tasks.          |        |      |      |       |
| Completed 3 out of 6   |        |      |      |       |
| tasks assigned.        |        |      |      |       |
| It is apparent that    |        |      |      |       |
| a moderate amount of   |        |      |      |       |
| effort went into the   |        |      |      |       |
| development of the     |        |      |      |       |
| tasks.                |        |      |      |       |
| Completed 2 or fewer   |        |      |      |       |
| tasks assigned and/or  |        |      |      |       |
| it is apparent         |        |      |      |       |
| that little effort     |        |      |      |       |
| went into the          |        |      |      |       |
| development of the     |        |      |      |       |
| task.                |        |      |      |       |

| **Process:** Teamwork  |        |      |      |       |
| It is evident the      |        |      |      |       |
| group demonstrated    |        |      |      |       |
| cooperation, and       |        |      |      |       |
| flexibility as they    |        |      |      |       |
| created the final      |        |      |      |       |
| product. Each member   |        |      |      |       |
| contributed to the     |        |      |      |       |
| final product.         |        |      |      |       |
| The team worked        |        |      |      |       |
| well together, but     |        |      |      |       |
| could have been        |        |      |      |       |
| more flexible in       |        |      |      |       |
| order to utilize each  |        |      |      |       |
| other’s skills to a    |        |      |      |       |
| better degree.         |        |      |      |       |
| The team had problems  |        |      |      |       |
| working together.      |        |      |      |       |
| Little collaboration   |        |      |      |       |
| or cooperation         |        |      |      |       |
| occurred.             |        |      |      |       |
| The final product is    |        |      |      |       |
| not the result of a    |        |      |      |       |
| collaborative effort.  |        |      |      |       |
| The group showed       |        |      |      |       |
| no evidence of         |        |      |      |       |
| collaboration.         |        |      |      |       |

| **Process:** Originality|        |      |      |       |
| The ideas expressed by |        |      |      |       |
| the body of work       |        |      |      |       |
| demonstrate a high     |        |      |      |       |
| degree of originality. |        |      |      |       |
| The ideas expressed by |        |      |      |       |
| the body of work are   |        |      |      |       |
| mostly original. The   |        |      |      |       |
| group may have         |        |      |      |       |
| improved upon a       |        |      |      |       |
| previous idea.         |        |      |      |       |
| The ideas expressed by |        |      |      |       |
| the body of work       |        |      |      |       |
| demonstrate a low      |        |      |      |       |
| degree of originality. |        |      |      |       |
| There were no          |        |      |      |       |
| original ideas         |        |      |      |       |
| expressed in this      |        |      |      |       |
| project.              |        |      |      |       |

**Total---->**

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Appendix J

Interview questions

Based on your learning experiences, please respond to the following questions.

1. What instructional strategy (WebQuests, streaming videos, laboratory manipulatives) used helped you the most?

2. What was your favorite part of this unit?

3. Do you think that the use of the technology, such as, WebQuests, streaming videos and laboratory manipulatives helped you understand the objectives better? Why or Why not?

4. Were there any problems during the unit that prevented you from learning?

5. In what way did your opinion or perception about science and science instruction change because technology was incorporated in this unit?

6. Would you like to see more technology used in the classroom? Why or why not?

7. What are some changes that you would make if you were the instructor for this unit?
The Influence of Technology-Based Instruction on Student Learning, Motivation, and Teacher Perceptions Toward Science Instruction

Janet S. Gaddy

Valdosta State University
Abstract

The research study was conducted to determine the impact of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction on student achievement. Student and teacher perceptions of the use of technology resources to learn the science objectives were also examined. For the study, 19 seventh-grade students studied the differences between bacteria and protists using WebQuests, streaming videos, and a variety of laboratory manipulatives over a 3-week time period. Data from science achievement tests, attitudinal surveys, and a teacher journal were analyzed to determine the influence that the various technologies had on student achievement, student perceptions of science and teacher perceptions of using technology to teach a unit of study. Those data show that the use of varied technology improved student achievement and their perceptions toward science. The teacher perceptions, as indicated from the excerpts in the teacher journal, were positive toward the use of technology resources for classroom instruction.
Introduction

As a middle school teacher for the past 19 years, I have observed a changing trend in science education during the last few years. Unlike the earlier part of my teaching career, when students entered middle school with prior knowledge of science content acquired during the elementary school years, students are presently entering middle school with limited science knowledge due to minimal science instruction in the elementary schools. Less time is being spent on science instruction in the elementary schools due to an increased emphasis on reading and mathematics to address Annual Yearly Progress (AYP) initiatives; thus, students begin middle school without the science content and skills needed for middle school science instruction. In addition to a lack of adequate science knowledge, students appear to be more interested in making good science grades, than in actually learning science.

Once students are in the middle school, the students are expected to take their limited science knowledge and extend it further with every science unit studied. Middle school students find that using prior knowledge and applying the knowledge to something new is a challenge. A focused emphasis on the Georgia Performance Standards (GPS) and the integration of technology should assist me in preparing my students for the attainment of knowledge throughout the year.

The GPS refer to specific academic standards, which are mandated by the Georgia Department of Education to be taught at each grade level, kindergarten through twelfth grade. The standards include content knowledge and skills to be acquired by students. By integrating technology and GPS, science instruction has become more project-based and student-centered.
Student learning has been changing during the past few years from a passive to an active experience in many schools. Many educational systems have encouraged active, student-centered instruction, rather than passive, teacher-directed instruction for teaching academic content (Leung, 2003). One teaching strategy, which has focused on student-centered learning, has been computer-based instruction. Computer-based instruction has been commonly referred to as the use of instructional computer programs, either web-based or disk-type programs, for learning academic content and skills. Another technology resource for student-centered learning is the use of manipulatives or laboratory equipment for conducting investigations or experiments in the classroom. Swan, Van t’ Hooft, Kratcoski, and Unger (2005) have reported that student learning has been evident, when technology has been involved in classroom instruction.

According to Frederick and Shaw (1998), computer-based science lessons have engaged students in the learning process. With the integration of technology into the science classroom, students have tended to be more motivated and willing to learn new information. The students have become involved in the learning process, and they have taken charge of their own learning. In addition, Swan et al. (2005) have found that individualized instruction, such as computer-based instruction, has enhanced student motivation and student perceptions toward science.

Computer-based instruction has been recognized as a teaching approach, which has addressed the varied needs and interests of students. According to Jackson (2002), computer-based instruction has presented teachers with a “presentation style or a medium that is used to present information and encourage the acquisition of knowledge or learning” (p. 5) to a wide spectrum of students.

Computer-based instruction, specifically, the use of Web-based or on-line instructional classes, has allowed educators to incorporate information and activities into classroom lessons,
which have dealt with real-world issues, and to individualize instruction (Bradford, 2005).
Another important aspect of web-based activities has been the development of higher order thinking skills of students, as they have engaged in classroom tasks (Sandars, 2005).

Another important part of teaching science has been the inclusion of manipulatives in science lessons. The use of manipulatives in a science classroom has been around since the 1950’s (Fredrick & Shaw). Bilgin (2006) has indicated that students need to experience science by being involved in activity-based lessons. Laboratory manipulatives have been an integral part of activity-based learning in the science classroom. According to Frederick and Shaw (1998), the involvement of the students in the learning process with the use of manipulatives and exploration has been an important progression from learning about science to truly experiencing science.

When students have been involved in the learning process, they have been more likely to assume responsibility for their own learning (Martens, Gulikers, & Bastiaens, 2004). One strategy for involving students in their own learning of subject matter has been through the use of computer-based instruction. Computer-based programs, such as website-based learning, WebQuests, and on-line learning classes, have assisted teachers in motivating students (Bradford, 2005). Students have been more motivated to use technology, when they have collaborated with others, and they have had the opportunity to communicate findings and discoveries to interested parties (Swan et al., 2005). The use of technology has increased positive attitudes toward science (Frederick & Shaw, 1998).

The purpose of my action research study was to examine how the use of technology resources, specifically WebQuests, streaming videos, and a variety of laboratory manipulatives influence student motivation to learn science and student science achievement. I also looked at teacher perceptions about using technology for teaching science. My research questions were:
1. How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student achievement?

2. How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student motivation to learn science?

3. What are the teacher perceptions about the use of technology, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction.

Method

Setting and Participants

The action research project was conducted in a middle school, was located in a suburban area of Augusta, Georgia. The middle school had approximately 856 students. Students came primarily from a middle-class community with a combination of one- and two-parent household incomes. The school population consisted of 75% Caucasian, 12% African-American, 5% Asian American, 4% Asian-Indian, 3% Hispanic-American, and 1% classified as Other. Twenty-six percent of the students participated in the free and reduced lunch program.

Participants in this research study included 19 seventh-grade students ranging in age from 12-14. The study was designed for 24 students, but five students withdrew from the school and did not complete the study. All of the students belonged to one science class, which was heterogeneously grouped according to science achievement. Three of the students were on a Student Support Team (SST); one was enrolled in English as a Second Language (ESOL); and one had special modifications based on an Individual Educational Plan (IEP). The intervention took place in a regular seventh-grade science lab and a computer lab classroom that was
designed for a class of 25. The lab had a sign-up procedure to reserve the room for designated times.

**Intervention**

A 3-week *Eubacteria* and *Protista* science unit, based on Georgia Performance Standards, was presented to seventh-grade students. Technology, specifically WebQuests and streaming videos, were integrated into the unit. In addition, science manipulatives such as microscopes, magnifying glasses, Petri dishes with agar (a growth medium) and measurement tools were included in the lessons in order to conduct science investigations.

The science unit consisted of approximately 15 lessons. Those lessons were conducted during 65-minute class periods and they included many activities. At the beginning of the lessons, I introduced the main concepts of the lessons in a lecture format. Also, the directions for laboratory investigations were discussed. During the middle of the classes, students worked together in small groups to participate in science investigations. Finally at the end of the classes, the results of the laboratory activities were discussed. Also, the students completed WebQuests and viewed streaming videos to extend their learning about related science topics.

**Measures**

Prior to the beginning of the study of Protists and Eubacteria, an achievement pretest and an attitudinal survey were administered to the participants. During the study, I maintained a daily teacher journal, which included teacher perceptions about the use of technology, specifically, WebQuests, streaming videos, and laboratory manipulatives for teaching students about science content and skills. At the conclusion of the study a posttest was administered to the students. Participants were also given another attitudinal survey at the conclusion of all activities. Finally, several students were interviewed about their experiences during this research study.
Procedures

Before the action research study began, students were given a permission slip to take home for a parent signature. Students had to return the permission slip to be able to participate. When students returned the permission slips, they signed an acknowledgment slip, indicating they understood the purpose of the action research project and they were willing to participate in the study.

Prior to the implementation of the action research, the sixth-grade science Criterion-Referenced Competency Test (CRCT) scores of the participating students were analyzed and used as baseline data. Also, an attitude pretest and a science achievement pretest were administered.

The action research began the following day and continued for 14 days. Each day’s class began with a brief overview of the instructional objectives for the day. Students were then released to their work stations to begin on that day’s assignments. Some students worked independently, while others worked in small groups completing a lab or another activity. Several days before the action research began, students swabbed several areas of the school and created a Petri dish of bacteria. The students observed the growth of bacteria and charted the changes. Microscope slides of bacteria were prepared by each student, and those slides were viewed using a student compound light microscope and the digital microscope. Each individual was given the opportunity to show the slides to the class, using the LCD projector.

WebQuests were introduced on the fourth day. Students had the opportunity to investigate the WebQuests in small groups or independently.

On the sixth day, the students were given an opportunity to observe protists using the microscopes. The students were again asked to use the microscopes and the digital microscope.
Prepared microscope slides were used for this part of the lab because of the difficulty in finding good protist samples in the winter. All participants observed the specimens and they recorded the observational differences between the protists and the bacteria.

The remaining eight days were spent in the computer lab. The participants worked on various parts of the assignments. Several students used WebQuests to acquire information to create science-related crossword puzzles and Venn Diagrams to compare and contrast protists and bacteria. Some students made PowerPoint presentations to illustrate what they had learned about protists and bacteria from using WebQuests, streaming videos, and manipulative laboratory materials. Throughout the entire action research process, I was available to answer any questions about protists and bacteria, as well as, troubleshoot through technology problems as they arose.

At the conclusion of each period, I recorded observations of students interacting with technology resources to acquire information about the science topic in my teacher journal. Also, I included my personal experiences in using technology for teaching science content.

At the conclusion of the research study, a science achievement posttest and an attitude survey posttest were administered to all participants. Then, student interviews were conducted.

Results

Quantitative and qualitative data were gathered and analyzed to address the study’s research questions. Data collection techniques included: student attitude surveys, science achievement test, classroom observations, a teacher journal, and student interviews.

Baseline Data: Criterion-Referenced Competency (CRCT) Science Scores

The CRCT science scores provided baseline data for student achievement prior to the implementation of the intervention. Scores on the CRCT are presented as scale scores, and those
scores are divided into three categories: *Exceeds, Meets*, and *Does Not Meet*. Scores within the *Exceeds* category indicate that a student exceeds the level of performance expected for the test; those scores are greater than 850. The *Meets* category includes students, who met the standards, and the scores for that category range from 800-849. The *Does Not Meet* category includes students, who do not meet standards of the test. Scores for that category extend below 800.

According to the science CRCT, 12 students (63%) met the required state standard for passing the science portion with a score of 800 or better, and seven students (37%) scored lower than 800.

*Science Achievement Pretest and Posttest*

A science achievement test about bacteria and protists was administered to students at the beginning and end of the intervention. Both tests, pretest and posttest, were identical in format and content. The tests consisted of 35 questions. A variety of questions were used; multiple choice, fill-in-the blank, and short answer.

The science achievement pretest scores ranged from 15% to 55%, while the posttest scores ranged from 64% to 93%. The mean percentage score for the overall class pretest was 35.5% (*SD* = 10.90), and the mean percentage score for the overall class posttest was 81.3% (*SD* = 7.74). There was a 45.78% (*SD* = 11.07) mean percentage difference between the overall class pretest score and posttest score.

All students (*n* = 19) showed a gain in scores from the science achievement pretest to the posttest. With the exception of one student, every participant passed the posttest; a score of at least 70% was needed to pass the test. Table 1 provides the pretest and posttest scores of the participants in the action research study. The mean percentage differences of those test scores are also provided.
### Table 1

*Science Achievement as Indicated by CRCT Scores and Test Percentages*

<table>
<thead>
<tr>
<th>Student</th>
<th>Scale Scores (CRCT)</th>
<th>% Pretest</th>
<th>% Posttest</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>814</td>
<td>44</td>
<td>73</td>
<td>29</td>
</tr>
<tr>
<td>Student B</td>
<td>816</td>
<td>36</td>
<td>89</td>
<td>53</td>
</tr>
<tr>
<td>Student C</td>
<td>831</td>
<td>49</td>
<td>82</td>
<td>33</td>
</tr>
<tr>
<td>Student D</td>
<td>805</td>
<td>47</td>
<td>87</td>
<td>40</td>
</tr>
<tr>
<td>Student E</td>
<td>831</td>
<td>35</td>
<td>87</td>
<td>52</td>
</tr>
<tr>
<td>Student F</td>
<td>795</td>
<td>24</td>
<td>64</td>
<td>40</td>
</tr>
<tr>
<td>Student G</td>
<td>846</td>
<td>55</td>
<td>85</td>
<td>30</td>
</tr>
<tr>
<td>Student H</td>
<td>828</td>
<td>42</td>
<td>89</td>
<td>47</td>
</tr>
<tr>
<td>Student I</td>
<td>779</td>
<td>16</td>
<td>82</td>
<td>66</td>
</tr>
<tr>
<td>Student J</td>
<td>795</td>
<td>31</td>
<td>75</td>
<td>44</td>
</tr>
<tr>
<td>Student K</td>
<td>795</td>
<td>33</td>
<td>89</td>
<td>56</td>
</tr>
<tr>
<td>Student L</td>
<td>805</td>
<td>36</td>
<td>73</td>
<td>37</td>
</tr>
<tr>
<td>Student M</td>
<td>738</td>
<td>25</td>
<td>80</td>
<td>55</td>
</tr>
<tr>
<td>Student N</td>
<td>807</td>
<td>35</td>
<td>78</td>
<td>43</td>
</tr>
<tr>
<td>Student O</td>
<td>845</td>
<td>33</td>
<td>93</td>
<td>60</td>
</tr>
<tr>
<td>Student P</td>
<td>823</td>
<td>51</td>
<td>82</td>
<td>31</td>
</tr>
<tr>
<td>Student Q</td>
<td>826</td>
<td>36</td>
<td>84</td>
<td>48</td>
</tr>
<tr>
<td>Student R</td>
<td>795</td>
<td>31</td>
<td>73</td>
<td>42</td>
</tr>
<tr>
<td>Student S</td>
<td>795</td>
<td>15</td>
<td>75</td>
<td>60</td>
</tr>
</tbody>
</table>

**Mean**

- Scale Scores: 809
- % Pretest: 35.50
- % Posttest: 81.30
- % Difference: 45.78

**SD**

- Scale Scores: 27.63
- % Pretest: 10.90
- % Posttest: 7.74
- % Difference: 11.07

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*WebQuest/Streaming Video/Science Manipulatives Rubric*

A science project, requiring the use of WebQuests, streaming videos, and laboratory manipulatives for acquiring science information related to bacteria and protists, was assigned. For that project, students were expected to develop products such as crossword puzzles, PowerPoint presentations, and Venn diagrams. A teacher-made rubric was developed and shared with the students prior to the implementation of the project. The rubric addressed the following
criteria: correctness of science content, completion of tasks, teamwork, and originality of ideas. A 16-point scale was used on the rubric. The mean percentage score was 84.4\% \ (SD = 9.89).

**Student Attitude Surveys**

A Likert-type attitude survey, which was administered as a pretest and a posttest, consisted of 12 questions having a 4-point scale, ranging from *strongly agree* to *strongly disagree*. Each scale was assigned a numerical value: *strongly agree* = 4, *agree* = 3, *disagree* = 2, and *strongly disagree* = 1. The mean and standard deviation for each of the survey items were computed. Mean differences between the pre-attitudinal survey and the post-attitudinal survey were calculated.

For the second item, “Science is a challenge to me and I give up easily when it becomes too difficult,” the class had a mean of 3.22 \ (SD = 0.55) on the attitude survey pretest and a mean of 1.72 \ (SD = 0.75) on the attitude posttest. After the unit on bacteria and protists, the students’ attitudes toward science as being too much of a challenge decreased with a mean difference of -1.5.

“I think science is important because it deals with information that can be used in my lifetime” was the fourth item on the survey. The class had a mean of 2.56 \ (SD = 0.92) in the attitude survey pretest and a mean of 3.44 \ (SD = 0.50) on the attitude survey posttest. A mean difference of 0.83 was found.

For the sixth item, “I learn more from science when there is a variety of teaching methods,” the class mean was 2.11 \ (SD = 0.83) on the attitude survey pretest and a mean of 3.06 \ (SD = 0.73) on the attitude survey posttest. A mean difference of 0.95 was found.

In regard to item 11, “Using technology and other sources of information allow me to learn the most information,” the class had a mean of 1.89 \ (SD = 0.68) on the attitude survey
pretest and a mean of 3.28 ($SD = 0.58$) on the attitude survey posttest. A mean difference of 1.39 was found.

The one survey item that showed the greatest amount of change was the first item, “I try my hardest to learn the science concepts, even if they are difficult to me.” The class had an attitude survey pretest mean score of 1.61 ($SD = 0.50$) and an attitude survey posttest mean of 3.33 ($SD = 0.69$). The mean difference for this survey item was 1.72.
<table>
<thead>
<tr>
<th>Question</th>
<th>Attitude Survey Pretest</th>
<th>Attitude Survey Posttest</th>
<th>Mean Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>1. I try my hardest to learn the science concepts, even if they are</td>
<td>1.61</td>
<td>0.50</td>
<td>3.33</td>
</tr>
<tr>
<td>difficult to me.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Science is a challenge to me and I give up easily when it becomes</td>
<td>3.22</td>
<td>0.55</td>
<td>1.72</td>
</tr>
<tr>
<td>too difficult.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. When I am learning new material, I try to understand the information.</td>
<td>3.17</td>
<td>0.62</td>
<td>3.44</td>
</tr>
<tr>
<td>4. I think science is important because it deals with information that</td>
<td>2.56</td>
<td>0.92</td>
<td>3.39</td>
</tr>
<tr>
<td>can be used in my lifetime.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I will participate in a science lesson when it is exciting and</td>
<td>3.11</td>
<td>0.68</td>
<td>3.39</td>
</tr>
<tr>
<td>changeable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I learn more from a science class when there is a variety of teaching</td>
<td>2.11</td>
<td>0.083</td>
<td>3.06</td>
</tr>
<tr>
<td>methods.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I work hard at learning the material and feel satisfied with a</td>
<td>3.22</td>
<td>0.65</td>
<td>3.28</td>
</tr>
<tr>
<td>good grade.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I am more motivated to learn the science concepts when there is a</td>
<td>2.83</td>
<td>0.71</td>
<td>3.17</td>
</tr>
<tr>
<td>grade attached to the assignment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Science is important to me and I participate to show others that I</td>
<td>2.94</td>
<td>0.64</td>
<td>2.89</td>
</tr>
<tr>
<td>am smart.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Science will help me reach my goals.</td>
<td>3</td>
<td>0.69</td>
<td>3.06</td>
</tr>
<tr>
<td>11. Using technology and other sources of information allow me to</td>
<td>1.89</td>
<td>0.68</td>
<td>3.28</td>
</tr>
<tr>
<td>learn the most information.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I will ask questions of the teacher and the students, during</td>
<td>2.17</td>
<td>0.99</td>
<td>3.06</td>
</tr>
<tr>
<td>discussion, to understand the information better.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teacher Journal

A teacher journal entry was recorded each day at the end of the period. Those entries addressed topics such as students’ interactions with technology, students’ interactions with other students, classroom management, technology, and teacher challenges in using technology to teach science.

In regard to students’ interactions with technology, journal entries indicated students were actively engaged in using WebQuests, streaming videos, and laboratory manipulatives throughout the intervention. Even students, who did not typically participate in science activities, became more involved in assignments because of the use of technologies for classroom instruction. An excerpt from the teacher journal, which illustrates the theme, is provided: “The students all entered the room and went right to their assigned computers. Student S started very slowly, but as soon as she realized that she could work on whatever she wanted, she got right to work.”

Students’ interactions with other students occurred throughout this entire intervention. Each student was paired up with another student for all assignments. The students worked well with each other. Often, the students helped each other find and navigate Web sites. Many of the students shared what they learned causing the other students to want to look at the Web sites, too. The following excerpt describes students’ willingness to help others: “Student O did not argue about where he was put, but instead told everyone around him that if they needed help, he would help them.”

There were very few, if any, negative attitudes or words used by students toward other students throughout the intervention. Many of the quiet students with extensive computer knowledge, who had not previously been acknowledged by other students, were now regarded as
experts by their peers. The following description from the journal illustrates this point: “Student B was asked by several people to show how he created a Venn diagram using the Word application. He gave very good instructions to all, even those who had been mean to him before.”

Although classroom management and technology were two areas for which I had initial concerns, both of those areas provided positive experiences during the intervention. My concerns focused on a possible lack of classroom management due to student-directed activities rather than teacher-directed instruction and possible student difficulty in using technology. Instead, I found that when students were knowledgeable of expectations and prepared to complete tasks, they asked fewer questions, they spent more time on the assignments, and they were more focused on learning the content. Consequently, classroom management was not a problem as initially expected. In regard to technology problems, students did not appear to have difficulty in using the technology resources, but on one occasion, a problem with the technology resources occurred. The Internet went down because of a surge on a power grid. The students were very upset about having to back to the classroom.

Like the occasion when the Internet went down, there were numerous teacher challenges in using technology to teach science. I found being prepared and well organized helped to overcome difficulties, which I encountered. Having a back-up plan was extremely important. One of the first things that I did was sign up early for the computer lab so there would not be a problem in securing the lab for numerous days. Next, I set up the science lab early with microscopes, digital projector, and microscope slides of bacteria and protists for microscope experiences, just in case the computers went down. I found I had to be willing to change my plans in a moments notice.
Student Interviews

Eight students were randomly selected to complete an interview at the end of the action research study. The purpose of the interviews was to determine how the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction influenced student motivation to learn science. Seven open-ended questions were asked. All student responses were very positive. Some responses to the questions included: “Can we do more activities using the computer?”; “I enjoyed using the computer…I didn’t feel dumb”; and “Science is fun, but this was better.” When asked if any changes should be made to the instructional program, three students stated that they liked working at their own pace, but they wanted more freedom to go to any site to find the information.

Discussion

My first research question was “How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student achievement?” According to the science CRCT data, seven (37%) participants of the study did not meet standards at sixth-grade level; thus, many students lacked strong science content knowledge. The science achievement pretest scores also indicated that the participants had minimal prior content knowledge regarding the topic, bacteria and protists. On the science achievement posttest, however, the students showed an increase in their overall science scores. Students also showed an understanding of science content about bacteria and protists as evidenced from the WebQuest rubric evaluations; all students scored 69% or higher on the rubric. Therefore, improved science achievement was evident at the conclusion of the intervention.
“How does the use of technology resources, specifically WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction, influence student motivation to learn science?” was the second research question. As I studied comments made by the students throughout my observations and notes in my teacher’s journal, it appeared that students were actively engaged in the activities and were learning the objectives throughout the intervention.

After tabulating the responses on the pre-attitudinal survey and the post-attitudinal survey, it was apparent that there was a shift in perceptions toward science and how the students learned objectives. Students indicated they enjoyed using the computers, streaming videos, and the laboratory manipulatives throughout the intervention. Students indicated that they wanted to be involved in the learning process.

My final research question, “What are the teacher perceptions about the use of technology, specifically, WebQuests, streaming videos, and laboratory manipulatives for science classroom instruction?” Based on the teacher journal, students were actively engaged in learning the science objectives and they were eager to help others. Those positive outcomes appeared to occur partially because prior teacher planning and organization of the intervention. Flexibility in presenting class instruction was important when working with computers and other technologies. I had to be willing to change my plans without panicking or becoming agitated. All students worked at their own pace and that worked well. Classroom management problems did not occur.

There were a few things that I would do differently, if I were to conduct this study again. I would make sure that each student had his or her own computer; and if a computer went down, there would be additional computers available for student use. Prior to the intervention, I would introduce the practice of saving work on the computer. Lots of time was lost by the students because they did not save the computer programs properly; thus, their files were lost.
Technology used earlier in the year would help have prepared my students for an intervention that incorporated this much technology into one unit of study.

School Celebration

A meeting of stakeholders was held at the conclusion of the action research study. Administrators, members of the technology committee, science teachers, and other interested parties were invited. Each stakeholder was given a copy of the action research study, along with a copy of the expectations, objectives, and activities that were completed during the intervention. A PowerPoint slide presentation was shared, and a question and answer period was conducted at the conclusion. The administrators were curious about how many computers would be needed in a classroom for this type of activity. Since money is always an issue, a discussion was held about extra computers in classrooms that are not being used. A possible solution was that another computer lab could be set up for the use of classes to access WebQuests and streaming videos during the school day. The technology specialist suggested that another computer lab could be made into a wireless lab instead of changing the existing lab. Each person that came to the celebration was very impressed by the data, and administrators were curious about how many others might try to teach a unit using a majority of technology. Suggestions and possible solutions were offered.
References


