

**MASTERY OF SIXTH GRADE TEKS OBJECTIVES THROUGH
INTEGRATED LEARNING**

A Thesis

by

MONIKA RAQUEL TREVINO-ANDERSON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2004

Major Subject: Agricultural Education

**MASTERY OF SIXTH GRADE TEKS OBJECTIVES THROUGH
INTEGRATED LEARNING**

A Thesis

by

MONIKA RAQUEL TREVINO-ANDERSON

Submitted to Texas A&M University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Approved as to style and content by:

Gary J. Wingenbach
(Co-Chair of Committee)

James R. Lindner
(Co-Chair of Committee)

Larry Johnson
(Member)

Glen C. Shinn
(Head of Department)

December 2004

Major Subject: Agricultural Education

ABSTRACT

Mastery of Sixth Grade TEKS Objectives Through Integrated Learning.

(December 2004)

Monika Raquel Trevino-Anderson, B.S., Sam Houston State University

Co-Chairs of Advisory Committee: Dr. Gary J. Wingenbach
Dr. James R. Lindner

The purpose of this study was to assess learning in sixth grade students' by gain scores in science and mathematics while participating in the integrative curriculum modules developed by the Partnership for Environmental Education and Rural Health (PEER) Program. The PEER Program is a collaboration between the College of Education and Applied Sciences, and the College of Veterinary Medicine at Texas A&M University.

Two *Integrated Curricular Modules* provided the experimental treatment in this study. The alliance of the PEER Program and Texas A&M University has developed a middle school integrated curriculum based on sixth grade mathematics, science, English, reading and social studies TEKS (Texas Essential Knowledge and Skills)-based objectives. This multimedia curriculum incorporates the five disciplines into an adventure narrative featuring characters similar in dynamics to its targeted population, with problem-solving activities aimed to spark learning interests of students and emphasize skill development.

Integrated learning allows students an alternative method to traditional or conventional ways of learning by conceptualizing the subject matter into more than one medium. Selected students who participated in this study were pre-tested with Texas Assessment of Knowledge and Skills (TAKS)-related instrumentation based on TEKS objectives. Their scores were recorded and some students were then selected to participate as the treatment group where they were taught the PEER Program's integrated curriculum, patterned to correspond to TEKS' objectives. Post-tests were administered to both groups, and gain scores were collected to evaluate and determine if there was evidence that the PEER Program was successful in improving the mastery of the TEKS objectives in mathematics and science.

Results varied in this study with findings that supported the notions that the integrated PEER experimental modules had a positive, negative, and no effect on the experimental populations compared to the control, or untreated population. It is inconclusive to whether the integrated modules were effective in raising and improving test scores based on the preparatory curriculum. Inconsistencies in the results from this study imply that further research is needed.

I dedicate this hard earned thesis to the hardest working person I know, my father, Moctesuma T. Trevino, who has always stressed the importance of education, and taught me that no work is ever too difficult when you are doing it for your children.

This is for them too, my children: Addison Noel and Magnus Justin.

ACKNOWLEDGEMENTS

First, and foremost, I would like to acknowledge one of the biggest blessings in my life, my best friend, my husband, Cameron Anderson. Throughout this long and trying process, he has been my endless support, never letting me give up when attaining my master's degree seemed absolutely impossible. I love you and thank God that you are among the precious gifts He has given me.

To my husband and my parents, M.T. and Hope Trevino, I am grateful more than words can say for all your help, physically, emotionally, and financially, that it has taken to get me here, but most of all for believing in me when even I didn't. Without such a strong foundation, I could not have done this without you all.

Never, I am sure, have two committee co-chairs heard so many explanations and excuses from a consecutively pregnant graduate student in the span of less than two years as Drs. Gary Wingenbach and Jimmy Lindner. With all my "wrenches in the wheel", the two of you were determined to make my goal of graduation a reality. Maybe it is because you are both loving fathers, weathered professionals, or just good people, but you have shown me great guidance, immense patience, and much understanding; thank you.

TABLE OF CONTENTS

	Page
ABSTRACT	iii
DEDICATION.....	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES.....	ix
 CHAPTER	
I INTRODUCTION.....	1
Statement of the Problem	5
Purpose of the Study	8
Theoretical Framework	9
Significance of the Study.....	11
Definition of Terms.....	11
Delimitations.....	13
Assumptions.....	13
II REVIEW OF LITERATURE.....	14
Learning Styles and Theories	14
Student Achievement in Mathematics.....	19
Student Achievement in Science.....	24
Test Preparation	26
Summary of Review of Literature.....	30
III METHODOLOGY	33
Target Population and Sample	35
Instrumentation	36
Validity and Reliability	37
Data Collection	37
Analysis of Data.....	39

CHAPTER	Page
IV FINDINGS	40
Demographic Characteristics of Hard River Escape.....	41
Hard River Escape Results	41
Demographic Characteristics of Tut's Revenge	47
Tut's Revenge Results.....	47
V CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS.....	53
Summary of Findings	53
Implications	57
Recommendations	58
Recommendations for Further Research	60
REFERENCES	61
APPENDIX A IRB PERMISSION LETTER	72
APPENDIX B TEACHER TEST FACILITATION INSTRUCTIONS ...	73
APPENDIX C HARD RIVER ESCAPE MATHEMATICS PRE-TEST	75
APPENDIX D HARD RIVER ESCAPE MATHEMATICS POST-TEST.....	79
APPENDIX E HARD RIVER ESCAPE SCIENCE PRE-TEST	83
APPENDIX F HARD RIVER ESCAPE SCIENCE POST-TEST	86
APPENDIX G TUT'S REVENGE MATHEMATICS PRE-TEST	89
APPENDIX H TUT'S REVENGE MATHEMATICS POST-TEST	93
APPENDIX I TUT'S REVENGE SCIENCE PRE-TEST	97
APPENDIX J TUT'S REVENGE SCIENCE POST-TEST	101
VITA	105

LIST OF TABLES

TABLE		Page
1	Hard River Escape Demographic Data from Career Interest Surveys	42
2	Hard River Escape Frequency Counts for Test Types by Treatment.....	43
3	Descriptive Statistics for Test Type by Treatment for Hard River Escape.....	44
4	Hard River Escape Paired Samples t-test Statistics by Treatment	45
5	Paired Samples t-test Statistics by Pre-and Post-tests for Hard River Escape.....	46
6	t-Test Statistics for Students' Gain Scores by Treatment for Hard River Escape.....	46
7	Tut's Revenge Demographic Data from Career Interest Surveys	48
8	Tut's Revenge Frequency Counts for Test Types by Treatment.....	49
9	Tut's Revenge Descriptive Statistics for Test Type by Treatment	50
10	Paired Samples t-test Statistics by Treatment for Tut's Revenge.....	50
11	Paired Samples t-test Statistics by Pre-and Post-tests for Tut's Revenge	51
12	t-Test Statistics for Students' Gain Scores by Treatment for Tut's Revenge.....	52

CHAPTER I

INTRODUCTION

In an age when multitudes of technological advances are invented and adopted everyday, it is no wonder that the advantages of the industrial technologies and computer sciences are expanding to be included as part of today's students' mandatory coursework. With such modifications in technologies, teaching capabilities have taken a step forward in utilizing a variety of technological mediums to address broader senses for learning and comprehension. Technological advances have allowed more flexible delivery modes to be explored.

Blended or integrated learning affords students an alternative method to traditional or conventional ways of learning by conceptualizing the subject matter into more than one medium. Contextual teaching and learning (CTL) is rooted in constructivism, in that constructivism calls for active participation in problem solving and critical thinking regarding an authentic learning activity that students find relevant and engaging (Briner, 1999). It has been reported that the use of both discovery learning features and direct instruction strategies in computer-based instruction resulted in improved mathematics achievement (Sfondilias & Siegel, 1990).

The National Center for Educational Statistics (NCES) (2000) studied the integration of various technologies in the teaching/learning process. The following examples of how teachers had integrated technology were reported from NCES: 44% used technology for classroom instruction, 42% used computer applications, 12% used practice drills, 41% required research using the Internet, 27% had students conduct

This thesis follows the style format of the *Journal of Agricultural Education*.

research using CD-ROMS, 27% assigned multimedia reports/projects, 23% assigned graphical presentations of materials, 21% assigned demonstrations/simulations, 20% required students to use technology to solve problems and analyze data, and 7% assigned students to correspond with others over the Internet (NCES, 2000).

The Partnership for Environmental Education and Rural Health (PEER) Program is a collaboration between the College of Education and Applied Sciences, and the College of Veterinary Medicine at Texas A&M University. A composition of two grants entitled, “Environmental and Rural Health Education Partnership” and “Integrating Environmental Health Science in Rural Schools” funded the PEER Program. The PEER Program hosts a myriad of courses including *Integrative Curriculum Workshops* that provide technology (Microsoft PowerPoint) instruction and integration of environmental health science into science and non-science classes.

Scientists' Visits is a feature of the PEER Program where Texas A&M University scientists visit and speak about environmental health and selected science topics at local schools. *Virtual Scientists' Presentations* are online scientific presentations that include, but are not limited to, the subject matter of Anthrax, Smoking, and the Respiratory System. PEER hosts online programs such as *Virtual Scientists' Interviews* where students and teachers can partake in online interviews of scientists, and *Virtual Educators' Interviews* where students and teachers participate in online interviews of educators. The PEER online materials include a collection of resources collected at the request of Texas Middle School Teachers entitled *Teacher Requested Resources*. *National Science Foundation Fellows Program, Collaboration Opportunities*, which

offers collaboration opportunities with Texas A&M University. The *Web Links* tab is where resources for middle school teachers are found.

The scheme of the PEER Program is broad and encompasses a variety of advantageous venues for educators and their pupils, but this study focused on one of the two curricular modules offered by PEER. The two curricular modules, *The Integrated Curricular Modules*, and *The Online Web-based Curricular Modules*, consisted of a pair of Environmental Health Science curricula for middle schools directed toward promotion of middle school science education. The first module, *The Integrated Curricular Modules*, provided the experimental treatment in this study, and integrated environmental health science into science and non-science classes. The alliance of the PEER Program and Texas A&M University has developed a middle school integrated curriculum based on sixth grade reading, math, science, and English TEKS (Texas Essential Knowledge and Skills)-based objectives. This multimedia curriculum incorporates the four disciplines into an adventure narrative featuring characters similar in dynamics to its targeted population, with problem-solving activities aimed to spark learning interests of students, and emphasize skill development.

The reasoning behind agriculture education's concentrated involvement in the PEER Program, and its concern with the learning and mastery of math and science is based on the foundation that agriculture can be described as an education melting pot and serves as a facet for many other disciplines, mainly math and science. Taylor and Mulhall (1997) concluded that providing contextual relationships has the potential to strengthen links among the learning environments of school, home and community.

Further, Taylor and Mulhall concluded that agriculture, as a contextual relationship, could act as a unifying theme for curricula relevant to students and add meaning to what students learn.

Shepardson (1929) deduced that agriculture is a meeting-ground of the sciences. The foundation is physics and chemistry, then to these elements biology adds its conception of organism, and mathematics is their common instrument. Echoes of Shepardson (1929) can be heard in today's widely accepted characterization of agriscience education, that is instruction in agriculture emphasizes the principle concepts of biological, chemical, and physical sciences in the teaching of agriculture, and uses agricultural examples to relate these concepts to students (Shelly-Tolbert, Conroy, & Dailey, 2000). Budke (1991) concluded that agriculture provides an excellent vehicle for teaching genetics, photosynthesis, nutrition, pollution control, water quality, reproduction, [and] food processing where real life examples can become part of the classroom for experimentation and observation. Agriscience and other secondary agricultural education courses, such as, aquaculture, could provide much-needed context and relevance for student learning in science (Conroy & Walker, 2000).

The Texas Education Agency web site hosts results of past Texas Assessment of Knowledge and Skills (TAKS) tests, and provides estimations on future success based on meeting the tests' standards (www.tea.state.tx.us). Following data analyses from the TEA website, one can pose the subsequent questions, "Does the curricula used in classrooms require students to apply mathematics and science learned in problem solving situations?" "Are teachers asking students questions that require them to think,

talk, and write to communicate the mathematics and science they are learning?” “How well does the rigor of the mathematics and science instructional program and materials prepare students for the rigor of TAKS?”

Selected students who participated in this study were pre-tested with TAKS-related instrumentation based on TEKS objectives. Their scores were recorded and some students were then selected to participate as the experimental group where they were taught the PEER Program’s integrated curriculum, patterned to correspond to the TAKS’ and TEKS’ objectives. Post-tests were administered to both groups, and gain scores were collected to evaluate and determine if there was sufficient evidence that the PEER Program was successful in improving the mastery of the TEKS objectives in mathematics and science.

Statement of the Problem

Texas middle school students perform academically at lower levels than did students in many other countries (National Center for Education Statistics, 2003). One attempt to address this gap in achievement is by incorporating an integrated curriculum, an alternative method to traditional or conventional ways of learning by conceptualizing subject matter into more than one medium (Shinn et al., 2003) into student’s everyday coursework.

A lack of evidence exists to support full use of an integrated curriculum, therefore, this study was conducted to assess learning in sixth grade students’ by gain

scores in science and mathematics while participating in the integrative curriculum modules developed by the PEER Program.

Drosjack (2003) reported that the National Assessment of Educational Progress found that less than one out of every three students-nationally and in Texas- still could not do math or read at a 'proficiency' level, as determined by a bipartisan board of experts. At the same time, Bayer Corporation (2003) found nine in ten Americans (90%) claim they are worried that today's students may not have the essential math and science skills to produce the science excellence necessary for homeland security and economic leadership in the 21st century.

In Texas, students in third to eleventh grades are required to take a state standardized test, TAKS, to assess their comprehension and mastery of the Texas Essential Knowledge and Skills. TEKS are the core objectives outlining grade appropriate learning. Specifically, in 2003, 86% of Texas sixth graders met the TAKS reading standard, but the Texas Education Agency estimated only 79% would meet the standard in 2004, and only 71% in 2005. In math, in 2003 79% of Texas sixth graders met the standard, with only 16% commended, dropping in standard percentile and commended percentile as the grade level increased (Texas Education Agency, 2003).

As society has produced new technologies, education has attempted to adopt and integrate those technologies to improve the education process. As technology becomes more prevalent in society and in our schools, educators are faced with the task of determining how to best utilize the technology to improve student learning. For the past

20 years educators have struggled with the task of how to effectively integrate technology into the Kindergarten through 12th grade classroom (Peake, 2003).

During the last decade, United States K–12 schools have approximately tripled their spending for instructional technology, from \$2.1 billion in 1991-1992 to \$6.2 billion in 1999-2000, not including E-rate funding (National Center for Education Statistics, 2000). In order for public schools to apply for certain types of federal funds, they are required to have a plan for integrating technology into their school. Monies are available also from state grants, grants from businesses, or philanthropies all of which are interested in an increase of technology integration in education (Alston, Miller & Williams, 2003).

Despite technologies being available in schools, many teachers report little or no use of computers for instruction (Pellegrino & Altman, 1997). Lack of teacher training in how to innovatively use technology is one of the major barriers preventing the infusion of technology in the classroom (Fabry& Higgs, 1997; Pelgrum, 1992). The PEER Program offers Integrative Curriculum Workshops to teachers throughout Texas. Teachers who attend the workshops are reimbursed up to \$200 for travel, meals and lodging. Millions of dollars have placed technology in PK-12 classrooms, but there has been considerably less attention paid to helping teachers make the transition into a technology-rich learning environment which would inevitably impact student learning (National Center for Education Statistics, 1999).

Purpose of the Study

The purpose of this study was to assess learning in sixth grade students' by gain scores in science and mathematics while participating in the integrative curriculum modules developed by the PEER Program.

To achieve the purpose of the study, eight specific objectives were identified for the integrated modules, Hard River Escape, and Tut's Revenge.

1. Describe the experimental group by mathematics and science pre-test/post-test scores.
2. Describe the control group by mathematics and science pre-test/post-test scores.
3. Describe the experimental /control group by gain scores in mathematics and science.
4. Assess differences between treatment groups' pre-test scores in mathematics and science.
5. Assess differences between treatment groups' post-test scores in mathematics and science.
6. Assess differences in control and experimental groups' mathematics and science pre-test scores.
7. Assess differences in control and experimental groups' mathematics and science post-test scores.
8. Assess differences in control and experimental groups' mathematics and science gain scores.

Theoretical Framework

The theoretical framework of this study was based on the sound educational principles, theories, and practices of Dewey (1900, 1910), Piaget (1951), and Bruner (1966), all which contended that contextual teaching and learning is rooted in constructivism that calls for active participation in problem solving and critical thinking in regards to a learning environment that students find relevant as well as engaging (Briner, 1999). In order for contextual teaching and learning to be a sound and promising pedagogy, the following themes and theories work together as underlying principles upon which contextual teaching and learning is derived. The contextual approach recognizes that learning is a compound and multifaceted progression that exceeds drill-oriented, stimulus-response methodologies and fluctuates in time according to each individual student.

- Knowledge-based constructivism: both direct instruction and constructivist activities can be compatible and effective in the achievement of learning goals (Resnick & Hall, 1998).
- Effort-based learning/incremental theory of intelligence: increasing one's efforts results in more ability (Resnick & Hall, 1998).
- Socialization: children learn the standards, values, and knowledge of society by raising questions and accepting challenges to find solutions that are not immediately apparent, along with seeking information, explaining concepts, and justifying their reasoning (Resnick & Hall, 1998).

- Situated-learning: knowledge and learning are situated in particular physical and/or social contexts. A range of contexts such as the home, the community, and the workplace may be used and may be relevant to particular students (Resnick & Hall, 1998).
- Distributed learning: Lave (1988) proposed that knowledge may be viewed as distributed or stretched over the individual, other persons, and other various artifacts such as physical and symbolic tools. Borko and Putman (1998) confirmed that people, as an integral part of the learning process, must share knowledge and tasks.

Students learn best when they are matched with a teacher having the same learning style. A student's learning style is the same no matter the subject area. The more a student can utilize learning through the combination of visual, auditory, and kinesthetic modalities, the more permanent the information will become (Eberling, 2001). These theories and themes are incorporated into the framework of this study.

Significance of the Study

The integrated PEER modules should show a positive association between the treated (experimental) populations by having higher gain scores than the untreated (control) population. Evidence will be collected to determine whether the integrated modules are effective in raising and improving test scores based on the preparatory curriculum.

Significant funds and resources have been invested in reform programs, but the link between student achievement and reformed practice at the classroom level has not been tested (Hamilton, et al., 2003). In order to determine whether results are associated with the desired changes in practice, a measurement of implementation and practice needs to be assessed directly to associate them with changes in student performance. In combination, this study tests the efficacy of the PEER Program; that is, whether the fundamental model of practice that guides the PEER Program actually works. It is important to know whether teaching in a particular manner improves student achievement. Determining whether the affects of the PEER Program are significant on student achievement in the areas of mathematics and science is essential to verifying the validity of the PEER Program's models by confirming the success of the curriculum or addressing the need to revamp, improve, amend or modify curriculum.

Definition of Terms

Assessment: The process used to systematically evaluate a learner's skill or knowledge level (Kaplan- Leiserson, n.d.).

Assessment item: A question or measurable activity used to determine whether the learner has mastered a learning objective (Kaplan- Leiserson, n.d.).

Blended learning: Learning events that combine aspects of online and face-to-face instruction (Kaplan- Leiserson, n.d.).

Contextual teaching and learning (CTL): A conception of teaching and learning that helps teachers relate subject matter content to real world situations and motivates

students to make connections between knowledge and its applications to their lives as family members, citizens, and workers and engage in the hard work that learning requires (Berns & Erickson, 2001).

Cooperative learning: Students working in pairs or small groups (House, 2003a).

Integration: Combining hardware, software (and, in e-learning, content) components together to work as an interoperable system. The process of integration may also include front-end planning and strategy (Kaplan- Leiserson, n.d.).

Integrated curriculum: Allows students an alternative method to traditional or conventional ways of learning by conceptualizing the subject matter into more than one medium (Kaplan- Leiserson, n.d.).

Inquiry-based learning: Learning that is rich in ample opportunities for contextualization and making real world connections through a variety of hands-on, applied learning media and experience-based activities (Conroy, Turmall, & Johnson, 1999).

Learning objective: A statement establishing a measurable behavioral outcome, used as an advanced organizer to indicate how the learner's acquisition of skills and knowledge is being measured (Kaplan- Leiserson, n.d.).

Delimitations

This study was delimited by including only sixth grade students participating in the PEER Program. Applicability of the results is suspect for other grades. Only

complete paired data sets were considered for analyses, which were limited by incomplete tests, students who completed the pre- or post-test only, and/or missing data.

Assumptions

The assumptions of this study were that the participants were honest in answering the measured instrumentation and no cheating occurred. The measured instrumentation and materials were TAKS comparable. It is believed that both the experimental and control groups were equivalent in academic ability. The participants were engaged in the teaching of the curriculum and had interest in mathematics and science. It was also assumed that the facilitator and/or teacher correctly taught the treatment material and executed the measured instrumentation.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this review of literature was to explore findings in similar studies reviewing pedagogical learning theories and student achievement with the specific subsections on student achievement in mathematics, student achievement in science, and test preparation. The PEER Program designed the measured modules' instructional activities and materials to promote student learning and achievement in mathematics and science using various test preparation methods and curriculum based on skills from standardized testing.

Preliminary research regarding media selection focused on selecting media that most influenced learning to determine which media was the best for teaching. As this research was compiled and analyzed, researchers came to realize that other factors also played a large role in student achievement (Peake, 2003). Content, teaching style, and learners' characteristics were found to influence student achievement (Kotrlik, Harrison, Redmann, & Handley, 2000). Consequently, researchers began to move away from the media comparison studies and focus more on how to best use the instructional technology that was available.

Learning Styles and Theories

Cronbach and Snow (1977) stated that information about the learner is helpful in adapting instruction in order to provide an environment in which the learner can thrive. It is inconsistent to assume that there is one single, universal learning ability. The skills

and habits that make one person a superior learner is based on the test, method of instruction, conditions of practice, and criterion against which learning is being evaluated (Cronbach & Snow, 1977). Cronbach and Snow believed that there was a need to design a true education that employs unique means wherever the learner's distinctive development makes traditional methods ineffective for themselves.

Basic learning styles include visual, where learning best takes place by seeing, auditory, in which learning takes place best by hearing, and kinesthetic/tactile, in which learning takes place best from touching, doing, and moving. Facts from these learning styles are that 1) students learn best when they are matched with a teacher having the same learning style, 2) a student's learning style is the same no matter the subject area, and 3) the more a student can utilize learning through a combination of visual, auditory, and kinesthetic modalities, the more permanent the information will become (Eberling, 2001).

Anthony Gregorc's Style Delineator (1982) focuses on the implications of right and left-brain functions for perceiving, how students take in the information and ordering, the way students arrange, systematize, and dispose of new information.

Ordering abilities include,

- Sequential learners: students prefer step-by-step presentations such as outlines.
- Random learners: students prefer unorganized, simultaneous display of information so that they can order the information in their own way.

Perceptual preferences include,

- Concrete-oriented: students prefer tangible input through the senses. Example: “Show me!”
- Abstract-oriented: students prefer more logical, deductive modes of learning. Example: I’ll figure it out!”

Howard Gardner’s Multiple Intelligence theory (1983) concedes that all people possess eight distinct sets of capabilities. These capabilities, or intelligences work in concert, not isolation of each other. Gardner’s eight intelligences include,

- Logical-Mathematics: the capacity to detect patterns, reason deductively and think logically. Highly developed in mathematicians, tax accountants, statisticians, scientists, computer programmer, and logicians (Brualdi, 1996).
- Linguistic: the capacity to use words effectively, either orally or in writing. Highly developed in storytellers, orators, politicians, poets, playwrights, editors, and journalists (Brualdi, 1996).
- Musical: the capacities to perceive, discriminates, transform, and express musical forms. Highly developed in musical performers, aficionados, and critics (Brualdi, 1996).
- Spatial: the ability to perceive the visual-spatial world accurately and to perform transformations upon one’s perceptions. This intelligence is highly developed in hunters, scouts, guides, interior designers, architects, artists and inventors (Brualdi, 1996).
- Bodily-Kinesthetic: expertise in using one’s whole body to express ideas and feeling and facility in using one’s hands to produce or transform things. Highly

developed in actors, mimes, athletes, dancers, craft persons, sculptors, mechanics, and surgeons (Brualdi, 1996).

- Naturalist: the ability to recognize and discriminate among flora and fauna, and other things in the world. Highly developed in hunters, gathers, and farmers (Brualdi, 1996).
- Intrapersonal: self-knowledgeable and the ability to act adaptively on the basis of that knowledge. This intelligence includes having an accurate picture of one's strengths and limitations, and awareness of one's moods and motivations, and the capacity for self-discipline (Brualdi, 1996).
- Interpersonal: an understanding of others and knowing how to deal well with them. This intelligence can include sensitivity to facial expressions, voice, and gestures as well as the ability to respond effectively to such cues- to influence other people (Brualdi, 1996).

The PEER Program's Integrative Curriculum was designed to utilize a combination of modalities and mediums to convey instructional materials to address students' multiple learning styles.

Cognitive theory defines learning as a process in which the learner is actively engaged in integrating new knowledge with old knowledge. This view of what learning is has altered the direction of instructional technology research because of student ability; prior knowledge, motivation, and instructional methods are considered to be factors that influence whether learning will occur (Clark & Surgue, 1988).

Cognitive theory researchers study the learning process itself and place greater emphasis on the learner than do behaviorists (Bruner, 1960; Carey, 1986; Hilgard & Bower, 1975). Bruner (1960) focused on how knowledge is organized in the learner's brain, readiness of the learner, and intuition of the learner. Instead of focusing on measurable outcomes, cognitive researchers emphasize cognitive functions of the learner like motivation and desire to learn. Cognitive theory closely examines the learner and gives a broader view of what is being learned.

When all theories of learning are considered, behaviorism has had the greatest impact on instructional technology (Thompson, Simonson, & Hargrave, 1996).

The use of behaviorism in education is based on the principle that instruction should be designed to produce observable and quantifiable actions by the learner. Behaviorists consider the mental state of the learner to be merely a predisposition. Because mental states cannot be observed, behaviorists do not believe teaching should be directed towards strengthening the mind, a common goal of educators of the early 20th century, but should be aimed at producing desirable outcomes in students. In other words, behaviorists expect any effective instructional activity, such as computer-based tutorial, to change the student in some obvious and measurable way. After completing a lesson, students should be able to do something that they could not, or could not do as well, before the lesson. (Thompson et. al., 1996, p 10).

Focusing on measurable outcomes, behaviorism theory helped to drive integration of technology into the education system. Behaviorists have had a remarkable

influence on the development of instructional technology because they seek to produce observable and measurable outcomes in students (Peake, 2003).

By being aware of the variety of ways learning occurs, more steps can be made to address these differences. Incorporating an assortment of teaching mediums and methods into today's classrooms. Levie and Dickie (1973) stated that people learn from a variety of media. Much of the research on different instructional technologies had produced similar findings; people can learn from computers (Salomon & Gardner, 1986; Schlosser & Anderson, 1994).

Student Achievement in Mathematics

It is essential to integrate several types of learning activities when designing effective mathematics instruction and to consider the motivational qualities of those teaching strategies (House, 2003c).

The Third International Mathematics and Science Study (TIMSS) represents the most comprehensive international comparison of student achievement yet conducted (Martin, 1996). Review of the TIMSS international assessment provides an exceptional opportunity to simultaneously assess the independent effects of several factors on student achievement. The intention of TIMSS was to investigate the association between the use of specific teaching strategies and classroom experiences for mathematics instruction and the motivation of students in Japan for learning mathematics. It has been suggested that national results on the TIMSS assessment can provide useful comparisons of instructional practices (Macnab, 2000).

The TIMSS study was designed to simultaneously assess the effects of several styles of teaching practices on student enjoyment for learning mathematics, as well as being designed to examine the general characteristics of earlier research findings for a large national sample of students from a cross-cultural context, who were part of a comprehensive international assessment of instructional practices and student achievement (House, 2003c).

There have been several instructional strategies for teaching mathematics that have the concurrent objectives of improved learning outcomes and increased student motivation for learning mathematics. TIMSS examined the relationship between the use of specific instructional tactics, classroom practices, and student motivation for learning mathematics. Cooperative learning activities have students working in pairs or small groups, for both instructional situations were found to be significantly associated with student enjoyment for learning mathematics. In the TIMSS study, the frequency of computer use in typical classroom situations was not significantly associated with students' enjoyment for learning mathematics when the effects of several teaching strategies were considered simultaneously. The results of the TIMSS study were consistent with previous research on the motivational effects of teaching strategies for mathematics learning.

One instructional design approach for mathematics learning has been developed (realistic mathematics education) that uses context problems to assist students' development of applied problem solving strategies (Gravemeijer & Doorman, 1999).

Realistic mathematics education provides experiences intended to help students become able to reinvent formal mathematics.

Another instructional design approach for mathematics learning incorporates video technology and cooperative learning situations (Cognitions and Technology Group at Vanderbilt, 1992). It was reported that the use of both discovery learning features and direct instruction strategies in computer-based instruction resulted in improved mathematic achievement (Sfondilias & Siegel, 1990). The utilization of cooperative learning activities when designing mathematics instruction shows to produce multiple opportunities for students to obtain explanations from other students and to result in positive perspectives about cooperative learning situations (Leikin & Zaslavsky, 1997). In addition to the use of specific learning strategies to facilitate cognitive gains, it has been noted that student motivation should be given consideration when designing effective instruction (Main, 1993; Spitzer, 1996).

Several large-scale educational assessments of student achievement have been conducted and their results have offered further understanding into factors related to student performance (Mislevy, 1995). Data from the TIMSS international assessment has been used to identify factors related to science and mathematics achievement in cross-cultural contexts. Results of the TIMSS international assessment found that students who indicated a higher level of enjoyment for learning mathematics reported that their teachers more often showed them how to do mathematics problems in their lessons and that they used computers more frequently and worked from worksheets or textbooks on their own when considering teaching activities used in typical mathematics

lessons (House, 2003c). Similarly, more frequent use of three strategies (working on mathematics projects, working together in pairs or small groups, and using things from everyday life in solving mathematics problems) was associated also with increased student enjoyment for learning mathematics (House, 2003c).

TIMSS found that when introducing new mathematics topics, students who reported higher levels of enjoyment for learning mathematics indicated that they more discussed frequently a practical or story problem related to everyday life, worked cooperatively together in pairs or small groups on a problem project, and tried to solve an example related to the new topic. More frequent use of a number of teaching activities for typical mathematics lessons were positively associated with student enjoyment for learning mathematics (House 2003c).

Several specific teaching strategies used when starting a new mathematics topic were significantly related to student enjoyment for learning mathematics. For instance, students whose teachers more frequently asked them what they knew related to the new topic, explained the rules and definitions, and discussed a practical or story problem related to everyday life tended to show higher levels of enjoyment for learning mathematics. Students who reported that they worked together in pairs or small groups on a problem or project also were more likely to express enjoyment for learning mathematics (House, 2003c). These results were similar to other research findings on the effects of instructional practices on student motivation for learning mathematics.

Another notable finding from the TIMSS study was that the frequency of computer use in mathematics lessons was not significantly associated with student

enjoyment, when compared by gender, for learning mathematics when all measured teaching tactics were considered simultaneously (House, 2003c). This result differed from previous findings. Results from a survey of college calculus instructors suggested that the use of computers and calculators was associated with improved student motivation, increased self-confidence, and better attitudes towards learning calculus (Rochowicz, 1999). Similar results also have been reported when using computers for science instruction (Gan, 1999; Howland, Laffey, & Espinosa, 1997). Further findings from the National Educational Longitudinal Study (1988) found that student use of home computers was related to their mathematics knowledge and reasoning (Kupermintz, Ennis, Hamilton, Talbert, & Snow, 1995).

Many factors contribute to the variation in students' math achievement. Contextual relationships have the potential to reinforce links among the learning environments of school, home, and informal settings and add meaning to mathematical knowledge for students (Shinn et al., 2003). *What* students learn is greatly influenced by *how* they are taught. Several researchers have proposed a pedagogical shift from teacher-centered to a student-centered instructional paradigm: one that engages students in interactive inquiry, nurtures positive self-concepts, and facilitates lifelong learning. Researchers agree that students will learn mathematics best when they see the concepts in real-life applications (Shinn et al., 2003). There are indications that student achievement in mathematics will increase when students become more engaged using inquiry-based, problem-solving learning strategies, particularly when coupled with

highly qualified caring teachers who utilize a contextualized curriculum that connects new concepts and skills to students' past knowledge and experiences.

Student Achievement in Science

The Third International Mathematics and Science Study (TIMSS) is acknowledged as the largest and most comprehensive assessment of educational contexts and student achievement yet conducted (Martin, 1996.) It examines the relationships between several types of instructional strategies and student interest in science. Another section of the TIMSS found that several teaching activities used when introducing new science topics and in typical science lessons were significantly associated with student enjoyment for learning science. Cooperative learning activities for both instructional conditions were significantly associated with student enjoyment for learning science. These results were consistent with previous findings on the motivational effects of specific instructional practices for science learning (House, 2003a).

Several types of instructional programs and activities have been developed to foster student interest in science. Programs designed to improve students' knowledge and problem-solving skills may also result in improved confidence levels (House, 2003a). A strategy has been proposed to incorporate motivational qualities into computer-based instruction; these approaches can help students raise their achievement expectancies and self-efficacy beliefs. These motivational beliefs are notably related to student achievement in mathematics and science.

A number of innovative instructional programs have been designed to provide opportunities for elementary and secondary school-aged students to learn various science concepts and laboratory techniques. One program conducted by the University of California (San Francisco) provided sixth grade students in San Francisco with instruction on topics related to health and biological sciences with the goal of enhancing student interest in science (Doyle, 1999). Similarly, a program coordinated by the University of California (Los Angeles) provided high school students in Los Angeles with integrated science learning and technology-based instructional experiences to facilitate a long-term goal of increased involvement in science careers. Several investigations have demonstrated that providing students with culturally sensitive learning materials and activities can facilitate students' interest in science (Bouillion & Gomez, 2001).

Students taking part in the TIMSS science portion of the study who reported that they more often discussed a practical or story problem related to everyday life and more often tried to solve an example correlated to the new topic, also tended to exhibit higher levels of enjoyment for learning science. A significant negative association between having students look at the textbook while the teacher talked about it and student enjoyment for learning science; students who indicated that they more frequently looked at the textbook while the teacher talked about it tended to show lower levels of enjoyment for learning science (House, 2003a).

When introducing new science topics, students from the United States and Japan, indicated that more frequent opportunities for trying to solve an example related to the

new topic was associated with higher levels of enjoyment for learning science (House, 2003a). Bearing in mind teaching approaches used in typical science lessons, students from both countries indicated that more frequent opportunities for using things from everyday life in solving science problems and cooperative learning (working together in partners or small groups) made science learning more enjoyable. In addition, students from Japan and the United States felt that more occasions for doing an experiment or practical investigation in class made science learning more enjoyable. Other research has shown that specific classroom activities, such as experiments and problem-based learning, are positively related to student interest in learning.

Research suggests that instructional technologies can help to improve student achievement in science in K-12 classes. Christmann and Badgett (1999) conducted a meta-analysis that examined the effects of instructional technology on student achievement in four science areas across urban, rural, and suburban educational settings. More than 2000 subjects and 11 studies were included in this meta-analysis that found that instructional technology had a positive effect on student achievement. Results showed that when traditional instruction was supplemented with instructional technology, students achieved higher scores than 60.4% of those students who did not receive supplemented instruction (Christmann & Badgett, 1999).

Test Preparation

As the amount of money that is being invested in technology grows, and the integration of technology grows, so do the accountability measures attached to it. Parent,

federal government, and business investors demand accountability in the form of higher test scores (Peake, 2003). Some educators view technology as a way to help prepare students for the workplace while others view it as a way to improve standardized test scores. Still others view technology as a way to foster education reform, changing the way teachers teach and the way learners learn (Alston, Miller & Williams, 2003). Educators need to clarify their goals for using technology in the classroom before effectiveness can be assessed (Trotter, 1998).

Instructional technology researchers have realized the interaction that occurs with external stimuli and the learner's internal cognitive processes can support learning (Clark & Surgue, 1988). By using a learner-centered instructional model that engages students in "best practices" that fosters interactive inquiry, nurtures positive self-concepts, and facilitates collaboration and teamwork, student achievement may be increased (Shinn, et, al., 2003).

Kuperstein and Gentile (2001) found that technology is a powerful way to call students back to a natural, experiential, and enjoyable way of learning. They supported the theory that engaged learning produces more acquisition of knowledge and understanding. Kuperstein and Gentile (2001) suggested being flexible in the ways in which new technologies are presented and learning how to guide students in asking probing questions. Technology, in the form of computers and the Internet within the classroom, has been shown to increase student performance and provide the teacher with a powerful tool for information gathering, communication, and presentation (Goldberg,

1996; Sion, 1998; Lewis, 1998; Baker & Blue, 1999). Computers have the potential to help improve the educative process (Milkin Exchange on Education Technology, 1999).

There is accumulating evidence indicating that Year 6 (sixth grade) teachers spend substantial amounts of time preparing pupils for the end-of-key-stage, or standardized tests in science. Previous lack in research evidence makes it ambiguous to accurately determine whether preparation for these tests is as effective as its potential (Sturman, 2003).

Koretz, McCaffery and Hamilton (2001) note that the term ‘test preparation,’ in common usage had a negative connotation. They distinguished seven types of test preparation, three of which could produce unambiguous, meaningful gains in test scores. These were 1) ‘teaching more,’ 2) ‘working harder,’ and 3) ‘working more effectively’. In contrast, three other strategies (4) ‘reallocation’ of resources, 5) ‘alignment’ of tests with curricula, and 6) ‘coaching’ of substantive elements) could lead to either meaningful or inflated gains, at the same time ‘cheating,’ the seventh strategy could only lead to inflated grades.

Various preparation strategies were reported for the assessments of standardized science tests in Struman’s study (2003), each represented several of these types of test preparation. These strategies included regular testing (Ellis, 1995) and the use of games (Patterson, 1999). Jurd (2000) reported ‘booster groups’ for borderline pupils, and learning vocabulary lists as homework. Up to 20% of teachers found evaluation reports of the previous year’s standardized tests useful in informing test preparation (Emery,

Wilmot & Fox, 1998). Teachers also reported using past test papers as practice tests, and ‘question spotting’ during testing week (Sturman, 2003).

Several studies into preparation for selection tests generally found positive score gains after coaching, although reported gains differed in degree (Sturman, 2003). Scholes and Lain (1997) found that type of test preparation had little impact on first-time performance, with only practice tests showing a small, positive effect. For repeat takers, preparation activities had little impact beyond the score gains that could be attributed to simply retaking the test. Similarly, Henriksson (1994) found that studies that took into account variables such as research design, length of preparation, complexity of test items, and type of coaching intervention generally reported modest gains. Powers and Rock (1999) reached similar conclusions and found that both coached and uncoached students retaking a test were more likely to show stability or a decrease in scores than they were to make large gains. It could be difficult to separate the effects of coaching from the effects of maturation and ongoing instruction, and this may be particularly the case for younger students (Henriksson, 1994).

In conclusion, with further analysis of responses in Sturman’s (2003) study, some indications were given that teacher confidence and an integrated approach to teaching and revision might be related to higher test attainment. An integrated approach is more likely than a gradual approach to be considered valid and these findings suggest that the integrated approach may be worth encouraging.

Researchers have faced a number of challenges when attempting to appraise comprehensive educational reforms that were designed to affect classroom practice. One

such reform is the National Science Foundation's Systemic Initiatives programs, or SI. Hamilton, et al. (2003) conducted, *Studying Large-Scale Reforms of instructional Practice: An Example from Mathematics and Science*, which found small but consistent positive relationships between teachers' reported use of standards-based instruction and student achievement.

A major problem in studying large-scale reforms is that the program may differ from site to site in ways that are not precise in the formal program model and that are not measured well. This occurs because large-scale reforms are often implemented in a top-down manner, with guidance coming from above but with significant local flexibility. SI programs provide examples of large-scale reforms that seek to influence instructional practices according to a common set of standards while permitting local variation in design and implementation. States and districts received SI funds to implement mathematics and science reforms that promote instruction consistent with national standards (Hamilton, et al., 2003). Although SI programs were intended to concentrate on the entire educational system, their effects on student achievement depend most directly on changes in instruction in the classroom.

Summary of Review of Literature

The purpose of this study was to assess learning in sixth grade students' by gain scores in mathematics and science while participating in the integrative curriculum modules developed by the PEER Program. Major relevant literature review themes correlated to this study were student achievement, technology in the classroom, and

pedagogy, more specifically, the subsections of student achievement mathematics, student achievement science, and student achievement as it relates to test preparation methods and curriculum.

Engagement in meaningful learning is a universal theme advanced in literature on student achievement. Students learn best when they are matched with a teacher having the same learning style. A student's learning style is the same no matter what the subject area. The more a student can utilize learning through the combination of visual, auditory, and kinesthetic modalities, the more permanent the information will become (Eberling, 2001). Integration of mathematical instruction into real-world problems is a second emerging theme. Crowley (2003) noted gains in academic performance resulting from a relationship between knowing how to execute a strategy (procedural knowledge) and knowing why the strategy works (conceptual knowledge).

Researchers have examined student achievement and identified numerous factors that contribute to the variation in student performance. Student achievement was directly related to student enjoyment. One finding of the TIMSS was that students who reported that they felt mathematics and science tended to be boring, tended to have lower mathematics and science achievement scores. Students who had higher test scores were more likely to indicate that they enjoyed mathematics and science and that mathematics and science was important in everyone's life (House, 2003b). When being exposed to new mathematics and science topics, students prefer technological integrations in teaching strategies, and cooperative learning methods (House, 2003a; House 2003c).

These results provided insight into student beliefs about academic activities that were associated with mathematics and science.

Weiner (2000) presented a theory of motivation that included several potential causes to which students attribute their academic achievement such as ability, effort, studying strategies, or luck. Sturman's (2003) study, gave some indications that teacher confidence and an integrated approach to teaching and revision could be related to higher test attainment. An integrated approach is more likely than a piecemeal approach to be considered valid and these findings suggest that the integrated approach may be worth encouraging.

Henriksson (1994) found that studies that took into account variables such as research design, length of preparation, complexity of test items, and type of coaching intervention generally reported modest gains. Contextual relationships have the potential to strengthen linkages among the learning environments of school, home, and community.

CHAPTER III

METHODOLOGY

The purpose of this study was to assess learning in sixth grade students' by gain scores in mathematics and science while participating in the integrative curriculum modules, Hard River Escape and Tut's Revenge, developed by the PEER Program. Prior to testing, teacher consent forms were signed and returned. Participating teachers were given a copy of the signed consent forms for their own records. Following the assignment of curricular materials to teachers, test administration instructions were distributed.

Once the pre- and post-test assessments of students at the participating schools were completed, a return envelope was included for convenient return of the survey instruments. To ensure anonymity, teachers were instructed to check that students had not placed their name or other identifying marks on the test booklets.

Post-data collection procedures included TAMU researchers scoring all tests and recording the data submitted from participating schools. All pre- and post-test booklets were then returned to the teachers to allow for result discussions with students.

The Backpack Adventure Series, from which the two integrated curriculum module narratives, Hard River Escape and Tut's Revenge were derived, featured the characters K.T., a daredevil girl always up for an adventure; Roman Castillo a computer whiz and his little sister, Connie, Summer, a wheelchair bound geography genius; and her protective older brother Travis, the oldest of the group. The "backpack club" as they were known around their small middle school carried backpacks with built in

microcomputers, invented by Roman and Connie's father, Professor Castillo. The diverse group of friends communicated by wireless hand-held "boxtox" devices disguised as key chains that connected to each other's backpacks and also served as tracking devices. With a new microchip, modified by Roman, that performed time travel and instantaneous language translations, the friends could travel and communicate anytime to anywhere together or alone.

The measured integrated curriculum module, *Hard River Escape*, was a narrative based on the Backpack Adventure series character, K.T., who when trying to visit her pen-pal friend Natasha in Dnepropetrovsk, Ukraine, found herself traveled back in time to the exclusion zone of the 1986 Chernobyl nuclear reactor accident. With a broken backpack computer (BPC), K.T. befriended Nikolai, a fourteen-year-old Ukraine native in search of his quarantined firefighter father. Together K.T. and Nikolai out ran the KGB in a U.S.S. R. - led government, and discovered the negative effects of pollution from factory effluents and agricultural waste run-off on a society. On their way to Dnepropetrovsk, by way of Dnieper, the third longest river in Europe, Nikolai informed K.T. of how pollutants of toxic chemicals and hazardous wastes have transformed a once recreational river into a breeding ground for cancers and mutations.

Tut's Revenge, another episode of the Backpack Adventure Series, featured K.T., Roman, Connie, Summer, and Travis, as they traveled back in time to ancient Egypt during King Tutankhamun's reign to find the best home for an orphaned kitten. It was in the town of Kaefa that the friends met Nefah, a young girl distraught over the new Pharaoh's government, after the sudden death of King Tut. Unsanitary working and

living conditions made the tomb workers very ill with stomach cramps, vomiting, and diarrhea. Nefah believed that this illness was King Tut's Revenge because of poor management by his successor, the new pharaoh, Ay. When the friends are summoned to the Overseer of the Tomb, it was evident that poor hygiene caused the contamination that was responsible for the tomb worker's mystery illness, and not the vengeance of the late King Tutankhamun.

A menagerie of disciplines such as, geography, history, social studies, English, and reading were incorporated into each integrated module, but only mathematics and science were measured in this study. The associated PowerPoint slide sets in the learning modules enabled teachers to utilize a variety of teaching mediums to address different learning styles. These include cooperative learning activities, as well as prompts for lecture, reading, audio-visual, demonstration, discussion, and practice. A student's learning style is the same no matter the subject area. The more a student can utilize learning through the combination of visual, auditory, and kinesthetic modalities, the more permanent the information will become (Eberling, 2001).

Target Population and Sample

The PEER Program's educational approach was focused on rural schools with high poverty rates and low population densities. The districts were diverse by geography, student ethnicity, and school characteristics. In Texas, the target population (teachers and students) of Texas Rural Systemic Initiative (TRSI) partner schools was comprised of 287 school districts in over 100 eligible rural counties enrolling over

311,064 Kindergarten through 12th grade students, 66% of whom were minorities (57% Hispanic (Oswald, 2002).

The focus on middle school responds to the Carnegie Council on Adolescent Development (1989) that reported at no other time in a student's school career will he/she be so at-risk for failure. Furthermore, middle school is a prime developmental period for social skills. Middle-school students need activities that engage them with others in collaborative learning groups so they can develop social skills in preparation for adulthood. One challenge was to find content that was motivational, engaging, and stimulating, and also organized in a manner that would enable the application of mathematics and science and foster critical thinking. A second challenge was to close the gap between rapid advances in scientific knowledge and the science content presented in middle schools.

Instrumentation

Each pre- and post-test booklet consisted of ten questions that were consistent with the TAKS testing format and based on the Texas Essential Knowledge and Skills (Appendices C, D, E, F, G, H, I & J). Instructional materials were modular and topical. For a given unit, linked material were created as follows:

- Goals and objectives
- Resources (included tutorials and Web links)
- Pre-Quiz (assisted teachers in preparing students for the lessons by focusing on prerequisite concepts and skills)

- Lessons (addressed prerequisite concepts and skills, provided opportunities for learner performance and feedback on performance regarding selected concepts and skills)
- Lesson activities (both group and individual)
- Post-Quiz (criterion-referenced)

PEER modules and activities were aligned to the Texas Essential Knowledge and Skills (TEKS) objectives and validated by science and mathematics specialists at Texas A&M University. A committee composed of middle school educators and science, mathematics and curriculum specialists, was used to parallel the student activities of the PEER modules to appropriate TEKS elements.

Validity and Reliability

A pilot study was not conducted. Validity and reliability will be estimated by conducting a split-half on the pre-test assessment, as a measure of stability, a Guttman split-half test will be conducted on the post-test data.

Data Collection

For pre-test facilitation, teachers were instructed to provide students with a copy of the appropriate “Backpack Adventures Series” story one week before testing. Participants were given RBI permission slips to be signed by a parent or legal guardian and returned to the teacher (Appendix A). Each student was assigned a test code number (such as a seating chart number or grade book number). The codes were recorded on

each of the students' pre-test booklets. Instructions were for teachers to safeguard their list of codes, as they would be using the same codes on the post-tests (Appendix B). Teachers then distributed the pre-tests (Mathematics or Science) to students in their classrooms. During the testing, students were allowed 15 minutes to complete each pre-test. If students completed the questions before the allotted time, teachers were encouraged to have them to check their answers.

In completing the mathematics and science pre-tests, students were given the option to use a calculator. Teachers were instructed to make arrangements for students to have access to a calculator during the test. Once students had completed the pre-tests, teachers collected all pre-test booklets, and stored them in a secure place.

Post-test facilitation was similar to pre-test data collection. Individual students were assigned a test code number. Codes were written on the post-test booklets and the list of codes safeguarded. Teachers could later use the codes to discuss test results with students. Mathematics and science post-tests were distributed to students in each teacher's classrooms. Teachers who used the integrated curricular materials administered a post-test to students after having completed the lesson plans. Testing dates coordinated with other teachers not using the curricular materials, so that pre- and post-testing occurred on the same (or close to the same) days. Teachers who did not use the curricular materials administered a post-test to students at approximately the same time as teachers who used the materials. Once students had completed the post-tests, all post-test booklets were collected.

Analysis of Data

The data were analyzed using Statistical Package for Social Science (SPSS) 12.0 (SPSS, Inc. 2003). The data generated were strictly descriptive. SPSS 12.0 (SPSS, Inc. 2003) was used to calculate frequencies, percentages, means, and standard deviations for each objective.

The SPSS 12.0 (SPSS, Inc., 2003) procedure *Frequencies* and *Descriptives* was used to calculate central tendencies, frequencies, and variability. Descriptive analysis was conducted on the pre and post-tests of each treatment group for the subjects of mathematics and science in each of the modules, Hard River Escape and Tut's Revenge.

CHAPTER IV

FINDINGS

The purpose of this study was to assess learning in sixth grade students' by gain scores in mathematics and science while participating in the integrative curriculum modules, Hard River Escape and Tut's Revenge developed by the PEER Program.

Eight specific objectives were identified as:

1. Describe the experimental group by mathematics and science pre-test/post-test scores.
2. Describe the control group by mathematics and science pre-test/post-test scores.
3. Describe the experimental/control group by gain scores in mathematics and science.
4. Assess differences between treatment groups' pre-test scores in mathematics and science.
5. Assess differences between treatment groups' post-test scores in mathematics and science.
6. Assess differences in control and experimental groups' mathematics and science pre-test scores.
7. Assess differences in control and experimental groups' mathematics and science post-test scores.
8. Assess differences in control and experimental groups' mathematics and science gain scores.

Demographic Characteristics of Hard River Escape

Data were collected for the PEER Integrated Curricula Module *Hard River Escape* ($N = 3037$) from sixth grade students. The module contained tests in science, mathematics, reading, English, and social studies as well as questionnaires designed to collect students' career interests (beliefs about science and information sources used to learn about math and science careers). This study only investigated the subjects of mathematics and science. The following analyses are results from the Hard River Escape module.

Hard River Escape Results

Only complete paired data sets were considered for analyses, which were limited by incomplete tests, students who completed the pre- or post-test only, and/or missing data. Usable instruments resulted in a response rate of 88.87% ($n = 2699$). To gain some sense of the test participants, career interest surveys were given out. Table 1 shows the demographic data for the Hard River Escape module derived from the career interest survey. It should be noted that not all demographics were recorded on all test types; school, teacher, gender, and grade were only recorded on the student career interests' surveys, thereby limiting discriminate analyses. No demographics were measured or recognized in this study.

Table 1

Hard River Escape Demographic Data from Career Interest Surveys

Variables	<i>f</i>	Percent
School: McAnally	1413	52.4
Crownover	416	15.4
South Middle	372	13.8
CC Hardy	360	13.3
Crosbyton	54	2.0
Stackhouse	184	6.8
Goodlander	130	4.8
Teacher: Akin	126	4.7
Koy	104	3.9
Norquest/Stackhouse	100	3.7
Church	63	2.3
Adriana	62	2.3
Trew	61	2.3
Alsop	48	1.8
Norquest	25	.9
High	17	.6

Note. Percentages may not equal 100% due to missing data.

To gain perspective on the number of students' paired data used for each type of Hard River Escape test analyses, frequencies and totals were computed. Table 2 shows the frequency counts for each test type categorized by experimental and control groups. Experimental groups had the PEER Program treatment; the control group did not.

Table 2

Hard River Escape Frequency Counts for Test Types by Treatment

Test Type	Treatment				Total <i>n</i>
	Experimental		Control		
	Pre-test	Post-test	Pre-test	Post-test	
Mathematics	460	460	436	436	896
Science	212	212	189	189	401

Table 3 provides descriptive analyses for mathematics and science, categorized by treatment type. To address objectives one and two, pre- and post-test scores were computed for each of the tests within each treatment group (experimental and control). Objective three, describe the experimental/control group by gain scores in mathematics and science, was included also in Table 3. Shown are the minimum and maximum scores out of a possible ten, one point represents a correct answer for each question. This breakdown of scoring illustrates the broad range of correct answers for each test type by both treatment groups. Gain scores were calculated by subtracting the summated pre-test scores from the summated post-test scores. The negative gain scores shows that there were participants whom did worse in the post-test.

Table 3

Descriptive Statistics for Test Type by Treatment for Hard River Escape

Tests	Type	Treatment							
		Experimental				Control			
		Min	Max	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>
Math	Pre-test	0	7	2.82 ¹	1.43	0	8	2.42 ¹	1.34
	Post-test	0	9	3.20 ¹	1.52	0	7	3.04 ¹	1.46
	Gain Score	-6	6	.37	2.03	-5	6	.63	1.88
Science	Pre-test	0	9	4.12 ¹	1.52	0	9	3.59 ¹	1.81
	Post-test	0	9	4.71 ¹	1.52	0	9	4.31 ¹	1.71
	Gain Score	-5	5	.59	1.91	-5	6	.72	1.86

Note. ¹ Mean scores ranged from -0 to 9 on a 10-point scale.

Table 4 shows the results of paired samples *t*-tests for each test type, objectives 4 and 5. Significant differences between pre- and post-test scores were investigated within treatment types (experimental and control) for the Hard River Escape module.

Differences occurred within groups. In the experimental group, students' post-test scores in mathematics and science were significantly higher ($M = 3.20, 4.71$, respectively) than were their pre-test scores ($M = 2.82, 4.12$).

Control group students scored significantly higher scores on the mathematics and science post-tests ($M = 3.04, 4.31$, respectively), than were their pre-test scores ($M = 2.42, 3.59$). (Table 4).

Table 4

Hard River Escape Paired Samples t-test Statistics by Treatment

Treatment	Test Type	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Experimental						
Math	Pre-test Sum	460	2.82	1.43	-3.96	.00*
	Post-test Sum	460	3.20	1.52		
Science	Pre-test Sum	212	4.12	1.52	-4.50	.00*
	Post-test Sum	212	4.71	1.52		
Control						
Math	Pre-test Sum	436	2.42	1.34	-6.96	.00*
	Post-test Sum	436	3.04	1.46		
Science	Pre-test Sum	189	3.59	1.81	-5.34	.00*
	Post-test Sum	189	4.31	1.71		

Note. * $p < .05$.

Table 5 shows objectives six and seven, that assessed the differences in control and experimental groups' mathematics and science pre-test scores and post-test scores. The results of Table 5 show *t*-tests for students' paired samples when compared by test type. Significant differences occurred in pre-tests for both mathematics and science experimental groups. Experimental group students scored higher in the mathematics pre-test ($M = 2.82$) than did students in the control group ($M = 2.42$) and science pre-test ($M = 4.12$) than did students in the control group ($M = 3.59$). In the science post-test, the experimental group, again showed a significantly higher difference ($M = 4.71$) than did the students in the control group ($M = 4.31$) (Table 5).

Table 5

Paired Samples t-test Statistics by Pre-and Post-tests for Hard River Escape

Test	Treatment	<i>n</i>	<i>M</i> ¹	<i>SD</i>	<i>t</i>	<i>p</i>
Math Pre-test	Experimental	460	2.82	1.43	4.38	.00*
	Control	436	2.42	1.34		
Science Pre-test	Experimental	212	4.12	1.52	3.19	.00*
	Control	189	3.59	1.81		
Math Post-test	Experimental	460	3.20	1.52	1.55	.12
	Control	436	3.04	1.46		
Science Post-test	Experimental	212	4.71	1.52	2.45	.01*
	Control	189	4.31	1.71		

Note. ¹ Mean scores ranged from -0 to 9 on a 10-point scale;

* $p < .05$.

Objective eight assessed differences in control and experimental groups' mathematics and science gain scores. Significant differences were investigated by calculating overall gain scores, analyzed by treatment types (experimental and control). Table 6 shows the results of *t*-tests for students' gain scores when compared by treatment group. Differences occurred between groups; experimental group students had significantly less gain in the mathematics test ($M = 0.37$) than did students in the control group ($M = 0.63$) (Table 6).

Table 6

t-Test Statistics for Students' Gain Scores by Treatment for Hard River Escape

Test	Treatment	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	<i>t</i>	<i>p</i>
Math Gain	Experimental	460	.37	2.03	-6	6	3.72	.05*
	Control	436	.63	1.88	-5	6		
	Total	896	.50	1.96	-6	6		
Science Gain	Experimental	212	.59	1.91	-5	5	.51	.47
	Control	189	.72	1.86	-5	6		
	Total	401	.65	1.89	-5	6		

Note. * $p < .05$.

Demographic Characteristics of Tut's Revenge

Data were collected for the PEER Integrated Curricula Module, *Tut's Revenge* ($N = 1623$) from sixth grade students. The module contained tests in science, mathematics, reading, English, and social studies as well as questionnaires designed to collect students' career interests (beliefs about science and information sources used to learn about math and science careers). This study only investigated the subjects of mathematics and science. The following analyses are results from the Tut's Revenge module.

Tut's Revenge Results

Only complete paired data sets were considered for analyses, which were limited by incomplete tests, students who completed the pre- or post-test only, and or missing data. Usable instruments resulted in a response rate of 92.42% ($n = 1500$). To gain some sense of the test participants, career interest surveys were given out. Table 7 shows the demographic data for the Tut's Revenge module derived from the career interest survey. It should be noted that not all demographics were recorded on all test types; school, teacher, gender, and grade were only recorded on the student career interests' surveys, thereby limiting discriminate analyses. No demographics were measured or recognized in this study.

Table 7

Tut's Revenge Demographic Data from Career Interest Surveys

Variable		<i>f</i>	Percent
School:	Crownover	578	38.5
	McAnally	485	32.3
	C.C. Hardy	358	23.9
	Crosbyton	79	5.3
Teacher:	Dickenson	122	8.1
	Wolf	120	8.0
	Smith	119	7.9
	Scott	117	7.8
	Pulattie	101	6.7
	Jensen	83	5.5
	Fritz	37	2.5
	Potts	7	.5

Note. Percentages may not equal 100% due to missing data.

Frequencies and totals were computed to gain perspective on the number of students' paired tests used for each type of analyses. Table 8 shows the frequency counts for each test type categorized by experimental and control groups. Experimental groups had the PEER Program treatment; the control group did not.

Table 8

Tut's Revenge Frequency Counts for Test Types by Treatment

Test Type	Treatment				Total <i>n</i>
	Experimental		Control		
	Pre-test	Post-test	Pre-test	Post-test	
Mathematics	45	45	27	27	72
Science	289	289	250	250	539

Table 9 provides descriptive analyses for mathematics and science, categorized by treatment type. For objectives one and two, pre- and post-test scores were computed for each of the tests within each treatment group (experimental and control). Objective three, to describe the experimental/control group by gain scores in mathematics and science, is included also in Table 9. Shown are the minimum and maximum scores out of a possible ten, one point represents a correct response for each question. This breakdown of scoring illustrates the broad range of correct answers for each test type by both treatment groups. Gain scores were calculated by subtracting the summated pre-test scores from the summated post-test scores. The negative gain scores shows that there were participants whom did worse in the post-test.

Table 9

Tut's Revenge Descriptive Statistics for Test Type by Treatment

Tests	Type	Treatment							
		Experimental				Control			
		Min	Max	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>
Math	Pre-test	0	6	3.51 ¹	1.25	0	6	3.15 ¹	1.61
	Post-test	1	6	3.31 ¹	1.46	0	5	3.19 ¹	1.33
	Gain Score	-4	4	-.20	2.00	-3	2	.04	1.40
Science	Pre-test	1	7	3.52 ¹	1.37	0	7	3.70 ¹	1.35
	Post-test	0	9	3.56 ¹	1.45	0	7	3.18 ¹	1.35
	Gain Score	-4	5	.03	1.75	-5	5	-.51	1.85

Note. ¹ Mean scores ranged from -0 to 9 on a 10-point scale.

Table 10 shows the results of paired samples *t*-tests for each test type; objectives 4 and 5. Significant differences between pre- and post-test scores were investigated within treatment types (experimental and control). Table 10 shows the results of paired samples *t*-tests for each group. Control group students scored significantly higher on the science pre-test ($M = 3.70$) than they did on the post-test ($M = 3.18$) (Table 10).

Table 10

Paired Samples t-test Statistics by Treatment for Tut's Revenge

Treatment	Test Type	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Experimental						
Math	Pre-test Sum	45	3.51	1.25	.67	.50
	Post-test Sum	45	3.31	1.46		
Science	Pre-test Sum	290	3.52	1.37	-3.30	.76
	Post-test Sum	290	3.56	1.45		
Control						
Math	Pre-test Sum	27	3.15	1.61	-.14	.89
	Post-test Sum	27	3.19	1.33		
Science	Pre-test Sum	250	3.70	1.35	4.37	.00*
	Post-test Sum	250	3.18	1.35		

Note. * $p < .05$.

Table 11 shows objectives six and seven, that assessed the differences in control and experimental groups' mathematics and science pre-test scores and post-test scores. The results show *t*-tests for students' paired samples when compared by test type. A significant difference occurred between treatment groups in the science post-test. Experimental group students scored higher in the science post-test ($M = 3.56$) than did students in the control group ($M = 3.18$) (Table 11).

Table 11

Paired Samples t-test Statistics by Pre-and Post-tests for Tut's Revenge

Test	Treatment	<i>n</i>	<i>M</i> ¹	<i>SD</i>	<i>t</i>	<i>p</i>
Math Pretest	Experimental	45	3.51	1.25	1.07	.29
	Control	27	3.15	1.61		
Science Pretest	Experimental	290	3.52	1.37	-1.46	.14
	Control	250	3.70	1.35		
Math Post-test	Experimental	45	3.31	1.46	.37	.72
	Control	27	3.19	1.33		
Science Post-test	Experimental	290	3.56	1.45	3.07	.00*
	Control	250	3.18	1.35		

*Note.*¹ Mean scores ranged from -0 to 9 on a 10-point scale;

* $p < .05$.

Objective eight assessed differences in control and experimental groups' mathematics and science gain scores. Significant differences were investigated by calculating overall gain scores, analyzed by treatment types (experimental and control). Table 12 shows the results of *t*-tests for students' gain scores when compared by treatment group. Differences occurred between groups in that experimental group students had significantly more gain in the science test ($M = 0.03$) than did students in the control group ($M = -0.51$) (Table 12).

Table 12

t-Test Statistics for Students' Gain Scores by Treatment for Tut's Revenge

Test	Treatment	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	<i>t</i>	<i>p</i>
Math Gain	Experimental	45	-.20	2.00	-4	4	.29	.59
	Control	27	.04	1.40	-3	2		
	Total	72	-.11	1.79	-4	4		
Science Gain	Experimental	290	.03	1.75	-4	5	12.23	.00*
	Control	250	-.51	1.85	-5	5		
	Total	540	-.22	1.82	-5	5		

Note. * $p < .05$.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary of Findings

The purpose of this study was to assess learning in sixth grade students' by gain scores in mathematics and science while participating in the integrative curriculum modules, Hard River Escape and Tut's Revenge, developed by the PEER Program. The findings of this research were derived from the data and relate to the effect of the PEER Program's integrative curriculum modules on sixth grade students' mathematics and science gain scores. Key findings are used to explain the conclusions by objective below.

Objectives one and two were to describe the experimental/control group by students' mathematics and science pre-test/post-test scores. For Hard River Escape, and Tut's Revenge, descriptive analyses for mathematics and science, categorized by treatment type showed a range of minimum and maximum scores for each test (pre and post), each subject (mathematics and science) and each treatment group (experimental and control). Evidence suggests conformity in the test materials, in that the range had consistent scoring from zero, or below zero, to nearly a perfect score of ten among all groups. This result suggests that the testing material discriminated among academic ability for individual students, but was still a valid measurement instrument because by every student not scoring badly, the tests were believed to be age-appropriate. If the majority of students had scored poorly, one would have to further investigate the reliability and validity of the tests as an age-appropriate measurement instrument.

Objective three was to describe the experimental/control group by gain scores in mathematics and science, which resulted in a similar legitimacy of the tests as being consistent and attainable for students. The negative gain scores showed that some students performed worse on the post-test than they did on the pre-test. This finding suggests possibly that the integrity of the tests may have been questionable. Outside factors, such as health or mood of students (was he/she feeling well on the test day), and/or student interest in participating in the study, etc., come into play as to how and why students scored lower on the post-test in both treatment groups.

The fourth and fifth objectives were to assess the differences between treatment groups' pre-test and post-test scores in mathematics and science. Significant differences between pre- and post-test scores were investigated within treatment types (experimental and control) for the Hard River Escape module. In the experimental group, students' post-test scores in mathematics and science were significantly higher ($M = 3.20, 4.71$, respectively) than they did on their pre-test scores ($M = 2.82, 4.12$). Control group students scored significantly higher scores on the mathematics and science post-tests ($M = 3.04, 4.31$, respectively), than were their pre-test scores ($M = 2.42, 3.59$). Time, the John Henry Effect, the Testing Effect, and whether testing between the treatment groups were conducted on the same days, are all factors that could have contributed to the control group scoring higher. In the John Henry Effect, control group participants' in a study perform at higher levels than normal. The Testing Effect is when people recall the answers they chose at a previous testing time to and apply those same recalled answers to similar test questions at another later testing time because the questions/answers are

familiar, but not necessarily correct. Whether or not experimental group students discussed the integrated curriculum coursework, or testing materials with control group students, or vice versa, in the time between the pre and post-test could have effected test performances. These findings are inconclusive to whether the PEER integrated curriculum modules had any connection to the higher post-test scores.

In the Tut's Revenge module, significant differences were found between pre- and post-test scores within treatment types (experimental and control). Control group students scored significantly higher on the science pretest ($M = 3.70$) than they did on the post-test ($M = 3.18$).

Objectives six and seven were to assess the differences in control and experimental groups' mathematics and science pre and post-test scores. These objectives differed in that the analysis of data were examined specifically for the pre-test scores of the two treatment groups and post-test scores of the two treatment groups. This was originally measured in order to establish equivalent treatment groups. Scores between the treatment groups (experimental and control) were compared by pre and post-test scores to show that one treatment group did not start off scoring higher than the other. However, data analyses did not support this hypothesis. For the Hard River Escape module, experimental group students scored higher in the mathematics pre-test ($M = 2.82$) than did students in the control group ($M = 2.42$), and science pre-test ($M = 4.12$) than did students in the control group ($M = 3.59$). In the science post-test, the experimental group, again showed a significantly higher difference ($M = 4.71$) than did the students in the control group ($M = 4.31$). The Tut's Revenge module showed a

significant difference occurred between treatment groups in the science post-test.

Experimental group students scored higher in the science post-test ($M = 3.56$) than did students in the control group ($M = 3.18$). The findings that some experimental groups scored significantly higher than did the control groups for objectives six and seven, imply the possibility of the Hawthorne Effect, that states that by merely participating in a test, trial, or study, that the participants have a better experience because of the focusing interest toward them is gratifying, thus rewarding in its own sake (www.burtonreport.com/InfHealthCare/Info&UseHawthorne.html).

Objective eight was to assess the differences in control and experimental groups' mathematics and science gain scores. Findings for Hard River Escape showed experimental group students had significantly less gain in the mathematics test ($M = 0.37$) than did students in the control group ($M = 0.63$). However; findings for Tut's Revenge did find significant differences between groups in that experimental group students had significantly more gain in the science test ($M = 0.03$) than did students in the control group ($M = -0.51$). The results for these findings support the notion that the integrated PEER experimental modules had a positive effect on the experimental populations by producing higher gain scores than were evident in the untreated population. It can be concluded that the integrated modules were effective in raising and improving test scores based on the preparatory curriculum.

The minimal gain can be attributed to a variety of reasons such as the previously discussed issues of novelty testing notions such as the Hawthorne Effect, the John Henry

Effect, the Testing Effect, as well as the factors of time and students' outside/extenuating factors.

Implications

An implication of this study was that the measured mathematics and science testing materials (Appendices C, D, E, F, G, H, I, & J) were fair and age-appropriate for valid gain score assessment. The individual scoring results in both the mathematics and science pre and post-tests produced evidence that the testing material was practical for sixth grade students.

Students in this study were not withheld to the information of whether their class was selected to participate as an experimental or control group. It is unknown whether all participants were told prior to pre-testing, their treatment group status. The findings that some experimental groups scored significantly higher than did the control groups for objectives six and seven, imply the possibility of the Hawthorne Effect, that states that by merely participating in a test, trial, or study, that the participants have a better experience because of the focusing interest toward them is gratifying, thus rewarding in its own sake (www.burtonreport.com/InfHealthCare/Info&UseHawthorne.html).

The Hawthorne Effect could also be the rationale behind the negative gain scores, which were evidenced that some study participants scored lower on the post-test than they did on pre-test. If the Hawthorne Effect occurs when people know they are being measured and modify their behavior towards the desired effect of the study because of heightened attention, the reciprocal of that could be apathy from the control group because of lack of interest. Instances of the control group scoring higher could be

attributed to the John Henry Effect, that because control participants are being measured, participants' performance is above normal.

Inconsistencies in the results from this study imply that further research is needed with more students, and with more closely monitored/controlled facilitation of tests, teaching materials, and participants.

Recommendations

The federal No Child Left Behind legislation places a heavy emphasis on scientifically based programs; much of the discussion surrounding education research has focused on the need for more stringent program evaluations and randomized experiments (Hamilton et al., 2003).

It is believed that contextualized learning holds promise for improving a student's ability to synthesize information from different sources, for furthering understanding of new and sometimes contradictory data, for assisting in making meaning, and ultimately, for enhancing one's ability to think critically and transfer learning to future life experiences (Edwards, Leising, & Parr, 2002).

After the pre-tests were conducted, experimental groups were taught with the PEER integrated curriculum modules and the control groups were taught with traditional curriculum. This study aimed to find that the integrated PEER modules should show significant gains in the treated (experimental) populations by having higher scores than the untreated (control) population. There was insufficient evidence to determine whether the integrated modules were effective in raising and improving test scores based on the preparatory curriculum.

Variations in the results from this study indicate that further research is needed with more students, and with more closely monitored/controlled facilitation of tests, teaching materials, and participants.

Teacher comments/suggestions would give incite to how better to fine tune the assessment method in this study.

It is recommended that students be given an incentive to honestly and sincerely participate in future studies so that there is an external motivation for participants such as having the tests be included in the coursework for a grade.

Recommendations are to maintain longitudinal databases over the course of a semester or school year. Maintaining databases on students and program implementation for an extended period of time would further strengthen the PEER Program's ability to conduct a more rigorous and thorough evaluation on the effects of the integrated curriculum modules. A longitudinal study, with a strict controlled environment, teachers having adequate knowledge and execution of the modules, proper facilitation of the tests and testing environment, and an examination into various demographic characteristics of participants, would enable evaluators to examine changes in implementation and growth in student achievement over time, providing a much stronger test of the PEER Program's effects.

Recommendations for Further Research

The completion of this study raised several additional questions about integrated curriculum, the PEER Program, and its effect on raising and improving test scores.

The following recommendations are suggested topics for further research.

1. This study should be replicated. Stricter attention should be given and monitored to the integrity of the testing environment and test participants.
2. This study should be replicated with more demographics considered.
Investigation into the correlations between test scores and gender may show different findings.
3. Investigate additional outside/extenuating factors such as student self-beliefs, family expectations and resources, classroom environment, and instructional practices are needed. There may be other differences in student characteristics across classrooms that contribute to differences in academic performance.
4. The study should be replicated with more participants. By enlarging the target population, a more descriptive and accurate conclusion would be determined.

REFERENCES

- Alston, A.J., Miller, W. M., & Williams, D.L. (2003). The future role of instructional technology in agricultural education in North Carolina and Virginia. *Journal of Agricultural Education*, 44(2), 38-39.
- Baker, R. J. & Blue, M.C. (1999). The cost-effective multimedia classroom. *T.H.E. Journal*. 17(1), 46-50.
- Bayer Corporation. (2003). *Bayer facts of science education IX: America's view on the role of science and technology in U.S. National Defense*. Retrieved October 4, 2003 from <http://www.bayerus.com/msms/news/factsofscience/survey03.html>
- Berns, R., & Erickson, P. (2001). Contextual teaching and learning: Preparing students for the new economy. In: *The Highlight Zone: Research @ Work*, N. 5. National Dissemination Center for Career and Technical Education, Columbus, OH.
- Borko, H., & Putman, R. (1998). The Role of Context in Teacher Learning and Teacher Education. In: *Contextual teaching and learning: Preparing teachers to enhance student success in and beyond school*, pp. 35-74. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education; and Washington, DC: ERIC Clearinghouse for Teaching and Teacher Education. (ERIC Document Reproduction Service No. ED427263) <http://www.contextual.org>
- Bouillion, L. M., & Gomez, L. M. (2001). Connecting school and community with science learning: Real world problems and school-community partnerships as contextual scaffolds. *Journal of Research in Science Teaching*, 38, 878-898.

- Briner, M. (1999). *Learning theories*. Denver: University of Colorado. Retrieved May 12, 2004 from <http://curriculum.calstatela.edu/faculty/psparks/theorists/501learn.htm>
- Brualdi, A. (1996). Multiple intelligences: Gardner's theory. Washington DC: ERIC Clearinghouse on Assessment and Evaluation. (ERIC Document Reproduction Service No.ED410226)
- Bruner, J. (1960). *The process of education*. New York: Random House.
- Bruner, J. (1966). *Toward a theory of instruction*. Cambridge, MA: Harvard University Press.
- Budke, W.E. (1991). Agricultural science – striving for excellence. *The Agricultural Education Magazine*, 63(7), 4 & 11.
- Burton, C.V. (Ed.) (n.d.). *The Hawthorne Effect*. Retrieved September 3, 2004, from <http://www.burtonreport.com/InfHealthCare/Info&UseHawthorne.html>
- Carey, S. (1986). Cognitive science and science education. *American Psychologist*, 41(10), 1123-1130.
- Christmann, E., & Badgett, J. (1999). A comparative analysis of the effects of computer-assisted instruction on student achievement in differing science and demographical areas. *Journal of Computers in Mathematics and Science Teaching*, 18, 135-143.
- Clark, R., & Salomon, G. (1986). Media in teaching. In M, Wittrock (Ed.), *Handbook of research on teaching* (Ed. 3). New York: Macmillan, 464-478.

- Clark, R., & Surgrue, B. M. (1988). Research on instructional media, 1978-1988. In D.P. Ely, B. Broadbent, and R.K. Wood (Ed. 3), *Educational media and technology yearbook, 14*, 19-36. Englewood, CO: Libraries Unlimited, Inc.
- Cognition and Technology Group at Vanderbilt. (1992). The Jasper experiment: An exploration of issues in learning and instructional design. *Educational Technology Research and Development, 40*, 65-80.
- Conroy, C. A., Turmball, D., & Johnson, D. (1999). *Agriculture as a rich context for teaching and learning, and for learning mathematics and science to prepare for the workforce of the 21st century*. White Paper presented to the National Science Foundation. Retrieved November 5, 2002, from <http://www.nsf.gov/sbe/tcw/events-990917w/2.htm>
- Conroy, C., & Walker, N. (2000). An examination of integration of academic and vocational subject matter in the aquaculture classroom. *Journal of Agricultural Education, 41*(2), 54-64.
- Cronbach, L. J. & Snow, R. E. (1977). *Aptitudes in instructional methods: A handbook for research on interactions*. New York: Irvington Publishers.
- Crowley, K. (2003). Learning new problem-solving strategies by observing and explaining. In D.Fasko (Ed.). *Critical thinking and reasoning: Current research, theory, and practice* (pp.99-119). Cresskill, NJ: Hampton Press, Inc.
- Dewey, J. (1900). *The school and society*. Chicago: University of Chicago Press.
- Dewey, J. (1910). *How we think*. Boston: D.C. Heath & Co.

- Doyle, H. J. (1999) UCSF partnership to enrich science teaching for sixth graders in San Francisco's schools. *Academic Medicine*, 74, 329-331.
- Drosjack, M. (2003, November 14). Texas' math scores up but treading still lagging. *The Houston Chronicle*, p. 21A.
- Eberling, D. (2001). *Individual differences: Learning styles, multiple intelligences*. Unpublished manuscript, Sam Houston State University at Huntsville, TX.
- Edwards, M.C., Leising, J. G., & Parr, B. A., (2002). *Improving student achievement in science: An important role for secondary agricultural education in the 21st century*. Unpublished manuscript, Oklahoma State University at Stillwater.
- Ellis, S. (1995, September 22). Across the test divide. *Times Educational Supplement*, p.24.
- Emery, H., Wilmut, J., & Fox, R. (1998). Monitoring assessment at Key Stage 2 in 1998: Report to the Qualifications and Curriculum Authority. London: QCA.
- Fabry, D. L. & Higgs, J. R. (1997). Barriers to the effective use of technology in education: Current status. *Journal of Educational Computing Research*, 16(4), 385-395.
- Gan, S. (1999). Motivating at-risk students through computer-based cooperative learning activities. *Educational Horizons*, 77, 151-156.
- Gardner, H. (1983). *Frames of mind*. New York: Basic Books Inc.
- Goldberg, M. W. (1996). *CALOS: First results from an experiment in computer-aided learning*. Retrieved February 8, 2003 from <http://homebrew1.cs.ubs.ca/papers/calos-res/>

- Gravemeijer, K. & Doorman, M. (1999). Context problems in realistic mathematics education: A calculus course as an example. *Educational Studies in Mathematics*, 39, 111-129.
- Gregorc, A. F. (1982). *An adult's guide to style*. Maynard: Gabriel Systems.
- Hamilton, L. S., McCaffrey, D. F., Stecher, B. M., Klein, S. P., Robyn, A., & Bugliari, D. (2003). Studying large-scale reforms of instructional practice: An example from mathematics and science. *Educational Evaluation and Policy Analysis*, 25(1), 1-29.
- Henriksson, W. (1994). Meta-analysis as a method for integrating results of studies about effects of practice and coaching of the test scores. *British Journal of Educational Psychology*, 64(2), 319-29.
- Hilgard, E. & Bower, G. (1975). *Theories of learning*. Englewood Cliffs, NJ: Prentice-Hall.
- House, J. D. (2002). The motivational effects of specific teaching activities and computer use for science learning: Findings from the Third International Mathematics and Science Study (TIMSS). *International Journal of Instructional Media*, 29(4), 423-434.
- House, J. D. (2003a). Instructional activities and interest in science learning for adolescent students in Japan and the United States: Findings from the Third International Mathematics and Science Study (TIMSS). *International Journal of Instructional Media*, 30(4), 429-442.

- House, J. D. (2003b). Self-beliefs and science and mathematics achievement of adolescent students in Hong Kong: Findings from the Third International Mathematics and Science Study (TIMSS). *International Journal of Instructional Media*, 30(2), 195-212.
- House, J. D. (2003c). The motivational effects of specific instructional strategies and computer use for mathematics learning in Japan: Findings from the Third International Mathematics and Science Study (TIMSS). *International Journal of Instructional Media*, 30(1), 77-95.
- Howland, J., Laffey, J., & Espinosa, L.M. (1997). A computing experience to motivate children to complex performance. *Journal of Computing Childhood*, 8, 291-311.
- Jurd, E. (2000). An unlooked-for effect of KS2 SATs on the teaching of science in year 6. *Forum*, 42(2), 73-6.
- Kaplan- Leiserson, E. (n.d.). *Glossary: ASTD's source for e-learning*. Retrieved March 8, 2004, from <http://www.learningcircuits.org/glossary.html>
- Koretz, D. M., Mc Cafferey, D. F., & Hamilton, L. S. (2001). *Towards a framework for validating gains under high-stakes conditions*. CSE Technical Report 551 (CRESST) Retrieved March 20, 2004 from <http://www.cse.ucla.edu/CRESST/reports/TR551.pdf>
- Kortlik, J. W., Harrison, B. C., Redmann, D. H., & Handley, C. H. (2000). Information technology related professional development needs of Louisiana agriscience teachers. *Journal of Agricultural Education*, 41(1), 18-29.

- Kupermintz, H., Ennis, M. M., Hamilton, L.S., Talbert, J.E., & Snow, R. E. (1995). Enhancing the validity and usefulness of large-scale educational assessments: I. NELS-88 mathematics achievement. *American Educational Research Journal*, 32, 525-554.
- Kuperstein, J., & Gentile, C. (2001, October). *Calling students back: Using technology to support engaged learning*. Retrieved October 15, 2001, from http://www.mircosoft.com/education/instruction/articles/miami_engage.asp.
- Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life*. Cambridge: Cambridge University Press.
- Leikin, R., & Zaslavsky, O. (1997). Facilitating student interaction in mathematics in a cooperative learning setting. *Journal for Research in Mathematics Education*, 28, 331-354.
- Levie, H. W., & Dickie, K. E. (1973). The analysis and application of media. In R.M.W. Travers (Ed.), *Second handbook of research on teaching: A project of the American Educational Research Association*. Chicago: Rand McNally, 4-28.
- Lewis, J. D. (1998). How the Internet expands educational options. *Teaching Exceptional Children*, 30(5), 34-41.
- Macnab, D. (2000). Raising standards in mathematics education: Values, vision, and TIMSS. *Educational Studies in Mathematics*, 42, 61-80.
- Main, R. G. (1993). Integrating motivation into the instructional design process. *Educational Technology*, 33(12), 37-41.

- Martin, M. O., (1996). Third International Mathematics and Science Study: An overview. In M.O. Martin & D.L. Kelley (Eds.), *Third International Mathematics and Science Study (TIMSS) technical report, Volume 1: Design and Development* (pp.81-100). Chestnut Hill, MA: Boston College.
- Milken Exchange on Education Technology. (1999). The state of the states: North Carolina. *Education Week on the Web* [On-line]. Retrieved on August 15, 2003, from <http://www.edweek.org/sreports/tc98/states/nc.htm>
- Mislevy, R. J. (1995). What can we learn from international assessments? *Educational Evaluation and Policy Analysis, 17*, 419-437.
- National Center for Education Statistics (NCES). (2000). *Status in brief: Teacher use of computers and the Internet in public schools*. Washington, DC, U. S. Department of Education.
- National Center for Educational Statistics (NCES). (2003). *More about NAEP mathematics*. Accessed October 15, 2003, at <http://nces.ed.gov/govnationsreportcard/mathematics/moreabout.asp>
- Oswald, D. (2002). The PEER program takes flight. *Advance*. Retrieved April 13, 2004, from http://vpr.tamu.edu/advance/2003/outreach_air.php
- Palacio-Cayetanz, J., Kanowith-Klein, S., & Stevens, R. (1999). UCLA's outreach program of science education in the Los Angeles schools. *Academic Medicine, 74*, 348-351.
- Patterson, P. (1999). Accommodating SATs: Revision made fun. *Primary Science Review, 60*, 14-16.

- Peake, J., (2003). *Relationships between student achievement and levels of computer technology integration by Texas agriscience teachers*. Unpublished doctoral dissertation, Texas A&M University, College Station.
- Pellegrino, J.W., & Altman, E.A., (1997). Information technology and teacher preparation: Some critical issues and illustrative solutions. *Peabody Journal of Education*, 72(1), 92-93.
- Pelgrum, W. J. (1992). International research on computers in education. *Prospects*, 22(3), 341-349.
- Piaget, J. (1951). *The child's conception of the world*. London: Routledge & Kegan Paul.
[Original work published 1945.]
- Powers, D.E. & Rock, D.A. (1999). Effects of coaching on SAT1: reasoning test scores, *Journal of Educational Measurement*, 36(2), 93-118.
- Relan, A. (1992). *Motivational strategies in computer-based instruction: Some lessons from theories and models of motivation*. Proceedings of Selected Research and Development Presentations at the Convention of the Association for Educational Communications and Technology (ERIC Document Reproduction Service No. ED348017).
- Resnick, L. & Hall, M. (1998). Learning organizations for sustainable education reform. *Daedalus* 127: 89-118.
- Rochowicz, J. A. (1996). The impact of using computers and calculators on calculus instruction: Various perceptions. *Journal of Computers in Mathematics and Science Teaching*, 15, 423-435.

- Salomon, G., & Gardner, H. (1986). The computer as educator: Lessons from television research. *Educational Researcher*, 15(1), 13-19.
- Schlosser, C. & Anderson, M. (1994). *Distance education: Review of the literature*. Washington, DC: Association for Educational Communications and Technology.
- Scholes, R. & Lain, M. M., (1997). *The effects of test preparation activities on ACT assessment scores*. Paper presented at the Annual Meeting of the American Educational Research Association. Retrieved March 18, 2004 from <http://newfirstsearch.oclc.org>
- Sfondilias, J. S., & Siegel, M. A. (1990). Combining discovery and direct instruction strategies in computer-based teaching of mathematical problem solving. *Journal of Computer-Based Instruction*, 17, 130-134.
- Shelley- Tolbert, C., Conroy, C., & Dailey, A. (2000). The move to agriscience and its impact on teacher education in agriculture. *Journal of Agricultural Education*, 41 (4), 51-61.
- Shepardson, W. (1929). *Agricultural education in the United States*. New York: The Macmillan Company.
- Shinn, G. C., Briers, G. E., Christiansen, J. E., Edwards, M. C., Harlin, J. F., Lawver, D. E., Lindner, J. R., Murphy, T. H., & Parr, B. A. (2003). *Improving student achievement in mathematics: An important role for secondary agricultural education in the 21st century*. Unpublished manuscript, Texas A&M University at College Station.

- Sion, R.T. (1998). The sixth technological revolution shaping today's high school curriculum. *The Educational Forum*, 62(4), 316-322.
- Spitzer, D. R. (1996). Motivation: The neglected factor in instructional design. *Educational Technology*, 36(3), 45-49.
- Sturman, L. (2003). Teaching to the test: Science or intuition? *Educational Research*, 45(3), 261-273.
- Taylor, P. & Mulhall, A. (1997). *Contextualising teaching and learning in rural primary schools: Using agricultural experience*. (Volume 1). Department for International Development Education Paper Serial No. 20. Retrieved February 8, 2003 from <http://www.id21.org/education/4ajd4.html>
- Texas Education Agency. (2003). *TAKS statewide performance results- Spring 2003*. Retrieved March 8, 2004, from <http://www.tea.state.tx.us>
- Thompson, A.D., Simonson, M. R., & Hargrave, C. P. (1996). *Educational technology: A review of research*, (2nd ed.). Ames, IA. College of Education, Iowa State University.
- Thorndike, E. (1969). *Educational psychology*. New York: Arno Press.
- Trotter, A. (1998). *A question of effectiveness*. Retrieved on August 20, 2003 from <http://www.edweek.org/reports/tc98/intro/in-n.htm>
- Weiner, B. (2000). Intrapersonal and interpersonal theories of motivation from attributional perspective. *Educational Psychology Review*, 12, 1-14.

APPENDIX A

IRB PERMISSION LETTER



Office of Research Coordination

Administration and
Special ProgramsAcademy for
Scholarly
Teaching, Mentoring,
and Learning
TechnologiesInstitute for
Scientific ComputationLaboratory Animal
Resources and ResearchMessage and
Learning CenterOffice of
Business Administration

Office of Graduate Studies

Office of Sponsored Programs

Texas A&M University
Research ParkTexas A&M
University

1312 TAMU

1000 Stevenson Building

College Station, Texas

77743-3132

409-254-4348

409-254-2117

January 22, 2003

MEMORANDUM

TO: Larry Johnson
Department of Veterinary Anatomy and Public Health
MS 4458

SUBJECT: Review of IRB Protocol "Integrating Biomedical Environmental Science in Rural 6-8" 2002-553

Approval Date: January 22, 2003 – January 21, 2004

Remarks: Remove the statement "I will benefit from participation by enhancing my knowledge about environmental and rural health and by improving my testing skills," from the student assent form. Also remove the same-related statement from the parental consent form. Revised assent and consent forms must be submitted to the IRB office before data collection may begin.

The Institutional Review Board – Human Subjects in Research, Texas A&M University has reviewed and approved the above referenced protocol. Your study has been approved for one year. As the principal investigator of this study, you assume the following responsibilities:

Renewal: Your protocol must be re-approved each year in order to continue the research. You must also complete the proper renewal forms in order to continue the study after the initial approval period.

Adverse events: Any adverse events or reactions must be reported to the IRB immediately.

Amendments: Any changes to the protocol, such as procedures, consent/assent forms, addition of subjects, or study design must be reported to and approved by the IRB.

Informed Consent/Assent: All subjects should be given a copy of the consent document approved by the IRB for use in your study.

Completion: When the study is complete, you must notify the IRB office and complete the required forms.

Alvin Larke, Jr.
Dr. Alvin Larke, Jr., Chair
Institutional Review Board –
Human Subjects in Research

APPENDIX B**TEACHER TEST FACILITATION INSTRUCTIONS****Pre-Tests:**

1. Provide the students with a copy of the appropriate “Backpack Adventures Series” story one week before testing.
2. Assign a test code number (such as a seating chart number or grade book number) for each student.
 - a. Write the codes on the pre-test booklets.
 - b. Distribute the pre-tests (mathematics or science,) to students in your room.
 - c. Safeguard your list of codes (you will use the same codes on the post-tests).
3. Allow students 15 minutes to complete each pre-test.
 - a. If students complete the questions before the allotted time, encourage them to check their answers.
 - b. Mathematics or science pre-tests: students may use a calculator; please make arrangements for them to have access to a calculator during the test.
4. Once students have completed the pre-tests, collect all pre-test booklets, and store them in a secure place.

Post-Tests:

1. Assign a test code number (such as a seating chart number or grade book number) for each student.
 - a. Write the codes on the post-test booklets.
 - b. Distribute the post-tests (mathematics or science) to students in your room.
 - c. Safeguard your list of codes (you may use the codes to discuss test results with students later).
2. Teachers who use the integrated curricular materials will administer a post-test to students after having completed the lesson plans; please coordinate testing dates with other teachers not using the curricular materials, so that pre- and post-testing occurs on the same (or close to the same) days.
3. Teachers who do not use the curricular materials will administer a post-test to students at approximately the same time as teachers who use the materials.
Once students have completed the post-tests, collect all post-test booklets.

APPENDIX C

HARD RIVER ESCAPE MATHEMATICS PRE-TEST

Backpack Adventures Series

*Hard River
Escape*

Pre-Test Mathematics

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

Mathematics Chart			
Length		Capacity and Volume	
Metric 1 kilometer=1000 meters 1 meter=100 centimeters 1 centimeter=10 millimeters	Customary 1 mile=1760 yards 1 mile=5280 feet 1 yard=3 feet 1 foot=12 inches	Metric 1 liter=1000 milliliters	Customary 1 gallon=4 quarts 1 gallon=128 ounces 1 quart=2 pints 1 pint=2 cups 1 cup=8 ounces
Time		Mass and Weight	
1 year=365 days 1 year=12 months 1 year=52 weeks 1 week=7 days 1 day=24 hours 1 hour=60 minutes 1 minute=60 seconds		Metric 1 kilogram=1000 grams 1 gram=1000 milligrams	Customary 1 ton=2000 pounds 1 pound=16 ounces

Perimeter	Square	$P = 4s$
	Rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	Circle	$C = 2\pi r$ or $C = \pi d$
Surface Area	Circle	$A = \pi r^2$
	Cone (lateral)	$A = \pi rl$
	Cone (total)	$A = \pi rl + \pi r^2$ or $A = \pi r(l + r)$
	Cube	$A = s^3$
	Cylinder (lateral)	$A = 2prh$
	Cylinder (total)	$A = 2\pi rh = 2\pi r^2$ or $A = 2\pi r(h + r)$
	Rectangle	$A = lw$ or $A = bh$
	Sphere	$A = 4\pi r^2$
	Square	$A = s^2$
	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	Triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
Volume	Cone	$V = \frac{1}{3} Bh^*$
	Cube	$V = s^3$
	Cylinder	$V = \pi r^2 h$ or $V = Bh^*$
	Prism	$V = Bh^*$
	Pyramid	$V = \frac{1}{3} Bh^*$
	Rectangular Prism	$V = lwh$ or $V = Bh^*$
	Sphere	$V = \frac{4}{3} \pi r^3$
<i>*B represents the area of the Base of a solid figure.</i>		
Pi	π	$\pi \approx 3.14$ or $\pi \approx \frac{22}{7}$
Pythagorean Theorem	$a^2 + b^2 = c^2$	
Simple Interest Formula	$I = prt$	

1. K.T. saw a frog with 1 back leg and 2 tiny front legs. After weighing the mutated frog, they found that it weighed 4 pounds, 2 ounces, and its back leg was 516 grams. What percent of the frog's body weight is its back leg? (1 lb = 453.5g; 16 oz = 1 lb)
 - a. 25.42%
 - b. 26.77%
 - c. 27.09%
 - d. 27.58%

2. After returning home, K.T. made some calculations and realized that a frog would need to be exposed to 12 rad doses of radiation before it grew an extra leg. If a frog had 8 whole extra legs and half of an extra leg, how much radiation was it exposed to?
 - a. 93.5 rad doses
 - b. 96 rad doses
 - c. 102 rad doses
 - d. 110.5 rad doses

3. The soldiers evacuated everybody within 30km of the accident site. What is the area of the evacuated site in miles? (1 mile = 1.61 km)
 - a. 117.06 mi²
 - b. 272.59 mi²
 - c. 347.08 mi²
 - d. 1090.79 mi²

4. It takes the soldiers 4 hours and 41 minutes to patrol the entire circumference of the zone. How fast are the soldiers going (in hour)?
 - a. 12.5 mph
 - b. 13.27 mph
 - c. 24.99 mph
 - d. 26.54 mph

5. Mercury is a toxic metal that is known to cause mental retardation in babies and damage to the brain. OSHA limits the amount of mercury that can be in water to 0.002mg per liter. Suppose you had an Olympic size swimming pool (50 meters long, 25 meters wide and 2 meters deep) filled with pure water. How many kilograms of mercury would you need to add to the water to reach the 0.002 mg/L limit (1m³ = 1,000L)?
 - a. 0.0025 kg
 - b. 0.005 kg
 - c. 0.025 kg
 - d. 0.5 kg

6. The Chernobyl accident occurred on April 26, 1986. If it is now June 13, 2003, how many days have passed since the accident (assume 365 days a year)?
 - a. 5,887 days
 - b. 5,900 days
 - c. 6,253 days
 - d. 6,278 days



7. Nikolai and K.T. helped the fisherman catch two yellow fish, three brown fish, five blue fish, eight green fish, and four red fish from the Kremenchug Reservoir. If they draw a fish from the holding tank, what is the probability that they will not draw a red fish?
- $5/22$
 - $3/11$
 - $17/22$
 - $9/11$

8. A box of explosives was on sale for \$65, which was 45% off the original price. What was the original price of the explosives?
- \$100
 - \$100.75
 - \$118.18
 - \$144.44

9. Nikolai recorded the amount of rainfall for 2 weeks and 3 days. His results are shown below. What was the mean rainfall in centimeters (1 in. = 2.54 cm)?

- 1.2 cm
- 1.39 cm
- 2.92 cm
- 3.11 cm

Days	Rainfall (inches)
M	1.2
T	0.0
W	3.4
Th	1.1
F	1.6
Sat	0.3
Sun	0.0
M	0.8
T	1.9
W	2.1
Th	1.2
F	1.7
Sat	0.4
Sun	0.1
M	2.5
T	1.8
W	0.7

10. If the ratio of soldiers to refugees in the gigantic armored car is 9 to 4, and there are 144 soldiers present, how many refugees are in the car?
- 11
 - 64
 - 72
 - 124

Workspace Area

APPENDIX D

HARD RIVER ESCAPE MATHEMATICS POST-TEST

Backpack Adventures Series

*Hard River
Escape*

Post-Test Mathematics

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

Mathematics Chart			
Length		Capacity and Volume	
Metric 1 kilometer=1000 meters 1 meter=100 centimeters 1 centimeter=10 millimeters	Customary 1 mile=1760 yards 1 mile=5280 feet 1 yard=3 feet 1 foot=12 inches	Metric 1 liter=1000 milliliters	Customary 1 gallon=4 quarts 1 gallon=128 ounces 1 quart=2 pints 1 pint=2 cups 1 cup=8 ounces
Time		Mass and Weight	
1 year=365 days 1 year=12 months 1 year=52 weeks 1 week=7 days 1 day=24 hours 1 hour=60 minutes 1 minute=60 seconds		Metric 1 kilogram=1000 grams 1 gram=1000 milligrams	Customary 1 ton=2000 pounds 1 pound=16 ounces

Perimeter	Square	$P = 4s$
	Rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	Circle	$C = 2\pi r$ or $C = \pi d$
Surface Area	Circle	$A = \pi r^2$
	Cone (lateral)	$A = \pi r l$
	Cone (total)	$A = \pi r l + \pi r^2$ or $A = \pi r(l + r)$
	Cube	$A = s^3$
	Cylinder (lateral)	$A = 2\pi r h$
	Cylinder (total)	$A = 2\pi r h + 2\pi r^2$ or $A = 2\pi r(h + r)$
	Rectangle	$A = lw$ or $A = bh$
	Sphere	$A = 4\pi r^2$
	Square	$A = s^2$
	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	Triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
Volume	Cone	$V = \frac{1}{3} Bh^*$
	Cube	$V = s^3$
	Cylinder	$V = \pi r^2 h$ or $V = Bh^*$
	Prism	$V = Bh^*$
	Pyramid	$V = \frac{1}{3} Bh^*$
	Rectangular Prism	$V = lwh$ or $V = Bh^*$
	Sphere	$V = \frac{4}{3} \pi r^3$
<i>*B represents the area of the Base of a solid figure.</i>		
Pi	π	$\pi \approx 3.14$ or $\pi \approx \frac{22}{7}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Simple Interest Formula		$I = prt$

- K.T. saw a frog with 3 back legs and 2 fused front legs. After weighing the mutated frog, they found that it weighed 5 pounds, 9 ounces, and its back legs were 879 grams. What percent of the frog's body weight is its back leg? (1 lb = 453.5g; 16 oz = 1 lb)

 - 32.64%
 - 33.85%
 - 34.85%
 - 38.61%
- After returning home, K.T. made some calculations and realized that a frog would need to be exposed to 7 rad doses of radiation before it grew an extra leg. If a frog had 6 whole extra legs and $\frac{3}{4}$ of an extra leg, how much radiation was it exposed to?

 - 42 rad doses
 - 43.75 rad doses
 - 47.25 rad doses
 - 51.33 rad doses
- The soldiers evacuated everybody within 45km of the accident site. What is the area of the evacuated site in miles? (1 mile = 1.61 km)

 - 613.56 mi
 - 1,590.43 mi²
 - 1,649.02 mi²
 - 2,454.27 mi²
- It takes the soldiers 5 hours and 16 minutes entire circumference of the evacuation zone. the soldiers going (in miles per hour)?

 - 18.29 mph
 - 31.74 mph
 - 33.35 mph
 - 34.03 mph
- Mercury is a toxic metal that is known to cause mental retardation in babies and damage to the brain. OSHA limits the amount of mercury that can be in water to 0.002mg per liter. Suppose K.T. swam in a swimming pool that was 35 meters long, 15 meters wide and 1.75 meters deep. How many kilograms of mercury would you need to add to the water to reach the 0.002 mg/L limit ($1\text{m}^3 = 1,000\text{L}$)?

 - 0.00018 kg
 - 0.0018 kg
 - 0.018 kg
 - 0.18 kg



to patrol the
How fast are

6. The Chernobyl accident occurred on April 26, 1986. If it is now September 3, 2001, how many days have passed since the accident (assume 365 days a year)?
- 5,605 days
 - 5,628 days
 - 5,632 days
 - 5,887 days
7. Nikolai and K.T. helped the fisherman catch seven orange fish, two purple spotted fish, four slimy eel-fish, ten blue fish, and five tumor fish from the Kremenchug Reservoir. If they draw a fish from the holding tank, what is the probability that they will draw a tumor fish or an eel-fish?
- $\frac{1}{7}$
 - $\frac{5}{28}$
 - $\frac{9}{28}$
 - $\frac{19}{28}$
8. A crate of bottled spring water was on sale for \$12, which was 15% off the original price. What was the original price of the bottled water?
- \$13.95
 - \$14.12
 - \$16.00
 - \$22.20
9. Nikolai recorded the amount of rainfall for 1 week and 5 days. His results are shown below. What was the mean rainfall in centimeters (1 in. = 2.54 cm)?
- 2.12 cm
 - 2.82 cm
 - 3.06 cm
 - 3.12 cm
10. If the ratio of soldiers to refugees in the huge armored car is 5 to 2, and there are 85 soldiers present, how many refugees are in the car?
- 17
 - 28
 - 31
 - 34

Workspace Area

APPENDIX E

HARD RIVER ESCAPE SCIENCE PRE-TEST

Backpack Adventures Series

*Hard River
Escape*

Pre-Test Science

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

1. Which of the following was NOT a basic health problem in the story?
 - a. Radiation sickness from the Chernobyl nuclear reactor accident
 - b. Frogs with three legs
 - c. Dead fish with tumors on them
 - d. Abnormal young turtles

2. Which of the following is a genetic disorder?
 - a. Abnormal growth on the liver
 - b. Color Blindness
 - c. Wrinkles
 - d. Skin Cancer

3. What are the multiple possible routes of exposure that chemicals could have taken to affect the frogs?
 - a. Air, Water, Skin
 - b. Water, Food, Air
 - c. Water, Dirt, Food
 - d. Radiation, Dirt, Air

4. Why are frogs good environmental monitors?
 - a. They live on land and in the water
 - b. They eat insects which carry lots of diseases
 - c. They have a highly complex metamorphosis
 - d. Both A and C

5. What is a hypothesis?
 - a. A question formed about a subject
 - b. A proven answer to a question
 - c. An experiment
 - d. An educated guess

6. Hypothetical Situation: The Commanche Peak Nuclear Power Plant in Sommerville County, TX had a meltdown on July 30, 2003. Two days later, regular tests of Lake Sommerville reported findings of frogs with no toes. These frogs could jump and swim but were much slower than the normal frogs. The tests also showed very high levels of industrial wastes and pesticide runoff from local farms. A county wide cleanup of both the power plant and Lake Sommerville occurred on August 30, 2003. On January 30, 2004, Lake Sommerville was tested again and all frogs had the correct number of toes. There was no evidence of any remaining nuclear, industrial, or farm wastes. Using the information above, what is the cause of the abnormality in the frogs?
 - a. Radiation from the power plant meltdown
 - b. Pollution from industrial and farm wastes
 - c. Natural birth defects
 - d. Cannot tell from the information given

7. What is a sentinel animal?
- An animal that is very susceptible to pollutants
 - An animal that is used to find chemicals and/or drugs
 - An animal that can sustain large amounts of radiation
 - None of the above
8. _____ is an electromagnetic wave in which energy can travel.
- Resonance
 - Solar heat
 - Radiation
 - Both A and B
9. Which is NOT a good way to rule out radiation as a possible mutation source in the frogs?
- See if other frogs have the same mutations in parts of the world without radiation sources
 - Research to see if there were abnormal frogs before the radiation incident occurred
 - Expose experimental frogs to pollution and radiation and see if the mutations occur
 - All of the above are good ways to rule out radiation as a possible mutation source
10. Which of the following is a hypothesis?
- What is the cause of the tumors on the fish?
 - Tumors are formed when chemicals damage DNA and cells begin to replicate out of control.
 - The chemicals in the river caused the tumors to grow.
 - The chemicals will be given to one group of fish for a period of time, while another group will receive a harmless chemical for the same period of time.

Workspace Area

APPENDIX F

HARD RIVER ESCAPE SCIENCE POST-TEST

Backpack Adventures Series

*Hard River
Escape*

Post-Test Science

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

1. Which of the following was a basic health problem in the story?
 - a. Fish with missing fins
 - b. Frogs with two legs
 - c. Dead fish with tumors on them
 - d. A sickness caused by a parasite released from the Chernobyl accident

2. Which of the following is a genetic disorder?
 - a. Atherosclerosis (Plaque in the Arteries)
 - b. Obesity
 - c. Down Syndrome (Trisomy 21)
 - d. Lung Cancer

3. _____ is/are the route(s) of exposure that the chemicals could have taken to affect the frogs?
 - a. Air
 - b. Water
 - c. Skin
 - d. All of the Above

4. Their highly complex metamorphosis and ability to live on land and water allows the frogs to be good _____?
 - a. at hiding from predators
 - b. environmental monitors
 - c. adaptors to change
 - d. animals for lab experiments

5. An educated guess or a theory is another word for a/an _____?
 - a. investigation
 - b. objective
 - c. tentative practice
 - d. hypothesis

6. Hypothetical Situation: One morning Tracy woke up and decided to grab her daily cup of coffee. At the local coffee shop she picked up the newspaper and began to read about a local resident who sued the Copologists Industry Corp. for illegally leaking chemicals into the town's aquifer. Tracy was immediately alarmed by this news considering she had been drinking well-water from that aquifer for the past 15 years. She vowed to call her lawyer right after her daily tanning at the local tanning saloon. Her lawyer told her that the company stopped leaking the chemicals over 8 years ago and that the water was pure ever since. No longer worried about the chemical issue, Tracy began planning how she would tell her husband that she was two months pregnant. Seven months later, Tracy is devastated to find out that her new daughter has a birth defect and one of her ovaries is cancerous. What is the cause of these deformities?
 - a. Contaminated well water that she drank for seven years
 - b. UV radiation from the tanning bed
 - c. Both A and B
 - d. Cannot tell from the information given

7. A/An _____ is an animal that is very susceptible to pollutants in the air, water, or on land?
- sentinel
 - whistle blower
 - arboreal alarm
 - monitor
8. What is radiation?
- A chemical
 - A pollutant
 - An electromagnetic wave
 - Both A and B
9. Which is NOT a good way to rule out radiation as a possible mutation source in the frogs?
- Have two sets of frogs and expose one set to pollution and the other set to radiation and pollution.
 - Find frogs that are abnormal and that were already mature before the radiation accident occurred.
 - Compare the radiation-exposed frogs with those that did not have radiation but that do live in the same climate as the radiation exposed frogs.
 - All of the above are good ways to rule out radiation as a possible mutation source.
10. Which of the following is a hypothesis?
- The abnormal growths on the fish lead us to believe that they are the reason for the fish die-off.
 - The chemicals will be given to one group of fish for a period of time to cause tumor growth, while another group will receive a harmless chemical for the same period of time.
 - Why did the fish in the river die?
 - Abnormal growths use a lot of energy and blood, preventing the organs from working properly, and killing the fish.

Workspace Area

APPENDIX G

TUT'S REVENGE MATHEMATICS PRE-TEST

Backpack Adventures Series

*Tut's
Revenge*

Pre-Test Mathematics

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

1. K.T., Travis and Connie are in Egypt for 3 hours. If each person needs to drink 0.75 Liters an hour because of the heat, then how many total water bottles do they need to bring with them? One water bottle is 0.5 Liters.
 - a. 4 bottles
 - b. 5 bottles
 - c. 9 bottles
 - d. 14 bottles

2. The Treasury Chamber in Tut's Tomb is a rectangular prism. What is the volume of the Treasury Chamber, given the dimensions below?
Height: 3.5 meters Length: 9.0 meters Width: 4.0 meters
 - a. 31.5 m^3
 - b. 126 m^3
 - c. 144 m^3
 - d. 283.5 m^3

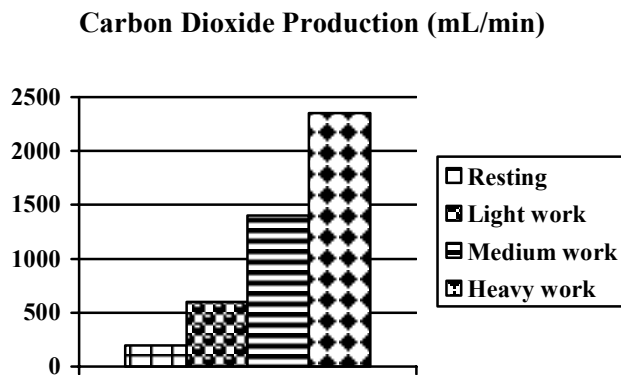
3. If the volume of the Annex is 18.48 m^3 , and if 1 cubic meter of volume holds 1,000 liters of air, how much air is in this room?
 - a. 1,848 L
 - b. 18,480 L
 - c. 184,800 L
 - d. 1,848,000 L

4. If the coffin in the Burial Chamber is 2 meters long, 1.5 meters wide, and 0.75 meters tall, and the Burial Chamber is 4.5 meters long, 2.75 meters wide, and 2.4 meters tall, what percent of the Burial Chamber does the coffin take up?
 - a. 1.82%
 - b. 6.57%
 - c. 7.58%
 - d. 15.15%

5. When Nefah came running around the corner and collided with the Backpack Club, she stumbled forward about 3 feet. If Nefah is 4 feet and 2 inches tall, what percentage of her height did she fall forward?
 - a. 69%
 - b. 72%
 - c. 75%
 - d. 78%

6. The Backpack Club got to ride in a chariot on their way to the Valley of the Kings, which was 13 miles away. If they got there in a speedy 35 minutes, how fast was the chariot going (in miles per hour)?
- 7.58 mph
 - 11.14 mph
 - 22.29 mph
 - 25.71 mph
7. After returning from Egypt, K.T. felt a strong craving for the cone-shaped bread Nefah gave them. They had 15 dollars, and the cost of a dozen loaves of bread is 24 Egyptian pounds. How many whole loaves of bread can K.T. buy? (1 U.S. dollar = 4.675 Egyptian pounds)
- 14
 - 24
 - 35
 - 38

For questions 8 and 9, please refer to the following graph:



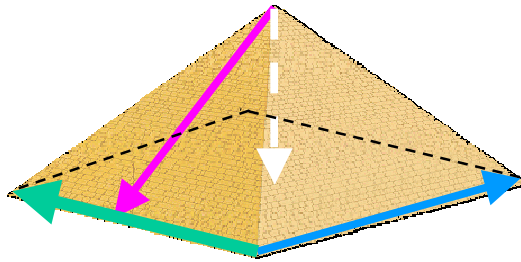
8. How much carbon dioxide would a worker produce (in liters) if he was performing medium work for 5 hours?
- 84 L
 - 420 L
 - 467 L
 - 7000 L

9. After doing heavy work for 4 hours, a worker experiences some discomfort and feels a little sick. Breathing a mixture of air in which the fraction of carbon dioxide is greater than $1/100$ will cause some discomfort and possibly sickness. What is the volume of air in the room that the worker has been in for the past 4 hours?
- 14,400 L
 - 33,600 L
 - 42,300 L
 - 57,600 L

10. The Great Pyramid resembles the pyramid shown below. Calculate the surface area of the pyramid (include the area of the base of the pyramid), given the following values:

Length: 230m
Slant Height: 420m

- $101,200 \text{ m}^2$
- $193,200 \text{ m}^2$
- $246,100 \text{ m}^2$
- $289,800 \text{ m}^2$



Workspace Area

APPENDIX H

TUT'S REVENGE MATHEMATICS POST-TEST

Backpack Adventures Series

*Tut's
Revenge*

Post-Test Mathematics

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

1. K.T., Travis and Connie are in Egypt for 5.5 hours. If each person needs to drink 0.90 Liters an hour because of the heat, then how many total water bottles do they need to bring with them? One water bottle is 0.5 Liters.
 - a. 5 bottles
 - b. 10 bottles
 - c. 15 bottles
 - d. 30 bottles

2. The Annex in Tut's Tomb is a rectangular prism. What is the volume of the Annex, given the dimensions below?
Height: 2.2 meters Length: 2.0 meters Width: 4.2 meters
 - a. 4.62 m^3
 - b. 6.16 m^3
 - c. 18.48 m^3
 - d. 19.36 m^3

3. If the volume of the Burial Chamber is 485.21 m^3 , and if 1 cubic meter of volume holds 1,000 liters of air, how much air is in this room?
 - a. 485.21 L
 - b. 4,852.1 L
 - c. 48,521 L
 - d. 485,210 L

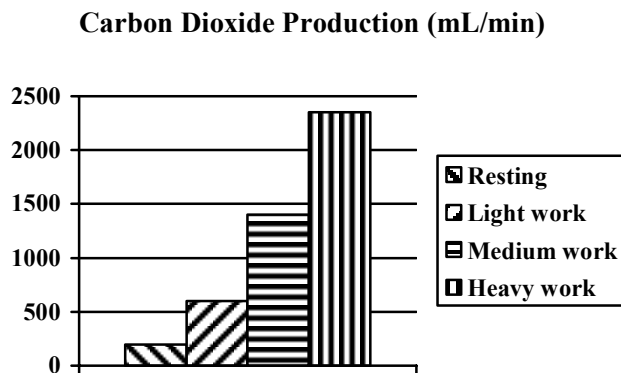
4. If a treasure box in the Treasury is 0.5 meters long, 2.8 meters wide, and 1.75 meters tall, and the Treasury is 2.3 meters long, 4.7 meters wide, and 3.5 meters tall, what percent of the Treasury does the coffin take up?
 - a. 3.7%
 - b. 6.48%
 - c. 7.72%
 - d. 92.7%

5. When Nefah came running around the corner and collided with the Backpack Club, she stumbled forward about 1 foot and 7 inches. If Nefah is 5 feet and 4 inches tall, what percentage of her height did she fall forward?
 - a. 20%
 - b. 30%
 - c. 38%
 - d. 89%

6. The Backpack Club got to ride in a chariot on their way to the Valley of the Kings, which was 18 miles away. If they got there in 1 hour 20 minutes, how fast was the chariot going (in miles per hour)?
 - a. 11.25 mph
 - b. 12 mph
 - c. 13.5 mph
 - d. 24 mph

7. After returning from Egypt, the K.T. felt a strong craving for Egyptian figs. They had 5 dollars, and the cost of a dozen figs is 16 Egyptian pounds. How many whole figs can K.T. buy? (1 U.S. dollar = 4.675 Egyptian pounds)
- 8
 - 11
 - 15
 - 17

For questions 8 and 9, please refer to the following graph:



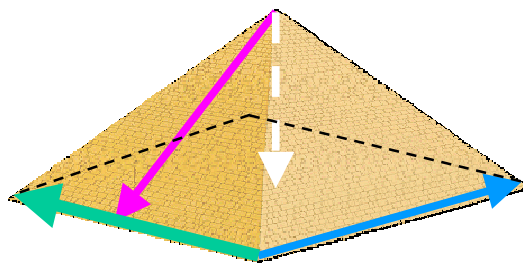
8. How much carbon dioxide would a worker produce (in liters) if he was performing heavy work for 8 hours?
- 18.8 L
 - 141 L
 - 204.26 L
 - 1,128 L
9. After doing heavy work for 2 hours, a worker experiences some discomfort and feels a little sick. Breathing a mixture of air in which the fraction of carbon dioxide is greater than $1/100$ will cause some discomfort and possibly sickness. What is the volume of air has been in the room for the past 2 hours?
- 3,000 L
 - 7,200 L
 - 16,800 L
 - 28,800 L

10. The Great Pyramid resembles the pyramid shown below. Calculate the surface area of the pyramid (include the base of the pyramid), given the following values:

Length: 125m

Slant Height: 385m

- a. $46,875 \text{ m}^2$
- b. $111,875 \text{ m}^2$
- c. $120,312.5 \text{ m}^2$
- d. $208,125 \text{ m}^2$



Workspace Area

APPENDIX I

TUT'S REVENGE SCIENCE PRE-TEST

Backpack Adventures Series

*Tut's
Revenge*

Pre-Test Science

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

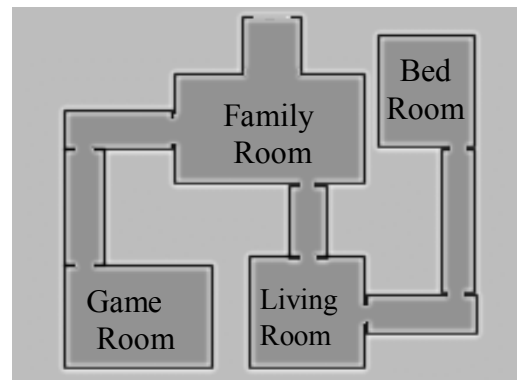
1. If many people are sick and you notice that everyone lives in close housing, this might suggest...
 - a. ...that a lack of refrigeration is causing a food-borne illness.
 - b. ...that an insect-borne disease is causing the sickness.
 - c. ...that the sickness is from contamination of the Nile River.
 - d. ...that an infectious disease is causing the sickness.

2. Which of the following is a hypothesis?
 - a. A change in the workers' conditions will decrease the number of sick workers.
 - b. Why are the workers getting sick?
 - c. The workers live in tight housing and their water source is contaminated.
 - d. After cleaning up the Nile, the workers began to feel better.

3. Which of the rooms has the worst ventilation?
 - a. Family Room
 - b. Game Room
 - c. Living Room
 - d. Bed Room

4. If you and your family were exercising in the family room, what would happen to the concentration of carbon dioxide in the room?
 - a. Increase
 - b. Decrease
 - c. Stay the same
 - d. Can't tell from the information given

5. Which of the following is not a serious consequence of vomiting and diarrhea?
 - a. Loss of Sodium ions
 - b. Loss of Protein
 - c. Loss of Chloride ions
 - d. Loss of Water



6. In anatomy, structure follows function. Which of the following animals would be able to vomit most easily?

a.



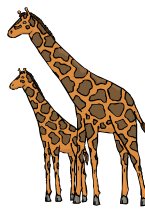
c.



b.



d.

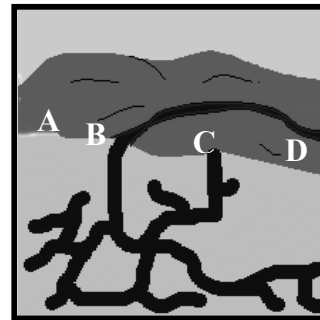


7. Which temperature and humidity would be best for the growth of bacteria?

- 102°F; 83% humidity
- 102°F; 4% humidity
- 77°F; 90% humidity
- 77°F; 15% humidity

8. Which place is the best place to put a privy?

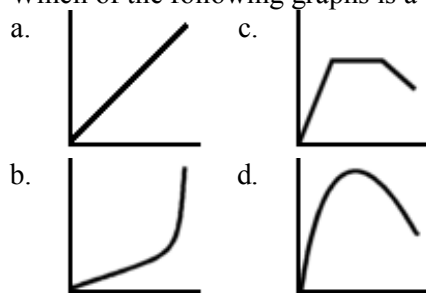
- A.
- B.
- C.
- D.



9. Which of the following foods that the Egyptians ate was least likely to support bacterial growth?

- Bread
- Meat
- Milk
- All of these are good substances for bacterial growth.

10. Which of the following graphs is a typical growth curve for bacteria and parasites?



Workspace Area

APPENDIX J

TUT'S REVENGE SCIENCE POST-TEST

Backpack Adventures Series

*Tut's
Revenge*

Post-Test Science

Teacher Name: _____

School Name: _____

Student Code: _____

*Produced through the Partnership for
Environmental Education and Rural Health,
Texas A&M University*

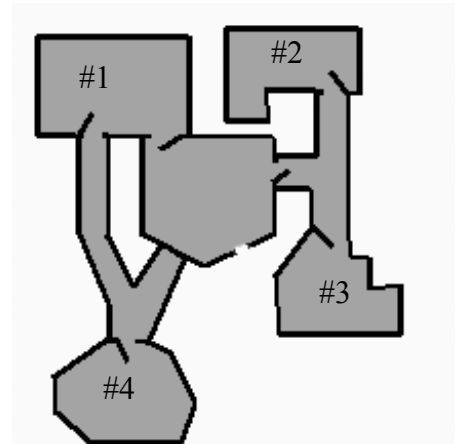
Backpack Adventure Series First Printing, June 2003

Copyright 2003 © Partnership for Environmental Education and Rural Health.

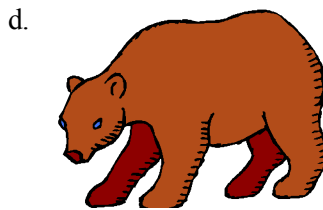
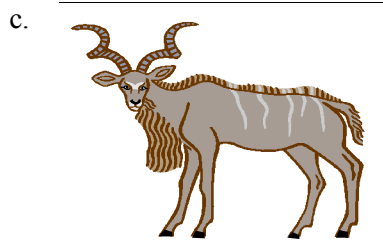
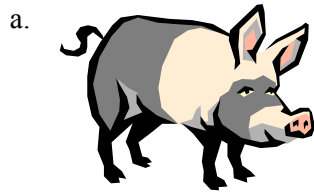
Partnership for Environmental Education and Rural Health (<http://peer.tamu.edu>), Texas A&M University

Funded by the National Institute of Environmental Health Sciences (NIEHS) (<http://www.niehs.nih.gov>)

11. If many people are getting sick and you notice that there is a lot of stagnant water around the village, this might suggest that...
- ...that an infectious disease is causing the sickness.
 - ...that the sickness is from contamination of the Nile River.
 - ...that an insect-borne disease is causing the sickness.
 - ...that a lack of refrigeration is causing a food-borne illness.
12. Which of the following is a hypothesis?
- Where do placental and marsupial mammals diverge in evolutionary history?
 - Placental mammals are classified as metatheria, while marsupials are classified as eutheria.
 - Judging by preliminary evidence, the two mammalian forms seem to have diverged in the Cretaceous period.
 - Careful examination of skeletons, rock structure, and vegetation, we can safely say that the two lineages separated during the Cenozoic period.
13. Which of the rooms has the worst ventilation?
- #1
 - #2
 - #3
 - #4
14. If you and your family were exercising in room #1 with the doors closed, what would happen to the concentration of oxygen in the room?
- Increase
 - Decrease
 - Stay the same
 - Can't tell from the information given
15. Which of the following is not a serious consequence of vomiting and diarrhea?
- Loss of Water
 - Loss of Enzymes
 - Loss of Electrolytes
 - All of these are serious consequences of vomiting and diarrhea

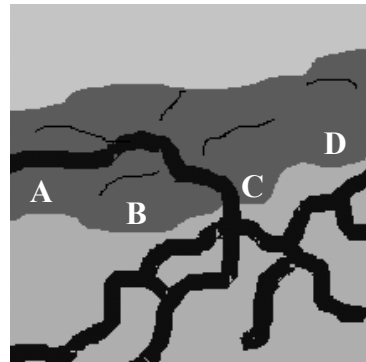


16. In anatomy, structure follows function. Which of the following animals would be able to run the fastest?



17. Which temperature and humidity would be best for the growth of bacteria?

- 100°F; 4% humidity
- 100°F; 88% humidity
- 77°F; 98% humidity
- 72°F; 20% humidity



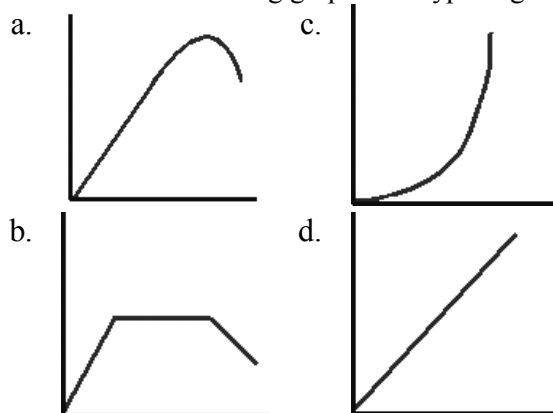
18. Which place is the best place to put a privy?

- A.
- B.
- C.
- D.

19. Which of the following foods that the Egyptians ate was least likely to support bacterial growth?

- Wheat
- Cheese
- Meat
- All of these are good substances for bacterial growth.

20. Which of the following graphs is a typical growth curve for bacteria and parasites?



Workspace Area

VITA

Monika Raquel Trevino-Anderson

21403 Golden Dove Dr.
 Spring, TX 77388
 (281) 651-1751
 trevino_anderson@hotmail.com

EDUCATION

- | | |
|------|--|
| 2004 | Master of Science, <i>Agricultural Education</i> ;
Emphasis in <i>Leadership Education</i>
Texas A&M University, College Station, TX |
| 2002 | Bachelor of Science,
Major: <i>Animal Science</i> Minor: <i>Secondary Education</i>
Sam Houston State University, Huntsville, TX |

HONORS

- | | |
|------------|--|
| 2004 | Phi Kappa Phi, Interdisciplinary Honor Society, TAMU |
| 2001 | Kappa Delta Pi, Education Honor Society, SHSU |
| 2001- 2002 | Delta Tau Alpha, Agricultural Honor Society, SHSU |

CERTIFICATIONS

Texas Teacher Certified in Vocational Agriculture, Secondary
Texas Teacher Certified in Elementary Comprehensive, Elementary