EVALUATING THE EFFECTIVENESS OF DOING MATHEMATICS WARM-UP PROBLEMS WITH AN AGRICULTURAL CONTEXT ON IMPROVING MATHEMATICS PERFORMANCE

A Dissertation

by

MARY HELEN JASEK

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

DOCTOR OF PHILOSOPHY

December 2005

Major Subject: Agricultural Education

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Approved by:

Chair of Committee,	Gary Briers
Committee Members,	Julie Harlin
	Tim Murphy
	Christine Stanley
Head of Department,	Chris Townsend

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ABSTRACT

Evaluating the Effectiveness of Doing Mathematics Warm-up
Problems with an Agricultural Context on Improving
Mathematics Performance. (December 2005)

Mary Helen Jasek, B.S., Texas A&M University;
M.Ed., Texas A&M University
Chair of Advisory Committee: Dr. Gary Briers

The purpose of this study was to evaluate one instructional activity that could be used by agricultural science teachers to improve math performance of students, grades 7-12. The treatment group (11 schools, 218 students) used math warm-up problems that coincided with topics covered in Agriscience 101, while the control group (13 schools, 170 students) did not use contextual warm-up problems. Both groups were tested with a 30-item word problem exam. Students and teachers in each group were asked questions regarding demographics. Students and teachers in the treatment group were also asked questions related to their perceptions of the activity and TAKS-related materials. The results of the study showed no statistically significant difference in the performance of the groups. The scores for schools in the treatment group had a mean of 18.95 (SD 4.33), while the scores for schools in the control group had a mean of 20.14 (SD 2.35). Hispanic students in the treatment group outperformed all other subgroups in both experimental groups. A majority of students in the treatment group perceived the difficulty level of the warm-up problems as “neutral” (42.2%) or “easy” (29.9%) and did not enjoy doing the warm-up problems (71.8%). Over 40% of the students in the treatment group believed that the warm-up problems were “absolutely” (4.9%) or “probably” (36.8%) beneficial for improving their math skills. Teachers in the treatment group perceived their students’ attitudes about doing the warm-up problems as favorable (40%) or indifferent (40%) and all perceived the warm-up problems as being “very beneficial (33.3%) or “beneficial” (66.6%). Furthermore, teachers were almost unanimous in expressing their desire for more TAKS-related materials based on an agricultural context. In summary, this study showed that the warm-up problems activity did not significantly improve math performance overall, but seemed to have some benefits for Hispanic students.

DEDICATION

To my parents, Helen and Leonard D. Jasek (deceased),
who always encouraged educational excellence for all of their children.

ACKNOWLEDGMENTS

It is with sincerity and deep appreciation that I acknowledge the numerous individuals who made it possible for me to accomplish this task. Without the love, support, and encouragement of so many, I would not have made it through this challenging experience.

To my mother, Helen Jasek, I want to say thank you for the love and support over the last forty-two years. Your faith and ability to raise nine kids without ever letting us know the difficulties that go with the job are an inspiration to me. Our large, loving family owes you much for your endless labors of love. Thank You!

My father, Leonard D. Jasek, passed away during the second year of my doctoral program. It has been tremendously difficult to continue this task in the wake of his absence, but he is the reason I would never give up. My father had to leave school during the tenth grade to go to work so that his family could survive the difficult times of the early 1940s, but he never failed to encourage his children to excel in education. Working side by side with my father on farm chores, I learned valuable lessons, including that if I'm going to do something, I had better do it right. I hope that with the completion of this dissertation, I can make my father as proud of me as I am of him. I miss him dearly and thank him from the bottom of my heart for the lessons he taught me.

My brothers and sisters have always been there to lend their support and make sure that my feet didn't get too high off the ground. To Debbie, Leonard, Andy, Nancy, Jennifer, Barbara, Lisa, and John (deceased), I say thank you for the life we shared growing up, the continued closeness, and the support you've given me. It would be a

huge mistake to not mention my three wonderful brothers-in-law, Steve, Victor, and Brent, who are as dear to me as my own family and who are always there to help me out.

Though I have no children of my own, I lay claim to the precious gifts from God, my nieces and nephews. To Amanda, Travis, Lori, Brian, Mary Katherine, Stephen, Laura, Leonard, Bruce, and Blake, I say thank you for the joys you bring to life and for the love and adventures you've shared with me.

For nearly twenty-five years, I have had the privilege of knowing and sharing a friendship with one of the best "teachers" in the world. Dr. Gary Briers has served as my doctoral committee chair, mentor, and teacher educator, but most importantly he has been a family friend. When interviewing at another university for a graduate assistantship, I told the interviewer that my goal was to be like Dr. Briers. The interviewer agreed with me that it was a lofty goal which he also shared. Although I may never achieve the level of brilliance as a researcher that Dr. Briers maintains, I would consider myself successful to make it half-way there. Dr. Briers, I thank you and your lovely wife, Sandra, for the years of friendship and mentorship.

I also owe a great deal of gratitude to Dr. Glen Shinn and my committee members, Dr. Tim Murphy, Dr. Julie Harlin and Dr. Christine Stanley. Dr. Shinn's national leadership in promoting academic excellence through agricultural education inspired me to change the direction of my research to focus on improving mathematics performance. Dr. Murphy was always willing to step in and help me work through situations when Dr. Briers was not available. Dr. Julie Harlin gave me the opportunity to work with her and learn how to develop a good student teaching program. I also appreciate her willingness to step in and take the place of Dr. Shinn on my committee when he was out of country. Dr. Stanley endured the brunt of my coursework and inspired me to work with the Center for Teaching Excellence on programs for graduate teaching assistants, for which I am ever grateful. To each of you, Dr. Shinn, Dr. Murphy, Dr. Harlin and Dr. Stanley, I say thank you for the knowledge you shared, advice you gave, and time you committed.

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Finally, I acknowledge and say thank you to my fellow agricultural science teachers and students who have supported and inspired me to pursue this doctoral degree. Special thanks goes to Terry Hausenfluck, my teaching partner at Bryan High School, and the twenty-four agriscience teachers and their students who volunteered for this research project.

Thank you to all who have touched my life – professionally and personally – may God bless you.

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CHAPTER I

INTRODUCTION

Opening Statement

From 1995 – 2005, national statements were made concerning student performance in mathematics and science. These statements come from several areas of our society including government entities and corporate associations. These statements resulted in directives and mandates that affected not only mathematics and science education, but all other areas of education, including agricultural education.

President Bill Clinton issued a Presidential directive on March 6, 1997, requiring the formation of an interagency group "to assist states and local school systems in preparing students to meet challenging mathematics standards in eighth grade, and for involving the mathematical, scientific, and technical communities in support of those efforts" (U.S. Department of Education-National Science Foundation, 1998, p. 1). One of the recommendations specified by the directive included strategies to "motivate students to help them understand how mathematical concepts are applied in today's global workplace" (U. S. Department of Education-National Science Foundation, 1998, p. 1).

The National Science Board, in its July 28, 1998, statement *Failing Our Children: Implications of the Third International Mathematics and Science Study*, urged "all stakeholders in our vast grass-roots system of K-12 education to develop a nation-wide consensus for a common core of knowledge and competency in mathematics and

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This dissertation follows the style of the *Journal of Agricultural Education*.

science” (National Science Foundation, 1998, p. 2).

Both the National Alliance of Business and the Business Coalition for Educational Reform presented concerns about student achievement in math and science. “While it is critical that students master a range of academic subjects, math and science are increasingly vital to success beyond the classroom in an increasingly technological society” (Business Coalition for Education Reform, n.d., p. 1; National Alliance of Business, n.d., p. 1).

The impetus behind these statements was mainly the results of the Third International Mathematics and Science Study (TIMSS), which showed American students performing below their peers from other countries in mathematics and science. Three statements (President Clinton’s directive, the National Science Board, and the joint National Alliance of Business and the Business Coalition for Educational Reform) referenced TIMSS results as the cause for their concern.

From the National Commission on Mathematics and Science Teaching, we heard, “Recent reports of the performance of our country’s students from both ...TIMSS and the National Assessment of Educational Progress echo a dismal message of lackluster performance, now three decades old; it’s time the nation heeded it – before it’s too late” (National Commission on Mathematics and Science Teaching for the 21st Century, 2000, p. 7). John Glenn, who chaired the commission, wrote in a letter dated September 27, 2000, to Richard Riley, then Secretary of Education, “…if they (issues and concerns) are ignored, our children and our nation will soon pay the high price that accompanies apathy” (Glenn, 2000, p. 2).

TIMSS was an international comparative study conducted by the International Association for the Evaluation of Educational Achievement. More than forty countries and more than half a million students were involved in TIMSS testing, which occurred at five grade levels: third, fourth, seventh, eighth, and final year of secondary school. The United States ranked 19th out of 21 countries in mathematics literacy and scored significantly lower than the international average (Third International Mathematic and Science Study [TIMSS] – 1995, 1998).

On January 8, 2002, sweeping changes in education became law when President George W. Bush signed the *No Child Left Behind Act of 2001*. Included in the law were requirements that every state develop standards for educating students in math, reading, and science and then test students' progress towards achievement of those standards (United States Department of Education, *No Child Left Behind*, 2002).

In Texas, an accountability system had been in place since 1993. Indeed, with George W. Bush as Governor of Texas from 1994 to 2000, Texas could be considered as the birthplace of the "No Child Left Behind" legislation (Achieve, Inc. Policy Review, 2002). Currently (2005), students in Texas are tested each year by TAKS, Texas Assessment of Knowledge and Skills, which is based on TEKS, Texas Essential Knowledge and Skills, standards.

Implementation of accountability systems in Texas, with the Texas Assessment of Knowledge and Skills, and across the United States with the *No Child Left Behind Act*, emphasizes the importance of improved performance of students in math and other academic areas. All educators have a stake in bettering students' knowledge and understanding of academic skills.

This study's focus was to determine if one classroom practice, solving warm-up problems in a contextual area, was a successful means of improving students' math performance. According to the National Research Council (2002), one of the underlying principles of human learning put forth by scientists over the last forty years is that of situated learning.

Statement of the Problem

Math performance by students in the United States on TIMSS and other educational evaluations has declined. Spurred on by the results of TIMSS and public statements, state and national governments have legislated accountability systems based on students' performance in academics, including mathematics.

Because of "high stakes" testing, teachers in all areas of curricula are held responsible for student performance by their school administration, community, and state. In Texas, the Professional Development Appraisal System, an instrument used by school administrators to evaluate teachers, contains criteria related to TAKS testing.

It is the responsibility of all teachers, including agricultural science teachers, to do their part to improve student academic performance. A dilemma that agricultural science teachers face is finding ways to incorporate mathematics standards into classroom instruction without detracting from the agricultural science curriculum.

Purpose, Goals, and Objectives

The purpose of this study was to determine whether student performance on mathematics tests improved by having students practice solving mathematical problems based on topics taught in agricultural science classes.

Whereas agricultural science classes are elective courses (not specifically required, but selected by students), in most cases, students choose to enroll in these courses because of their interests. Using agricultural science as an area of interest for students enrolled, this study exposed students to mathematical problems based on their contextual interest. The educational publication *Mathematics Problems Teachers Guide: Introduction to World Agricultural Science and Technology* (Jasek, 2000) was used as the source for the math warm-up problems.

The goals of this contextual math practice were to improve student performance on mathematics tests and to provide agricultural science teachers with an instructional activity that incorporates practice of mathematical standards within the agricultural science curriculum.

Three objectives were established to achieve the purpose and goal of this study. The first objective was to measure differences in students' mathematical performance based on the use or non-use of math warm-up problems in the agriscience course *Introduction to World Agricultural Science and Technology* (AGSC 101). The second objective was to determine how students viewed the difficulty, enjoyment, and usefulness of math warm-up problems. The third objective was to determine agricultural science teachers' attitudes about and desires for academic standards-based instructional materials with an agricultural science context.

Significance of Study

According to the National Research Council (2002), “Forty-nine states have developed standards and curriculum frameworks in mathematics and science. All 50 states test their students and 27 states hold schools accountable for results” (p. 3-4).

The *No Child Left Behind Act of 2001* introduced a system of accountability that requires all states to develop academic standards, including mathematics standards, and test students for achievement of those standards. Schools’ performance would be publicly reported and schools failing to make adequate yearly progress would be held accountable (U. S. Department of Education, *No Child Left Behind*, 2002).

As previously mentioned, Texas has had an accountability system in place since 1993 and has been standards-testing since 1991. The Texas Assessment of Academic Skills (TAAS) involved criterion-referenced testing based on academic skills, *Essential Elements*, in math, reading, and writing. Students were tested at grades 3, 5, 7, 9 and 11. Prior to TAAS, student testing covered basic or minimal skills, including the TABS test (1979-1983) and the TEAMS test (1984-1989) (Texas Education Agency, *Timeline of Testing in Texas*, n.d.).

The new accountability system legislated in 1993 rated campuses and districts on TAAS performance and required students to pass TAAS in order to graduate. The current testing and accountability system in Texas came about through major changes with the development of the Texas Assessment of Knowledge and Skills, or TAKS, which began in 1999, and was based on new standards called TEKS, Texas Essential Knowledge and Skills (Texas Education Agency, *Timeline of Testing in Texas*, n.d.).

To further emphasize the value placed on students' achievements of standards, Texas uses a teacher appraisal system that contains criteria related to TAKS testing to evaluate teacher performance. All Texas teachers are evaluated by school administrators on their efforts for improving students' performance in mathematics as well as other academic areas on which testing standards are based.

How, then, are agricultural science teachers in Texas and across the United States going to prove to administrators, community members, and state and national legislators that they are doing their part to prepare students to achieve in the academic world of standards-based testing?

This study examined a simple method of improving students' performance in mathematics through contextual applications of math skills in agricultural science classes. Additionally, identifying students' and teachers' views about using warm-up problems and other standards-based activities for instruction in agricultural science classes would help determine if further development of such materials was necessary.

CHAPTER II

REVIEW OF LITERATURE

Student Achievement in Mathematics

When the National Commission on Excellence in Education published the 1983 report *A Nation at Risk*, national and state legislatures were moved to reform education. The general theme for the recommendations made by the commission was "… that more should be demanded of teachers, students, and administrators, and that basic subjects and cognitive skills should be reemphasized" (National Research Council, 1988, p. 60).

There were numerous "Indicators of Risk" that the National Commission on Excellence in Education observed in literacy, mathematics, and science performance. The alarming factors that the commission cited related to mathematics performance included the following:

> - Average achievement of high school students on most standardized tests is now lower than 26 years ago when Sputnik was launched.
> - The College Board's Scholastic Aptitude Tests (SAT) demonstrate a virtually unbroken decline from 1963 to 1980. …average mathematics scores dropped nearly 40 points.
> - Many 17-year-olds do not possess the "higher order" intellectual skills we should expect of them…only one-third can solve mathematics problems requiring several steps.
> - Between 1975 and 1980, remedial mathematics courses in public 4-year colleges increased by 72 percent and now constitute one-quarter of all mathematics courses taught in those institutions. (U. S. Department of Education, National Commission on Excellence in Education, 1983, p. 2-3)

Thirteen years after the publication of *A Nation at Risk*, the International Association for the Evaluation of Educational Achievement (IEA) released its results of the 1995

TIMSS. Once more, alarms were sounded as students in the United States performed below international averages in both mathematics and science.

With an international average mean achievement score of 500 and countries like Netherlands, Sweden, and Denmark scoring highs of 560, 552, and 547, respectively, the United States score of 461 looked dismal for mathematics achievement at the final-year grade level (Third International Mathematics and Science Study – 1995 Highlights, 1998). Scores for achievement in advanced mathematics of the United States' students (mean of 442) ranked 15 among the 16 countries testing (501 international average) (TIMSS 1995, 1998).

In 1999, a repeat of the Third International Mathematical and Science Study was conducted. It provided an assessment of eighth grade students and revealed trends of performance for those countries that participated in 1995. Of the 38 countries participating, the United States ranked nineteenth in mathematics. Although the United States scored significantly higher than the international average (502 versus 487), when comparing the United States to those countries that tested in 1995, the U. S. scored below the international average (502 versus 521) (TIMSS-1999, 2000).

The *Condition of Education 2002*, a report by the National Center for Educational Statistics (NCES), confirmed the dismal results of the international comparisons between eighth-grade students from the U. S. and the other 37 countries. NCES reported that there was no statistically significant change in the performance of U. S. eighth-graders in mathematics from 1995 to 1999. Furthermore, when comparing the mathematical scores, "U.S. students' performance decreased relative to the international average of the

17 countries, from the 4th grade in 1995 to the 8th grade in 1999" (U. S. Department of Education, National Center for Educational Statistics [NCES], 2002, p. 60).

Arthur Eisenkraft, president of the National Science Teachers Association in Arlington Virginia, noted in a February, 2001, commentary for *Education Week* that,

> These results are particularly disappointing because four years ago, many of these American 8th graders – then 4th graders – were outperformed only by Korea in science and ranked above the international average in math. The hope was that this group represented the early results of reform efforts and would continue to do well as they progressed through school. But the fact is, students from many other countries are learning at a faster rate and are leaving America's students far behind. (2001, p. 1)

Following the publication of *A Nation at Risk*, educational reforms were implemented across the nation. Though there did not seem to be any positive impact when looking at the results of the 1995 and 1999 TIMSS assessments, one can find a glimmer of hope when viewing the results of the *Nation's Report Card: Mathematics 2000*.

The National Assessment of Educational Progress (NAEP) is administered by the NCES in the U. S. Department of Education and "regularly reports to the public on the educational progress of students in grades 4, 8, and 12" (U. S. Department of Education, NCES, 2000, p. 1) in *The Nation's Report Card*.

Students' assessments are represented by average scores on a scale (0-500) and, "in terms of these percentages of students attaining three achievement levels: Basic, Proficient, and Advanced. The achievement levels are performance standards adopted by the National Assessment Governing Board" (U. S. Department of Education, NCES, 2001, p. 1). The following NAEP results were reported in mathematics for 2000:

- Fourth-, eighth- and twelfth-grade students had higher average scores in 2000 than in 1990, the first assessment year in which the current mathematics framework was used. Fourth- and eighth-graders showed steady progress across the decade. Twelfth-graders made gains from 1990 to 1996, but their average score declined between 1996 and 2000.
- In 2000, the percentage of students performing at or above Proficient – identified by NAGB as the level that all students should reach – was 26 percent at grade 4, 27 percent at grade 8, and 17 percent at grade 12. At each grade, the percentage of students performing at or above this level was higher in 2000 than in 1990. There were gains over the decade at the Basic and Advanced levels as well. However, from 1996 to 2000, the percentage of twelfth-graders reaching the Basic level declined.
- Score increases are evident across the performance distribution -- higher-, middle-, and lower-performing students have made gains since 1990 at each grade. At grade 12, however the decline in the average score between 1996 and 2000 was reflected mostly in the scores of students in the middle- and lower- performance ranges: scores declined only at the 50th, 25th, and 10th percentiles. (U. S. Department of Education, NCES, 2001, p. 2)

NAEP progress was also reported for various subgroups, including race/ethnicity.

The following results were reported for race/ethnicity subgroups:

- In 2000, at all three grades, the average scores of white students were higher than those of black, Hispanic, and American Indian students.
- In 2000, at grade 12, the average score of Asian/Pacific Islander students was higher than the scores of white, black, and Hispanic students.
- White, black, and Hispanic students at grade 4 and 8 had higher average scores in 2000 than in 1990. The score gaps between white and black students, and between white and Hispanic students, were large at every grade. There was no evidence in the 2000 assessment of any narrowing of the racial/ethnic group score gaps since 1990 (U. S. Department of Education, NCES, 2001, p. 3).

Educational Reforms

One of the outcomes of testing results over the last twenty years has been state and national actions directed at improving student achievement. These actions have taken various forms including recommendations, frameworks, standards, and mandatory testing.

The National Commission on Excellence in Education made recommendations concerning the content of the mathematics curriculum, sequence of studies available to students, and that students should be able to “apply mathematics in everyday situations” (U. S. Department of Education, National Commission on Excellence in Education, 1983, p. 1). Additionally, the Commission recommended that,

> The high school curriculum should also provide students with programs requiring rigorous effort in subjects that advance students’ personal, educational, and occupational goals, such as …vocational education. These areas complement the New Basics, and they should demand the same level of performance as the Basics. (U. S. Department of Education, National Commission on Excellence in Education, 1983, p. 2)

Along with recommendations in content, the commission made recommendations in standards and expectations, including standardized testing.

In 1989, President George H. Bush met with the 50 state governors and developed the National Educational Goals, which were a general set of educational standards. Included as one of the goals was that “U. S. students will be first in the world in mathematics and science achievement” (McCarty, n.d., p. 1).

No formal national standards were developed at that time for any of the major subjects, but voluntary standards were developed for mathematics, science, and history. The National Council of Teachers of Mathematics (NCTM) created curriculum standards for mathematics in 1989 (McCarty, n.d.).

Though voluntary, widespread adoption of the NCTM standards occurred when “over 80 percent of the states have modified their mathematics framework so that they are in-line with the NCTM standards” (McCarty, n.d., p. 4).

The National Research Council (2002) stated that as of 2001, “Forty-nine states have developed standards and curriculum frameworks in mathematics and science. All 50 states test their students and 27 states hold schools accountable for results” (p. 3-4).

It was recognized by businesses and industries how academic achievement affects the workforce. In 1991, Lynn Martin, Secretary of Labor, along with 29 people representing a wide array of businesses and industries in the U.S., submitted a report, *The Secretary’s Commission on Achieving Necessary Skills* (SCANS). Business owners, public employers, union leaders, workers, and supervisors interviewed by the commission over a 12-month period voiced the same message, “good jobs will increasingly depend on people who can put knowledge to work” (U. S. Department of Labor, Secretary’s Commission on Achieving Necessary Skills [SCANS], 1991, p. viii).

Mathematic skills were seen by the SCANS members as being essential to most employees, who

> ... will be required to maintain records, estimate results, use spreadsheets, or apply statistical process controls as they negotiate, identify trends, or suggest new courses of action. Most of us will not leave our mathematics behind us in school. Instead, we will find ourselves using it on the job…. (U. S. Department of Labor, SCANS, 1991, p. ix)

The SCANS report identified 5 competencies that are required for work. These competencies are based on a three-part foundation, which includes basic skills such as mathematics. Specifically, concerning mathematics, students should be able to “perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques” (U. S. Department of Labor, SCANS, 1991, p. xi).

In 1998, a joint working group from the U. S. Department of Education and the National Science Foundation developed an action strategy to address the objectives of President Bill Clinton’s March 6, 1997 Presidential Directive. The aim of the directive was to improve mathematics and science performance.

The action strategy focused immediate attention on mathematics and proposed voluntary national testing in mathematics for eighth graders. Challenges were issued to the Department of Education, National Science Foundation, state and local school personnel, colleges and universities, professional organizations, and families to do their part in improving mathematics and students’ achievement. (U. S. Department of Education – National Science Foundation, 1998).

On January 8, 2002, President George W. Bush made educational reforms no longer a voluntary action, but the law, when he signed the *No Child Left Behind Act of 2001* (NCLB). In addition to requiring the development of standards and requiring testing, the NCLB Act established an accountability system.

No Child Left Behind Act of 2001 “contains the most sweeping changes to the *Elementary and Secondary Education Act* (ESEA) since it was enacted in 1965” (U. S. Department of Education, *No Child Left Behind*, 2002, p. 1). A major difference between the NCLB Act of 2001 and previous educational reform efforts is that NCLB includes the element of accountability in its reform principles.

As stated by the *No Child Left Behind Act*,

> An *accountable* educational system involves several critical steps:
>
> - States create their own standards for what a child should know and learn for all grades. Standards must be developed in math and reading immediately. Standards must also be developed for science by the 2005-06 school year.
> - With standards in place, states must test every student's progress toward those standards using tests that are aligned with the standards. Beginning in the 2002-03 year, schools must administer tests in each of three grade spans: grades 3-5, grades 6-9, and grades 10-12 in all schools. Beginning in the 2005-06 school year, tests must be administered every year in grades 3 through 8 in math and reading. Beginning in 2007-08 school year, science achievement must also be tested.
> - Each state, school district, and school will be expected to make adequate yearly progress toward meeting state standards. This progress will be measured for all students by sorting the results for students who are economically disadvantaged, from racial or ethnic minority groups, have disabilities, or have limited English proficiency.
> - School and district performance will be publicly reported in district and state report cards. Individual school reports will be on the district report cards.
> - If the district or school continually fails to make adequate progress toward the standards, they will be held accountable.
>
> (U. S. Department of Education, *No Child Left Behind*, 2002, p. 1)

Now more than the previous twenty years, the Federal Government has taken a leading role by legislating that all states follow standards for curriculum, test for achievement, and are held accountable for the results.

Texas has a history of requiring standards for curriculum, testing for achievement, and holding schools accountable for the results. Texas has played a leading role in educational reforms, including raising graduation requirements, testing annually, reporting student achievement by sub-groups, developing standards, and holding schools accountable (Achieve, 2002).

The Texas Education Agency provided descriptions of standards, testing, and accountability for the State of Texas in the "Timeline of Testing in TEXAS" (Appendix

A). The timeline outlines the history of legislated testing requirements for Texas schools beginning with the Texas Assessment of Basic Skills (TABS) Test in 1979, which tested 3rd, 5th and 9th grade students in math, reading, and writing. Though students were not required to pass the test to receive their high school diploma, results were reported beginning the accountability system.

In 1984, the TABS test was replaced by the Texas Education Assessment of Minimum Skills (TEAMS) Test. This test, which increased the rigor of the testing, was administered to first, third, fifth, seventh, ninth, and eleventh grade students. In order to receive a diploma, students were required to receive a passing score on the TEAMS test.

The Texas Assessment of Academic Skills (TAAS) Test replaced the TEAMS Test in 1990 and became a criterion-referenced test program based on the state-mandated curriculum called Essential Elements. From 1992 through 1995, some changes were made to the original TAAS testing program, including expanded testing, a new campus and district rating system for accountability, and a Texas Learning Index.

The state's current testing program, the Texas Assessment of Knowledge and Skills (TAKS) Test, began in 1999. The new assessment program was aligned to the new state-mandated curriculum, the Texas Essential Knowledge and Skills (TEKS). The legislature also ended social promotion with the more rigorous testing program and required passing scores in order for students to advance to the next grade level or receive their high school diploma (TEA, *Timeline of Testing in Texas*, n.d.).

In addition to accountability standards to which schools are held based on test results, teachers within Texas schools are held accountable for academic performance through the Professional Development Appraisal System (PDAS). Specifically, *Domain VIII: Improvement of Academic Performance of All Students on the Campus* evaluates teachers based on the following dimensions:

> a. The teacher diagnoses student needs and provides performance feedback related to all appropriate TEKS/TAKS objectives.
> b. The teacher aligns the planning and delivery of instruction to all appropriate TEKS/TAKS objectives.
> c. The teacher collaborates with other faculty and administrators to improve TAKS related performance of all students on the campus…. (Texas Education Agency, Professional Development Appraisal System, 2004)

Learning-based Theories

To understand how solving math problems based on agricultural topics could improve performance in mathematics, one must review the philosophical foundation of constructivism and the theoretical base of contextual learning to find the roots of this instructional strategy.

Constructivism

“Constructivism is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own ‘rules’ and ‘mental models,’ which we use to make sense of our experiences” (The Basics of Learning Theories, n.d., p. 1).

John Dewey’s belief that learners construct knowledge based on experience is cited as the origins of constructivism (Gabler & Schroeder, 2003; Baxter Magolda, 1999). Jean Piaget also contributed to constructivism with his theory of cognitive development (Schunk, 2000; Baxter Magolda, 1999; Gabler & Schroeder, 2003). Lev Vygotsky emphasized social context as an important influence in knowledge construction (Gabler & Schroeder, 2003; Schunk, 2000).

Jerome Bruner's constructivist theory represents one perspective of the broad philosophy of constructivism and is "a general framework for instruction based upon the study of cognition. Much of the theory is linked to child development research (especially Piaget)" (Theories in Practice: Theories [TIP], 1992, p. 1). Bruner used the context of mathematics and social science to illustrate his theory that "learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge" (TIP: Theories, 1992, p. 1).

The principles of the constructivist theory include learner readiness, structured teaching, and extrapolation. In other words, instruction should be presented in such a way that will make students want to learn, be easily grasped by students, and enable students to "go beyond the information given" (Learning Theories: Constructivist Theory, 1996, p. 1).

In analyzing constructivism from the perspective of career and technology education, Doolittle and Camp (1999) listed the following *Essential Factors of Constructivists Pedagogy*:

- Learning should take place in authentic and real-world environments.
- Learning should involve social negotiation and mediation.
- Content and skills should be made relevant to the learner.
- Content and skills should be understood within the framework of the learner's knowledge.
- Students should be assessed formatively, serving to inform future learning experiences.
- Students should be encouraged to become self-regulatory, self-mediated, and self-aware.

- Teachers serve primarily as guides and facilitators of learning, not instructors.
- Teachers should provide for and encourage multiple perspectives and representations of content. (p. 7-10)

Also emphasized by constructivism is the concept of integrated curriculum (Schunk, 2000).

According to Schunk (2000), “Many contemporary theorists contend that constructivism represents a viable model for explaining how mathematics is learned (Cobb, 1994; Lampert, 1990; Resnick, 1989)” (p. 284). Schunk further stated, “ ... Mathematical knowledge is not passively absorbed from the environment but rather is constructed by individuals as a consequence of their interactions” (Schunk, 2000, p. 284).

Situated Learning

From the constructivist philosophy, we get a learning-based theory that applies to the use of math problems with a contextual base. Situated learning is an example of a learning-based theory that has the constructivist philosophy as a pedagogical foundation.

Jean Lave, the originator of the situated learning theory, believed that “learning as it normally occurs is a function of the activity, context and culture in which it occurs (i.e. it is situated)” (Learning Theories: Situated Learning, 1996, p. 1).

Two principles of situated learning are:

1. Knowledge needs to be presented and learned in an authentic context, i.e. settings and applications that would normally involve that knowledge.
2. Learning requires social interaction and collaboration.

(Learning Theories: Situated Learning, p. 2)

Baxter Magolda (1999) stated that situated learning validates "students as knowers" (p. 73) and that using the students' experience through situated learning was necessary for students to learn.

Greeno and the Middle School Mathematics Through Application Projects Group (1998) stated that

> Conceptual growth is an important aspect of a person's participation in substantive discourse both within the conceptual domains of subject-matter disciplines and in other domains where disciplines' concepts and principles are useful. We need to organize learning environments and activities that include opportunities for acquiring basic skills, knowledge, and conceptual understanding, not as isolated dimensions of intellectual activity, but as contributions to students' development of strong identities as individual learners and as more effective participants in the meaningful social practices of their learning communities in school and elsewhere in their lives. (p. 17)

Communities of practice are an important aspect of situated learning. Barab and Duffy (2000) described communities "as having three components: a common cultural and historical heritage, including shared goals, understandings, and practices; individuals becoming a part of an interdependent system; and the ability to reproduce as new members work alongside more competent others" (p. 49).

Wenger (1998) stated that, "Communities of practice sprout everywhere ..., officially or in the cracks. And in spite of curriculum, discipline, and exhortation, the learning that is most personally transformative turns out to be the learning that involves membership in these communities of practice" (p. 6).

Learning in Context

Constructivism, situated learning, communities of practice, and several other learning theories, philosophies, and approaches include learning in context as a component. *Issues of Teaching and Learning* (1998) stated that "… the context in which students learn is important in providing meaning and deepening understanding of the concept, procedure, information or skill that they are required to learn" (p. 1).

Bettina Lankard viewed teaching in context as an important component of the situated learning approach. "In situated learning, it is the authentic social context in which learning occurs that offers the benefit of increased knowledge and offers the learner the potential for applying that knowledge in new ways and in new situations" (Lankard, 1995, p. 2).

David Stein included context as an important component of situated learning in his description of the learning process:

> Situated learning places the learner in the center of an instructional process consisting of **content** – the facts and processes of the task; **context** – the situations, values, beliefs, and environmental cues by which the learner gains and masters content; **community** – the group with which the learner will create and negotiate meaning of the situation; and **participation** – the process by which learners working together and with experts in a social organization solve problems related to everyday life circumstances (Brown, Collins, & Duguid, 1989; Lave, 1988; Skor, 1987). Learning becomes a social process dependent upon transactions with others placed within a context that resembles as closely as possible the practice environment. Situated learning in the classroom integrates content, context, community, and participation (Stein, 1998, p. 2).

Naylor (1988) tied contextual learning of academic skills to vocational programs when describing effective integration of basic skills and vocational instruction.

> The technique of applying academic concepts in learning activities that require

> students to solve a problem related to their vocational program is another effective way of combining basic skills and vocational instruction. The approach is based on the following principles:
>
> - Problem-solving and decision-making processes and competencies are embedded in the activities.
> - Activities are participatory in nature and related to the real world and real consequences.
> - Reinforcement of basic skills information needed in the situation is provided along with a suitable degree of guidance on how to proceed. (Pritz and Crowe 1987a, p. 47)
>
> Because such instructional materials help students develop strong problem-solving skills (skills that employers find very important in workers) and present material in a context whose relevance is readily apparent to students (which has been shown to increase students' motivation to learn), they are doubly effective in preparing vocational students for eventual employment (p. 2).

Stein (1998) held a similar belief about basing learning on real-world situations. "Learning is essentially a matter of creating meaning from the real activities of daily living" (p. 1). According to Stein, when subject matter is embedded in learners' experience or real-world challenges, "knowledge is acquired and learning transfers from the classroom to the realm of practice" (p. 1).

Brooks and Brooks (1999) stated that learning, "occurs most naturally and lastingly when it is in a meaningful context and when it relates to authentic concerns and problems faced by students" (p. 96).

The Contextual Learning Institute and Consortium (CLIC) Research Project, conducted by Oregon State University, found the following results concerning the use of contextual teaching and learning:

- Students accepted more responsibility of their own learning.
- Student discipline problems, absenteeism, and tardiness were down.
- Students enjoyed a positive social interaction.
- All students learned more (gifted, average, and less gifted).

- Contextual learning teachers need significant school-based logistical support.
- Teaching teams are important in contextual teaching and require planning time.
- Longer class sessions and teacher teamwork are significant keys for contextual teaching and learning.

(Advanced Technology Environmental Education Center, 2000, p. 2)

A 1991 report, *The Secretary's Commission on Achieving Necessary Skills* (SCANS), stated in the *Executive Summary* that contextual learning was the most effective way of acquiring skills. "We believe, after examining the findings of cognitive science, that the most effective way of learning skills is 'in context,' …" (U. S. Department of Labor, SCANS, 1991, p. viii).

Practice

Many people are familiar with the saying "practice makes perfect." Practice is an instructional strategy with a theoretical basis in behaviorism. As Copeland (1984) stated, "The premise is that if he repeats it, sooner or later, he will remember it. Thus the procedure is the familiar 'drill and practice' which is based on behaviorists" (p. 10-11). B. F. Skinner and Robert Gagne′ are two well-known behavioral psychologists who support practice (Copeland, 1984).

McEwan (2000) stated the following in support of the practice strategy. "Students become skilled problem solvers in the same way that students become good readers – by doing a lot of it" (p. 77).

Anderson, Reder and Simon (2000) affirmed McEwan's view stating that "All evidence, from the laboratory and from extensive case studies of professionals, indicates that real competence only comes with extensive practice (e.g. Hayes, 1985; Ericsson, Krampe, & Tesche-Romer, 1993)" (p. 13). They further argued that, "In denying the critical role of practice one is denying children the very thing they need to achieve real competence. The instructional task is … to find tasks that provide practice while at the same time sustaining interest" (Anderson, Reder & Simon, 2000, p. 13).

Pressley and Woloshyn (1995) outlined the importance of practice as part of mathematics instruction, based on theory and evidence. Practice should:

- help students develop long-term memory for math facts,
- develop automatic recognition of problem types,
- develop proceduralization of complex problem-solving procedures, and
- be distributed. (pp. 196-200)

Mathematics Education

In 1989, the National Council for Teachers of Mathematics (NCTM) created voluntary standards that were adopted by many states. A summary of the recommended changes for the content and emphasis in mathematics for grades 9-12 included increasing the "use of real-life problems to motivate and apply theory" (National Council for Teachers of Mathematics [NCTM], 1989, p. 126). Recommendations were also made for changes in instructional practices, including increased attention to:

- Active involvement of students in constructing and applying mathematical ideas.
- Problem solving as a means as well as a goal of instruction.
- Effective questioning techniques that promote student interaction.
- Use of a variety of instructional formats (small groups, individual explorations, peer instruction, whole-class discussion, and project work).
- Use of calculators and computers as tools for learning and doing mathematics.
- Student communication of mathematical ideas orally and in writing.
- The establishment and application of the interrelatedness of mathematical topics.

- The systematic maintenance of student learning and embedding review in the context of new topics and problem situations.
- The assessment of learning as an integral part of instruction.
  (NCTM, 1989, p. 129)

The 1991 National Council of Teachers Mathematics *Professional Standards for Teaching Mathematics* followed the 1989 mathematics curriculum standards with recommendations that provided five components for guidance in developing professionalism in mathematics teaching (NCTM, 1991).

Baxter Magolda (1999) described mathematical reform efforts from a theoretical position as supporting the social-constructivist view.

Cangelosi (1992) described the direction of educational reforms based on research. "Numerous curricula-reform efforts have attempted to bring the teaching of mathematics more in line with the research-based principles that indicate students need experiences discovering and inventing mathematics and utilizing mathematics to solve real-life problems (eg. The 1908 Committee ...)" (p. 27).

Steven Leinwald, in *Sensible Mathematics: A Guide for School Leaders*, stated that the beliefs needed to implement recommendations of the NCTM Curriculum and Evaluation Standards included the following:

- Effective teachers increasingly believe that in a world of calculators and computers, mathematics is problem solving and reasoning; that is, applying mathematical concepts and skills to everyday and real-world situations.
- Effective teachers increasingly believe that real-world situations and contexts (applications) and extensive work with concrete materials and pictorial representations (concept-building) are essential motivators for and pre-requisites to skill development.
- Practice with skills is just one of the many strategies used by good teachers to help students achieve broader goals of learning. (Everybody Counts, p. 57)

> - Effective teachers increasingly act on the belief that mathematics classes are best characterized by students working in groups, actively engaged in solving engaging problems.
> - Effective teachers increasingly act on the belief that students learn best when they are engaged by the context in which the mathematics is presented and given frequent opportunities to discover and discuss.
>
> (Leinwald, 2000, p. 114-115)

Leinwald (2000) believed that there were eight characteristics to make sensible, sense-making mathematics, including access and integration. He described *access* as "putting mathematics into relevant and interesting context; encouraging the use of technology...; allowing students to collaborate... and, making full use of materials whenever hands-on experience can concretize mathematics" (pp. 42-43). He described *integration* as "connecting mathematics to other disciplines" (p. 42) and "relying on interesting contexts" (p. 52).

The National Research Council has stated,

> Research on the situated nature of cognition indicates that the way people learn a particular domain of knowledge and skills and the context in which they learn it become a fundamental part of what is learned (Greeno, 1993; Lave, 1991). When students learn, they learn both information and a set of practices, and the two are inextricably related. McLellan (1996, p. 6) states that situated cognition "involves adapting knowledge and thinking skills to solve unique problems…and is based upon the concept that knowledge is contextually situated and is fundamentally influenced by the activity, context, and culture in which it is used." Learning, like cognition, is shaped by the conventions, tools, and artifacts of the culture and the context in which it is situated.
>
> (National Research Council, 2002, p. 127)

Furthermore, the National Research Council stated that,

> Because the practices in which students engage as they acquire new concepts shape what and how the students learn, transfer is made possible to the extent that knowledge and learning are grounded in multiple contexts (Brown, Collins, and Duguid, 1989). Transfer is more difficult when a concept is taught in a limited set

> of contexts or through a limited set of activities. When concepts are taught only in one context, students are not exposed to the varied practices associated with those concepts. As a result, students often miss seeing the concepts' applicability to solving novel problems encountered in real life, in other classes, or in other disciplines. It is only by encountering the same concept at work in multiple contexts that students can develop a deep understanding of the concept and how it can be used, as well as the ability to transfer what has been learned in one context to others (Anderson, Greeno, Reder, & Simon, 1997). (National Research Council, 2002, p. 127-128)

Britton, Huntley, Jacobs, and Weinberg (1999) advocated the use of "real-world" applications for motivating students' interest and learning in mathematics. "Explaining workplace uses of science, mathematics, and technology is an obvious, but often unexplored, way of making subject matter more relevant and useful to students' lives (Hurd, 1998; Richmond, 1998)" (p. 3). Britton, Huntley, Jacobs and Weinberg further reinforced the theory of contextual learning as they stated, "Connecting science and mathematics to workplace contexts is consistent with what research has revealed about how students learn" (1999, p. 7).

McEwan described how the use of word problems provided opportunities for applied learning. He stated,

> When considering mathematics, the most common means of portraying problem-solving situations are through the use of word problems. These story problems, as they are often called, provide a bridge from the basic arithmetic skills of the primary grades to the application of such skills in real-world settings (Briars and Larkin 1984)." (McEwan, 2000, p. 77)

Contemporary mathematics educators have developed the following teaching strategies based on constructivism:

- Much of instruction should involve presenting problems to students to solve.
- Instruction should emphasize how mathematical operations relate to operations in the real world.
- Word problems ... should be a part of problem-solving instruction at all grade levels.
- Use of manipulatives.
- Model problem solving.
- Question, pay attention to answers, support and elaborate as needed.
- Small group problem solving should be encouraged.
- Students should experience many and diverse examples.
- Many examples should come from the everyday world, with much of problem-solving in everyday situations.
- Technology should be used when its use increases student opportunities to attend to higher order aspects of problem solving.
- Students need to be encouraged to explain their problem-solving.

(Pressley, M. and Wososhyn, V., 1995, pp. 189-191)

Velta Clarke described the motivational aspect of contextual learning in her book, *Effective Strategies in the Teaching of Mathematics*.

> The teaching of mathematics in a practical context should be basic to any pedagogy. Real-life situations arouse the curiosity of students, challenge them to solve problems, and invite them to explore and create new mathematics concepts that may be used for pragmatic ends. (Clarke, 2003, p. 28)

Clarke (2003) further argued that, "Every principle in mathematics has an empirical base. Indeed the invention of mathematics was for the purpose of solving real-life problems. ...The teaching of every problem in mathematics should begin with a real-life problem" (pp. 153-154).

Clarke (2003) described contextual learning as a way of helping students connect mathematics to life outside of school. "Most students do not make the connection between mathematics learned in school and the application of that knowledge outside the school unless they learned the mathematics in a real life context" (p. 154).

Martin (1996) believed that teaching mathematics should cross curricular boundaries because mathematics is "the language of science, the key to business and finance, and an essential element in understanding the technology of change. It helps us interpret the world around us" (p. 1).

Research in Agricultural Education

The importance of academic skills to the field of agriculture and agricultural education can be found throughout history. Science and mathematics are deeply entrenched in the philosophical roots of agriculture. As Glen Shinn stated,

> Founders, including W.H. Shepardson, recognized the important linkage between science and agriculture. ...Today's agricultural education students will benefit from the knowledge of science, math and reading to solve increasingly complex problems of food systems, natural resources, and environmental degradation. In addition, the students will perform better on school tests. (Shinn, 2002, p. 14)

In April, 2002, teachers, state directors and consultants, university faculty, and other national leaders in agricultural education formed a 19-member work group to research and recommend practices that would benefit agricultural education through improved academic performance. According to Glen Shinn, chairman of the work group, "The mission of the work group aims to communicate research-based practices in agricultural education that have positive impacts on student achievement in mathematics, science, and reading" (Shinn, 2002, p. 14).

Though this researcher could find no studies showing a direct relationship between agricultural education and improved performance in mathematics, there is evidence that agricultural education uses the problem-solving approach prescribed by mathematics education reformers and there is evidence that agricultural education improves students' academic performance in areas such as science. "Agricultural Education has emphasized problem solving as a means of helping students to develop decision-making skills…" (Lankard Brown, 1998, p. 1). Boone (1990) and Flowers and Osborne (1987) have conducted research on the use of problem solving in agricultural education and found that the problem solving approach had a positive effect on students' knowledge retention.

Connors (1998) reported that 98% of participants in a regional Delphi study agreed that, "All agriculture teachers should integrate academics into their agriculture curriculum" (p. 43).

Newsom-Stewart and Sutphin (1994) reported that high school tenth-grade agricultural science students "highly rated agriculture examples as a good way to understand science and vice versa" (p. 3), followed by mathematics, communication, and computer skills. Students rated the relationships between agriculture and academic courses on a five-point Likert-type scale and all items scored above 2.8 or higher, indicating the relationship of agriculture examples for understanding academics and vice versa (Newsom-Stewart & Sutphin, 1994).

Connors and Elliot (1995) found “that high school seniors who had agriscience and natural resource classes performed as well as seniors who did not have agriscience and natural resource classes on the science achievement test” (p. 62).

Balschweid and Thompson (2002) reported that Indiana agricultural science and business teachers “agreed” that “science concepts are easier to understand for students when science is integrated into the agricultural education programs” and that “students learn more about agriculture when science concepts are an integral part of the instruction” (p. 4).

In a case-study approach to “determine how high school students perceive science and agriculture after completing a traditional yearlong biology class that used animal agriculture as a context” (p. 58), Balschweid (2002) found that the subjects “either agreed or strongly agreed that participating in a biology class that used agriculture as the context helped them understand the relationship between science and agriculture” (p. 65).

Chiasson and Burnett (2001) reported that Louisiana public school eleventh grade agriscience students “achieved significantly higher overall scores than non-agriscience students on the science portion of the GEE” (p. 68).

Roegge and Russell (1990) reported that Illinois agriculture students who participated in an integrated approach (incorporating biological principles into vocational agriculture instructional unit) produced higher overall achievement and higher applied biology achievement than students in the traditional approach.

Dayberry (1987) found that vocational agriculture teachers used materials containing mathematical and scientific concepts, thereby exposing students to those concepts.

Researchers have also studied the mathematical abilities of agricultural science teachers, undergraduate pre-service teachers, and high school vocational agriculture students. Gliem and Warmbrod (1985) found that undergraduate pre-service teachers were only moderately competent at solving agricultural mechanics word problems, while vocational agriculture students scored low on a test measuring ability to perform mathematical operations.

Miller and Gliem (1994) found that there were statistically significant relationships between teachers' mathematical problem-solving ability and "years of teaching experience, final college grade point average, and attitude toward including mathematics concepts in the curriculum and instruction of secondary agriculture programs" (p. 27).

Summary of Literature Review

Several reports/statements over the past twenty-five years have voiced concern over students' achievement in academics, including mathematics.

A Nation at Risk released by the National Commission on Excellence in Education in 1983 and the results of the Third International Mathematics and Science Study (TIMSS) in 1995 had major impacts on calls for educational reform.

Educational reform efforts came in the form of the development of the National Education Goals in 1989, development of national standards such as The National Council of Teachers of Mathematics' curriculum standards for mathematics in 1989, a

Presidential Directive in 1997 to improve mathematics and science performance, and most notably, the *No Child Left Behind Act of 2001*, which made educational reforms and an accountability system the law.

The curriculum standards put forth by the National Council of Teachers of Mathematics, the report submitted by The Secretary's Commission on Achieving Necessary Skills, and researchers directed educational reforms in mathematics towards constructivism and the use of real-life problems. The following concepts have influenced mathematics pedagogy:

- John Dewey's constructivist beliefs (Baxter Magolda, 1999; Gabler & Schroeder, 2003),
- Jean Piaget's theory of cognitive development (Baxter Magolda, 1999; Gabler & Schroeder, 2003; Schunk, 2000),
- Lev Vygotsky's social constructivism (Gabler & Schroeder, 2003; Schunk, 2000),
- Jerome Bruner's constructivist theory (Theories in Practice, 1992),
- Jean Lave's situated learning theory (Baxter Magolda, 1999; Greeno et. al., 1998),
- Communities of Practice (Barab & Duffy, 2000; Wenger, 1998),
- Learning in Context (ATEEC, 2000; Brooks & Brooks, 1999; Issues of Teaching and Learning, 1998; Lankard, 1995; Naylor, 1988; SCANS, 1991; and Stein, 1998), and

- Practice (Anderson, Reder, & Simon, 2000; Copeland, 1984; and McEwan, 2000).

Mathematics education has been greatly influenced by the 1989 NCTM's *Curriculum and Evaluation Standards for School Mathematics*. Much has been written about reforming mathematics education to reflect real-life experiences and contextual applications that interest and motivate students (Baxter Magolda, 1999; Britton, Huntley, Jacobs, & Weinberg, 1999; Cangelosi, 1992; Clarke, 2003; Leinwald, 2000; McEwan, 2000; and National Research Council, 2002).

Research in agricultural education has focused more on achievement in science rather than mathematics. However, research shows that agricultural education uses the problem solving approach (Lankard-Brown, 1998; Boone, 1990; Flowers & Osbourne, 1987) as prescribed by mathematics education reformers. Furthermore, agricultural science educators agreed that academics should be integrated into curriculum (Connors, 1998) and have formed a work group to research and recommend practices for improving academic performance (Shinn, 2002).

Research has shown that agricultural science is a good context for teaching science successfully (Newsom-Stewart & Sutphin, 1994; Connors & Elliot, 1995; Balschweid & Thompson, 2002; Balschweid, 2002; Chiasson & Burnett, 2001; and Roegge & Russell, 1990). Research has also shown that agricultural science teachers use materials containing mathematical and scientific concepts (Dayberry, 1987).

CHAPTER III

METHODOLOGY

Description of Study

The primary purpose of this study was to determine whether student performance on mathematics tests was improved by having students practice solving mathematical problems based on topics covered in agricultural science classes.

This research was a one-variable experimental study. It utilized a post-test to measure mathematical performance differences between a treatment group and a control group (Gall, Borg, & Gall, 1996). The design of this experimental research is based on the representative design which is, "a process for planning an experiment so that it accurately reflects both real-life environments in which learning occurs and the natural characteristics of learners" (Gall, Borg, & Gall, 1996, p. 478).

Population and Sample

All students enrolled in the *Introduction to World Agricultural Science and Technology* course (AGSC 101) in Texas public schools in 2003 and the instructors teaching that course were included in the target population of this study.

Cluster sampling was used in this study because it was more feasible to identify and select agriscience instructors and their AGSC 101 classes (i.e., schools) than it was to identify and select individual students enrolled in AGSC 101. Gall, Borg, & Gall (1996) defines cluster sampling as, "a group of research participants that is formed by selecting naturally occurring groups (i.e. clusters) in the population" (p. 775).

Potential AGSC 101 classes were identified by recruiting agricultural science teacher volunteers at the 2003 Professional Development Conference for Agricultural Science and Technology Teachers of Texas, Wichita Falls, Texas, July 28-August 1. Teachers were asked to complete a volunteer form indicating their interest in participating in the study. The volunteer form (Appendix B) included contact information, intention of teaching AGSC 101 in the Fall, 2003 semester, and estimate of students enrolled in that AGSC 101 course.

The school administrators (principals/superintendents) of the teacher volunteers were contacted via letter (Appendix C) the first week of August, to seek permission for participation of their teachers and students in the study. From the list of 71 teacher volunteers, 40 administrative consent forms were received.

The teachers in the 40 schools with administrative consent were randomly divided into treatment and control groups. The schools in each group were sent consent forms for the teacher, students, and parents (Appendixes D, E, and F, respectively).

Initially, there were 21 treatment schools and 19 control schools. By the time the testing phase was completed, 24 schools (11 treatment and 13 control) remained. So, collectively, there was a 40% mortality rate. By experimental group, treatment schools experienced 47.6% mortality and control schools, 31.6%. A total of 218 students were in the treatment group, and 170 students were in the control group.

Treatment versus Control

Teachers in both the treatment group and the control group were sent, via priority mail on August 30, 2003, research packets containing cover letter (Appendix G), consent forms (Appendixes D, E, and F), instructions for treatment group (Appendix H) or instructions for control group (Appendix I), and envelope for retaining consent forms. In addition, teachers in the treatment group were provided a notebook containing a contents page and 90 transparencies of problems and solutions from *TAAS Math Problems Teachers' Guide for Introduction to World Agricultural Science and Technology* (Appendix J).

Teachers in the treatment group were asked to present one math problem per day that related to the topic of instruction for that day. Problems were to be presented at the beginning of the class period and students were to be given one to two minutes to work the problem. Students were allowed to use calculators and collaborate on solving the word problems. It was recommended that teachers have students write down problems and solutions. A weekly problem sheet (Appendix K) was included in the packet for teachers to copy and provide for students' use. Teachers were then to present students with the solution and provide two to three minutes to discuss the problem and answer questions. Because teachers were supposed to select math problems that related to the agricultural topic being discussed that day, the warm-up problems could function as an introduction or anticipatory set to the day's lesson. Teachers were instructed to use the warm-up problems throughout the entire fall semester on a daily basis, if possible.

Teachers in the control group did not use the math warm-up problems from *TAAS Math Problems Teacher's Guide for Introduction to World Agricultural Science and Technology* and were instructed to follow their normal class routine. It was possible that some teachers in the control group used some type of TAKS preparation materials, if their schools required them to do so.

Teachers were contacted via letters, e-mails, and phone calls to monitor progress, address questions, and provide information.

A letter dated September 10, 2003, (Appendix L) was sent to the treatment group to let them know that they should have received the treatment package and to reiterate the instructions.

On October 13, 2003, e-mails (Appendix M) were sent to treatment group members to check on how it was going with the math warm-up problems.

On November 14, 2003, a letter (Appendix N) was sent to members of both groups, treatment and control, to let them know about the intentions of the researcher concerning distribution, administration, and collection of testing materials.

The final phase of the study began on November 26, 2003, when test packets were priority-mailed to members of the treatment group and the control group. The test packets included a cover letter (Appendix O), 30-question math tests (Appendix P), student scantron answer sheets (Appendix Q), instructions for administering tests (Appendix R), teacher survey (Appendix S), and a checklist for return materials (Appendix T). Also included were extra copies of the teacher, student, and parent consent forms and a return envelope.

Instrumentation

Two instruments were used to collect data for this study, one for the students and one for the agricultural science teachers.

The students' instrument consisted of scantron answer sheet and a 30-item word problem exam. The top portion of the scantron answer sheet (Appendix Q) contained student demographic and perceptions items, including chapter number, grade, ethnicity, group assignment, math courses currently taking, math courses completed, math grades, level of difficulty of math warm-up problems, attitude about math warm-up problems, and perceived usefulness of math warm-up problems. The bottom portion of the scantron contained the answer choices for the math word problems.

The math exam (Appendix P) consisted of 30 word problems with multiple choice answers. The examination was developed using math problems from released TAAS 2000 (TEA, 2000) and 2001 (TEA, 2001) tests. Problems were selected to correspond with the types of problems addressed by the math warm-up problems. All but one of the TAAS objectives were represented by at least one test item. Appendix U contains the TAAS objectives and the number(s) of the test items which covered those objectives.

The teachers' instrument (Appendix S) contained demographic items for the school, including chapter number, group assignment, FFA area, and size classification of school. Other items on the survey included administration requirement of TEKS-related activities for math, prior use of math warm-up problems, desire for development of more TAKS materials based on agricultural context, and type of TAKS materials needed. In addition, teachers in the treatment group were asked about the following items:

frequency of use of math warm-up problems, perceived benefits to students of doing math warm-up problems with an agricultural context, and perceived students' attitudes about doing the warm-up problems.

Data Collection and Analysis

Teachers in both the treatment group and the control group were sent testing packages on November 26, 2003, via United States Postal Service priority mail. Included in the test package were instructions, answer scan sheets for students, 30-question math tests, teacher survey, return checklist, and return envelope.

Teachers were instructed to administer the math exam to students by December 10, 2003, and return student answer scan sheets and teacher survey, along with consent forms by December 12, 2003.

Teachers who did not return test materials by December 16, 2003, were called on the phone. This improved the return response, but still only 25 teachers returned materials. One teacher returned the students' test problems, but not the student scan sheets. Although this teacher was contacted in person, student scan sheets were never received.

In the end, a total of 24 teachers returned the appropriate materials, including student scan sheets, teacher survey and consent forms. This gave a response rate of 60% from the initial 40 schools that were sent test packages.

Reasons for not returning materials included:

- Semester didn't end until second week in January, so test was not administered,
- Too busy collecting money for fruit sales so didn't have time to test students.

Data that were collected were scanned using an optical scanner. Data were analyzed using SPSS® 11.5 for Windows®, 2002.

CHAPTER IV

RESULTS

Demographics

The students and teachers in the sample were divided into treatment and control groups based on a random selection of classes. The treatment group (teachers and students who used math warm-up problems) included 11 schools with a total of 218 students. The control group (teachers and students who did not use math warm-up problems) included 13 schools with a total of 170 students.

Students in both the treatment group and the control group were asked to respond to questions that described their personal and educational characteristics on an answer scan sheet. The students were also asked to take a 30-question math test and record answers on the answer scan sheet. Teachers in the treatment and control groups were asked to respond to survey question describing school, student, and educational characteristics.

Of the 382 students in the testing sample, most were ninth graders (73.5%) and Caucasian (66.2%). Table 1 shows the complete breakdown of students by grade, while Table 2 shows the breakdown of students by ethnicity.

Table 1

Students by Grade Level

Grade	Frequency	Percent
8th Grade	13	3.4%
9th Grade	285	73.5%
10th Grade	32	8.2%
11th Grade	27	7.0%
12th Grade	25	6.4%
Total	382	98.5%

Missing data: 6

Table 2

Students by Ethnicity

Ethnicity	Frequency	Percent
African American	21	5.4%
Asian American	1	.3%
Caucasian	257	66.2%
Hispanic/Latino	63	16.2%
Native American	9	2.3%
Other	24	6.2%
Total	375	96.6%

Missing data: 13

The treatment and control groups were similar in make-up based on grade and ethnicity. There were a higher percentage of ninth graders in the make-up of the treatment group (78.4%) than in the make-up of the control group (69.5%), while the make-up of tenth grade students was higher in the control group (15.9%) compared to the treatment group (2.8%). The make-up of the treatment group and the control group, when comparing eighth, eleventh, and twelfth grade student, was within a two-percent difference. Table 3 represents compositions of the treatment and control groups based on grade level.

Table 3

Students by Grade Level Categorized as Treatment or Control

Grade	Experimental Group			
	Treatment		Control	
	n	Percent	n	Percent
8th Grade	8	3.7%	5	3.0%
9th Grade	171	78.4%	114	69.5%
10th Grade	6	2.8%	26	15.9%
11th Grade	17	7.8%	10	6.1%
12th Grade	16	7.3%	9	5.5%

The make-up of the treatment group and the control group based on ethnicity were within a 2.1% difference among African American, Asian American, Native American, and students who selected “other” as their ethnic description. The control group (76.5%) had a larger percentage of Caucasian students in its make-up compared to the treatment group (62.4%). The treatment group (23%) had a higher percentage of Hispanic/Latino students in its make-up compared to the control group (8.6%). Table 4 shows the make-up of each group based on ethnicity.

Table 4

Students by Ethnicity Categorized as Treatment or Control

Ethnic Group	Experimental Group			
	Treatment		Control	
	n	Percent	n	Percent
African American	11	5.2%	10	6.25%
Asian American	1	0.5%	0	0.0%
Caucasian	133	62.4%	124	76.5%
Hispanic\Latino	49	23.0%	14	8.6%
Native American	7	3.3%	2	1.2%
Other	12	5.6%	12	7.4%

The treatment and control groups were compared on the basis of size of schools within each group. The treatment group had a larger percentage of 3-A classification schools, while the control group had a larger percentage of 5-A classification schools. Table 5 shows the make-up of the treatment group and the control group based on size of school.

Table 5

Groups by Size of School

Size	Experimental Group			
	Treatment		Control	
	n	%	n	%
1A (<190)	2	18.2%	3	23.1%
2A (190 – 389)	3	27.3%	3	23.1%
3A (390 – 899)	3	27.3%	0	0.0%
4A (900 – 1,924)	2	18.2%	3	23.1%
5A (>1,924)	1	9.1%	4	30.8%

Note: School size as defined by University Interscholastic League (U.I.L., 2003).

Teachers were asked to describe the geographic location of their school based on the ten Texas FFA Areas (Appendix V). Area III, which has the largest population of FFA members, also had the highest representation (25%) in the testing sample, followed by Area VIII. Area II, one of the smallest populations of FFA membership, had no schools in the testing sample. Table 6 shows the geographic distribution of schools by Texas FFA Areas.

Table 6

Geographic Location (FFA Area)

Area	Frequency	Percent
I	2	8.3%
II	0	0%
III	6	25%
IV	3	12.5%
V	1	4.2%
VI	2	8.3%
VII	2	8.3%
VIII	4	16.7%
IX	2	8.3%
X	2	8.3%

Mathematics Background

Students were further characterized based on mathematics education and performance, including math courses that they were currently taking, math courses that they completed, and the grade average that they normally made in math.

Table 7 describes the math courses that students were currently taking in the Fall semester of 2003. Almost half of the students (48.5%) were currently enrolled in an Algebra I class. Students were allowed to check more than one response since it was possible that a student could have been enrolled in more than one math class during the semester.

Table 7

Math Courses Students Are Currently Taking

Courses Students Are Currently Taking	Number Enrolled
Algebra I	188
Algebra II	23
Geometry	96
Pre-Calculus	2
Math Models	17
Independent Study in Math	1
Advanced Placement - Statistics	0
Advanced Placement – Calculus AB	4
Advanced Placement – Calculus BC	0
Other	43

Table 8 displays the responses of students based on math courses that they had completed. As with the previous question, students were allowed to check more than one response since it was likely that students could have completed more than one math course. Algebra I (172) was the course selected by the largest number of students, followed by "other" (166), which most students listed as 8th grade math.

Table 8

Math Courses Students Completed

Courses Students Have Completed	Number Completed
Algebra I	172
Algebra II	30
Geometry	55
Pre-Calculus	5
Math Models	7
Independent Study in Math	0
Advanced Placement - Statistics	0
Advanced Placement – Calculus AB	0
Advanced Placement – Calculus BC	0
Other	106

Students were asked to describe the grade that they normally made in their math courses. The largest number of students reported making numerical grades in the 80-89 average range, followed by numerical grades in the 90-100 range. Table 9 describes the grade averages students reported.

Table 9

Students' Grade Average for Mathematics Courses

Grade Average	Frequency	Percent
100 – 95	39	10.5%
94 – 90	69	18.5%
89 – 85	89	23.9%
84 – 80	74	19.8%
79 – 75	55	14.7%
74 – 70	28	7.5%
below 70	19	5.1%

Missing data: 15

When broken down into treatment and control groups, students were similarly distributed by math average in each group (Table 10).

Table 10

Grade Average for Mathematics Courses by Experimental Group

Grade	Experimental Group			
	Treatment		Control	
	Frequency	Percent	Frequency	Percent
100 – 95	18	8.5%	21	13.1%
94 – 90	40	18.8%	29	18.1%
89 – 85	60	28.2%	29	18.1%
84 – 80	35	16.4%	39	24.4%
79 – 75	35	16.4%	20	12.5%
74 – 70	11	5.2%	17	10.6%
below 70	14	6.6%	5	3.1%

Teachers in the treatment and control groups were asked to describe their current and previous experience with TEKS-related activities for math and use of math warm-up problems.

Both groups were similarly divided when asked about their school administrations requirements for math-related TEKS activities. Table 11 contains teachers responses to this "yes" or "no" question, "Does your school administration require you to do TEKS-related activities for math?"

Table 11

Administration Requirement of Math TEKS Activities

Response	Experimental Group			
	Treatment		Control	
	n	Percent	n	Percent
Yes	5	45.5%	6	50.0%
No	6	54.5%	6	50.0%

Teachers in both treatment and control groups were also similarly divided when asked if they had used math warm-up problems in their classes, prior to participating in this study. Table 12 shows that most teachers in the treatment group (81.8%) and most teachers in the control group (76.9%) had not used math warm-up problems in their classes.

Table 12

Teachers' Prior Use of Math Warm-Up Problems

Response	Experimental Group			
	Treatment		Control	
	n	Percent	n	Percent
Yes	2	18.2%	3	23.1%
No	9	81.8%	10	76.9%

Perceptions

In addition to the descriptive characteristics of the students, data were collected from the groups to determine how students and teachers viewed the use of math warm-up problems.

Students were asked to describe their opinion of the level of difficulty of the math warm-up problems that were presented to them in class. Students selected responses ranging from "very difficult" to "very easy" or a response of "not applicable" for students in the control group. Table 13 describes the treatment group students' responses to the level of difficulty question, "In your opinion, what was the level of difficulty of the math warm-up problems?" Most students in the treatment group, responded with "neutral" (47.47%) or "easy" (30.81%).

Table 13

Treatment Group Students' Perceptions of Level of Difficulty of Math Warm-up Problems

Level of Difficulty	Frequency	Percent
Very Difficult	5	2.53%
Difficult	20	10.10%
Neutral	94	47.47%
Easy	61	30.81%
Very Easy	18	9.09%
Total:	198	100%

Number of students who reported "not applicable" = 16.
Number of students who failed to respond = 4.

Students were asked to describe their attitude about doing the math warm-up problems through the question, “Did you enjoy doing the math warm-up problems in AGSC 101?” Students were able to respond “yes,” “no,” or “not applicable.” More students answered “no” (72.11%) than “yes” (27.89%). Table 14 contains treatment group students’ responses to the attitude question of whether they enjoyed doing warm-up problems.

Table 14

Attitudes of Students in the Treatment Group About Doing Math Warm-up Problems

Did you enjoy doing math warm-up problems?	Frequency	Percent
Yes	53	27.89%
No	137	72.11%
Total:	190	100%

Number of students who responded “not applicable” = 24.
Number of students who failed to respond = 4.

Teachers in the treatment group were also asked what they thought students’ attitudes were about doing the math warm-up problems. Surprisingly, teachers stated that they thought most students liked (40%) doing or were indifferent (40%) about doing the warm-up problems. Table 15 shows the teacher responses (treatment only) about students’ attitudes.

Table 15

Experimental Treatment Teachers' Perceptions of Students' Attitudes About Doing Math Warm-up Problems

In your opinion, what were your students' attitudes about doing the warm-up problems?	Frequency	Valid Percent
Students liked doing warm-up problems	4	40%
Students were indifferent about doing warm-up problems	4	40%
Students did not like doing warm-up problems	2	20%

Missing data: 1

Teachers in the treatment group were asked what they thought was the level of benefit for the students of doing the math warm-up problems with an agricultural context. All teachers who responded to the question said the warm-up problems were beneficial (66.6%) or very beneficial (33.3%). Table 16 displays the responses of the teachers in the treatment group as to the benefit of math warm-up problems with an agricultural context.

Table 16

Experimental Treatment Teachers' Perception of Level of Benefit of Doing Math Warm-up Problems

Level of Benefit	Frequency	Valid Percent
Very Beneficial	3	33.3%
Beneficial	6	66.6%
Not Beneficial	0	0%
Totally Useless	0	0%

Missing data: 2

Students were also asked if they believed that doing the math warm-up problems were helpful in improving their math skills. Again, students' responses differed somewhat from teachers' responses when describing the usefulness of math warm-up problems. Table 17 lists treatment group students' responses to the usefulness of math warm-up problems. The majority of the treatment students believed that "probably yes" (37.5%) or "were not sure" (25.0%) that the warm-up problems were helpful in improving their math skills.

Table 17

Treatment Students' Perceptions of Usefulness of Math Warm-up Problems for Improving Mathematics Skills

Do you believe that doing the math warm-up problems helped you to improve your math skills?	Frequency	Percent
Absolutely Yes	9	4.33%
Probably Yes	78	37.50%
Not Sure	52	25.00%
Probably Not	44	21.15%
Definitely Not	25	12.02%
Total:	208	100%

Number of students who responded "not applicable" = 5.
Number of students who failed to respond = 5.

Teachers in the treatment group were asked to estimate the number of problems that they had their students do during the semester. The frequencies of use of math warm-up problems are listed in Table 18.

Table 18

Number of Warm-up Problems Used by Treatment Group Teachers

Problems Used	Frequency	Percent
None	0	0%
1 – 10	0	0%
11 – 20	1	10%
21 – 30	1	10%
31 – 40	0	0%
41 – 50	4	40%
51 – 60	0	0%
61 – 70	2	20%
71 – 80	1	10%
81 – 90	1	10%

Finally, teachers were asked whether they would like to see more development of TAKS-related curriculum materials based on agricultural contexts and what types of TAKS materials they felt were needed. Twenty-three out of twenty-four teachers responded “yes” they would like to see more TAKS materials developed. Table 19 contains results of teachers’ responses to whether or not they would like to see the development of TAKS-related curriculum materials with an agricultural context and Table 20 lists teachers’ responses as to what types of TAKS materials were needed.

Table 19

Teachers’ Desires for Development of TAKS-related Curriculum Materials with Agricultural Context

Would you like more development of TAKS-related curriculum Materials with an agricultural context?	Frequency	Percent
Yes	23	95.8%
No	1	4.2%

Table 20

Types of TAKS Materials Needed

What types of TAKS materials based on agricultural contexts do you feel are needed?	Response	Frequency	Percent
Math warm-up problems	Yes	13	54.2%
	No	11	45.8%
Math worksheets with word problems	Yes	14	58.3%
	No	10	41.7%
Reading worksheets with paragraphs and multiple choice questions	Yes	12	50.0%
	No	12	50.0%
Science trivia warm-ups	Yes	17	70.8%
	No	7	29.2%
Science worksheets with paragraphs and multiple choice questions	Yes	9	37.5%
	No	15	62.5%
Social Studies trivia warm-ups	Yes	14	58.3%
	No	10	41.7%
Social Studies worksheets with paragraphs and multiple choice questions	Yes	6	25.0%
	No	18	75.0%

Achievement

The second part of the students' survey was the completion of a 30-question mathematics test. Students were asked to solve 30 math problems selected from released 2000 and 2001 TAAS (Texas Assessment of Academic Skills) math tests. The word problems with multiple choice answers covered 12 of 13 TAAS objectives (Appendix U). Students were instructed to solve the problems and record their answers on the answer scantron sheets. Cronbach’s coefficient alpha, a measure of internal consistency, for the 30-item mathematics examination was .89.

The following table (Table 21) shows the frequency distribution of answer choices for each test item. The asterisk identifies the correct answer choice.

Table 21

Students’ Responses to 30 Multiple Choice Math Examination Items (N = 388)

Item/Response Choices	n	Percent
1 In 40 baseball games Juan's team has scored 50 runs. If the team continues at this rate, how many runs could the team expect to score in a 160-game season?		
A 128	44	11.3%
B 170	53	13.7%
* **C** 200	267	68.8%
D 250	21	5.4%
2 During 4 nights of working as a waiter, Billy earned $9.50, $14, $9.50, and $11.50 in tips. What was the median amount of money Billy earned in tips for those 4 nights?		
A $9.50	63	16.2%
* **B** $10.50	197	50.8%
C $11.50	89	22.9%
D $11.75	35	9.0%

Table 21 *continued.*

Item/Response Choices:	n	Percent
3 The amount of time that it takes to fill the empty tank of a 30-gallon water heater can be determined by the formula $t = \frac{30}{f}$ where *t* is the time in minutes and *f* is the rate of water flowing into the tank in gallons per minute. If it takes 12 minutes to fill the tank, what is the rate of the water flowing into the tank?		
A 0.4 gal per min	36	9.3%
B 1.8 gal per min	40	10.3%
* **C** 2.5 gal per min	264	68.0%
D 3.6 gal per min	44	11.3%
4 A softball-throwing contest was held on field day. The top 4 distances were recorded in meters. Which lists the distances in order from shortest to longest?		
A 53.257 m, 53.432 m, 54.97 m, 53.25 m	17	4.4%
B 53.25 m, 54.97 m, 53.432 m, 53.257 m	12	3.1%
* **C** 53.25 m, 53.257 m, 53.432 m, 54.97 m	339	87.4%
D 54.97 m, 53.432 m, 53.257 m, 53.25 m	18	4.6%
5 Mr. Barnes needed to paint a rectangular wall that was 125 feet long and 6 feet tall. When he stopped to rest, he still had 100 square feet of wall unpainted. How many square feet of wall did he paint before he stopped to rest?		
A 150 ft^{2}	58	14.9%
B 162 ft^{2}	59	15.2%
* **C** 650 ft^{2}	210	54.1%
D 750 ft^{2}	58	14.9%

Table 21 *continued.*

<table>
<tr><th>Item/Response Choices</th><th>n</th><th>Percent</th></tr>
<tr><td>6
Which expression should be next in this pattern?
$2a + 3,\ 4a + 6,\ 8a + 12,\ 16a + 24,\ \ldots$</td><td></td><td></td></tr>
<tr><td>A $10a + 15$</td><td>12</td><td>3.1%</td></tr>
<tr><td>B $12a + 18$</td><td>15</td><td>3.9%</td></tr>
<tr><td>C $24a + 36$</td><td>42</td><td>10.9%</td></tr>
<tr><td>* D $32a + 48$</td><td>317</td><td>81.7%</td></tr>
<tr><td>7
A storm brought more than 2 inches of snow to 4 different towns. The chart shows the amount of snow each town received.
Snow
<table>
<tr><th>Town</th><th>Number of Inches</th></tr>
<tr><td>Brackville</td><td>$2\ ^5/_8$</td></tr>
<tr><td>Cannon</td><td>$2\ ^7/_{10}$</td></tr>
<tr><td>Odem</td><td>$2\ ^1/_2$</td></tr>
<tr><td>Shelton</td><td>$2\ ^3/_4$</td></tr>
</table>
Which list shows the towns in order from the greatest amount of snow received to the least amount of snow received?</td><td></td><td></td></tr>
<tr><td>A Odem, Brackville, Cannon, Shelton</td><td>87</td><td>22.4%</td></tr>
<tr><td>B Shelton, Odem, Brackville, Cannon</td><td>73</td><td>18.8%</td></tr>
<tr><td>C Cannon, Brackville, Shelton, Odem</td><td>73</td><td>18.8%</td></tr>
<tr><td>* D Shelton, Cannon, Brackville, Odem</td><td>153</td><td>39.4%</td></tr>
</table>

Table 21 *continued*.

Item/Response Choices	n	Percent
8 Gracie has scored 18, 21, 12, 18, 22, 20, 19, 18, 19, and 16 points in her last 10 basketball games. What was the mode of these scores?		
A 17	16	4.1%
* **B** 18	271	69.8%
C 18.3	59	15.2%
D 18.5	38	9.8%
9 The average daily temperature for the first 6 days in July was recorded for the town of Grandville. The temperatures were 78°F, 75°F, 71°F, 66°F, 73°F, and 75°F. What was the mode of these temperatures?		
A 66°F	15	3.9%
B 72°F	34	6.2%
C 73°F	67	17.3%
* **D** 75°F	278	71.6%
10 A florist uses 8 carnations, 3 lilies, 6 daisies, and 4 roses for a certain spring flower arrangement. Last week between 700 and 730 flowers were used to make these arrangements. About how many of these arrangements were made?		
A 20	40	10.3%
B 25	48	12.4%
* **C** 35	269	69.3%
D 40	26	6.7%

Table 21 *continued*.

Item/Response Choices	n	Percent
11 Raúl selected 12 CDs at Joe's CD Exchange and Resale Store. The CDs were priced from $2.99 to $5.49. Which is a reasonable amount that he paid for the CDs before tax was added?		
A Less than $35	41	10.6%
* **B** Between $35 and $70	304	78.4%
C Between $70 and $95	30	7.7%
D Between $95 and $110	10	2.6%
12 Connie's Cookie House sells a gift box of chocolate chip cookies. The charge is 50¢ per cookie plus 75¢ for the gift box. Waylon bought a gift box of 1 dozen cookies for his aunt. Which equation could be used to find his cost, *c*, before sales tax was added?		
A $c = 12 + 0.50 + 0.75$	2	6.7%
B $c = 12(0.50)(0.75)$	39	10.1%
C $c = 12(0.50 + 0.75)$	60	15.5%
* **D** $c = 0.50(12) + 0.75$	260	67%

Table 21 *continued*.

Item/Response Choice	n	Percent
13 To pass an amendment to the Constitution, at least $^2/_3$ of the members of the legislature must vote in favor of the amendment. Which inequality describes *v*, the number of votes required to pass an amendment if there are *m* members of the legislature?		
A $m \geq \frac{2}{3}v$	88	22.7%
* **B** $v \geq \frac{2}{3}m$	145	37.4%
C $m \leq \frac{2}{3}v$	88	22.7%
D $v \leq \frac{2}{3}m$	64	16.5%
14 The County Clipper Bus Line sets the ticket prices for various destinations using this formula. $p = 8.25 + 0.12d$ Which is the best estimate of the ticket price, *p*, when the destination, *d*, is 460 miles away?		
A $13	35	9.0%
B $35	48	12.4%
C $45	60	15.5%
* **D** $60	241	62.1%

Table 21 *continued*.

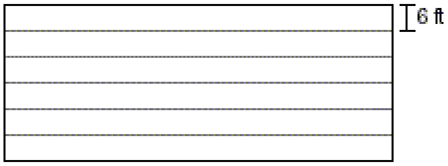
Item/Response Choice	n	Percent
15 Camilla bought 8 yards of fabric at the regular price and 19 yards of the same fabric on sale. She needs 2¼ yards of the fabric to make 1 costume for the school play. Which expression could Camilla use to determine how many costumes she could make with the fabric she has?		
A (19 - 8) × 2¼	45	11.6%
* **B** (8 + 19) ÷ 2¼	246	63.4%
C (19 × 2¼) + 8	59	15.2%
D (19 - 2¼) + (8 - 2¼)	35	9.0%
16 A community swimming pool is 2½ times as long as it is wide. There are 6 swimming lanes running the length of the pool. Each lane is 6 feet wide. What is the length of the pool? 		
A 30 ft	29	7.5%
B 36 ft	107	27.6%
C 51 ft	24	6.2%
* **D** 90 ft	225	58.0%

Table 21 *continued*.

Item/Response Choices	n	Percent
17 On days when pizza is being served, a school cafeteria manager plans the number of meals to prepare using the formula $m = 0.85s$ where *m* is the number of meals and *s* is the number of students enrolled in the school. If the school has an enrollment of 352 students, which is a reasonable number of pizza meals prepared?		
A 50	24	6.2%
B 150	39	10.1%
C 200	58	14.9%
* **D** 300	262	67.5%
18 Carver High School has a total enrollment of 756 students. Approximately 35% of the students ride the school bus daily. Which is the best estimate of the number of students who ride the bus daily?		
A 450	51	13.1%
B 350	61	15.7%
* **C** 250	249	64.2%
D 150	22	5.7%

Table 21 *continued*.

Item/Response Choices	n	Percent
19 Raymond and his mother picked all the peaches from their tree to make peach preserves. They used 15 peaches for each jar of preserves. They made 12 jars of preserves and still had 40 peaches left over. How many peaches did they get from their tree?		
A 140	32	8.2%
B 180	57	14.7%
* **C** 220	267	68.8%
D 495	27	7.0%
21 Mr. Hernández bought his wife 3½ dozen roses, which cost $22.80 per dozen. How much did the roses cost, not including tax?		
A $68.40	52	13.4%
B $77.40	53	13.7%
* **C** $79.80	257	66.2%
D $89.80	20	5.2%
22 Ann's car gets 27.5 miles per gallon of gas. How far can Ann drive if she uses 15 gallons of gas?		
A 42.5 mi	27	7.0%
B 137.5 mi	30	7.7%
C 302.5 mi	29	7.5%
* **D** Not Here	296	76.3%

Table 21 *continued*.

Item/Response Choices	n	Percent
23 Andy participated in a neighbor's garage sale. He sold 3 items: a picture frame for $8.50, a teapot for $3.75, and a set of 6 cups for $4.75. What were his total sales?		
A $9.35	25	6.4%
B $15.00	26	6.7%
C $15.90	42	10.8%
* **D** $17.00	289	74.5%
24 Paula works for a tax accountant. She earns $42 for each tax return that she completes for a client. On the average, she can complete a return in 3½ hours. At this rate, how much does Paula earn per hour?		
A $6	38	9.8%
* **B** $12	198	51.0%
C $14	106	27.3%
D $21	40	10.3%

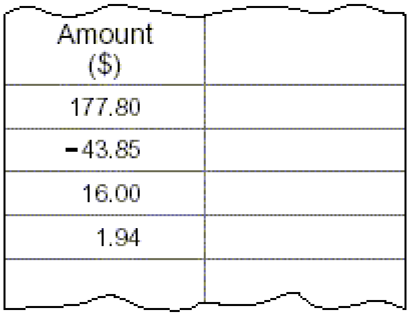
Table 21 *continued*.

<table>
<tr><th>Item/Response Choice</th><th>n</th><th>Percent</th></tr>
<tr><td>25 The chart shows the height of several mountains.
Height of U.S. Mountains
<table>
<tr><th>Mountain</th><th>Height</th><th>Rank</th></tr>
<tr><td>McKinley (Alaska)</td><td>20,230 feet</td><td>1</td></tr>
<tr><td>St. Elias (Alaska)</td><td>18,008 feet</td><td>2</td></tr>
<tr><td>Foraker (Alaska)</td><td>17,400 feet</td><td>3</td></tr>
<tr><td>Bona (Alaska)</td><td>16,550 feet</td><td>4</td></tr>
<tr><td>Whitney (California)</td><td>14,494 feet</td><td>18</td></tr>
<tr><td>Elbert (Colorado)</td><td>14,433 feet</td><td>19</td></tr>
</table>
Which statement is <i>not</i> supported by the data?</td><td></td><td></td></tr>
<tr><td>A The highest mountains in the United States are found in Alaska.</td><td>49</td><td>1.6%</td></tr>
<tr><td>B The highest mountain is about 2200 feet taller than the next highest.</td><td>78</td><td>20.1%</td></tr>
<tr><td>C There are 13 U.S. mountains with heights between 14,494 feet and 16,550 feet.</td><td>113</td><td>29.1%</td></tr>
<tr><td>* D The first 17 tallest mountains in the United States are located in Alaska.</td><td>140</td><td>36.1%</td></tr>
</table>

Table 21 *continued.*

Item/Response Choice	n	Percent
26 Malcolm spent $85.43 on wallpaper, $21 on paint, and $7.84 on brushes and other supplies for redecorating a bathroom. How much did he spend in all, not including tax?		
* **A** $114.27	300	79.2%
B $103.27	30	7.9%
C $95.37	26	6.9%
D $93.48	23	6.1%
27 Kerry earns $9.75 per hour. If he works 40 hours in 1 week, how much will he earn before deductions?		
* **A** $390.00	276	71.1%
B $380.00	42	10.8%
C $360.75	33	8.5%
D $49.75	25	6.4%
28 An hour of vacuuming or making beds uses 240 calories. This is 40% of the number of calories burned by jogging for 1 hour. What is the total number of calories burned by jogging for 1 hour?		
A 60 calories	54	13.9%
B 96 calories	100	25.8%
* **C** 600 calories	178	45.9%
D 960 calories	43	11.1%

Table 21 *continued*.

Item/Response Choice	n	Percent
29 Lisa put $455 into an interest-bearing savings account. After 1 year there was $481.66 in the account. If she made no deposits or withdrawals during that year, how much interest did Lisa's account earn?		
A $25.34	30	7.7%
B $25.66	45	11.6%
C $26.34	67	17.3%
* **D** $26.66	231	59.5%
30 Elton had 4 entries on his spreadsheet. What is the sum of these entries?  Amount ($) 177.80 -43.85 16.00 1.94		
A $239.59	59	15.2%
* **B** $151.89	245	63.1%
C $136.05	36	9.3%
D $116.01	33	8.5%

An analysis of students' performance on the 30-problem math test revealed a statistical mean of 19.23 problems answered correctly with a standard deviation of 6.79 and a standard error of .34 (N=388). As we look at group comparisons, we can see that there was no statistically significant difference in mean scores between the sampling units of the treatment group (18.99 with a standard deviation of 7.31 and standard error of .49) and the sampling units of the control group (19.55 with a standard deviation of 6.07 and standard error of .47). Table 22 represents results of the independent *t*-test between the individuals in the treatment group and the individuals in the control group.

Table 22

Comparison of Treatment and Control Groups' Individual Students' Performance on Mathematics Achievement Examination

	Experimental Group							
	Treatment			Control			*t*-value	p
	n	Mean	SD	n	Mean	SD		
Mathematics Achievement Scores	218	18.99	7.31	170	19.55	6.07	-.82	.42

Note: These results are based on sampling units rather than experimental units. Grand Mean (N=388) was 19.23 with a standard deviation of 3.37.

When aggregating the scores and comparing the means of the schools in the treatment group and the schools in the control group, we get similar results. The mean for the treatment group schools was 18.94 with a standard deviation of 4.33 and standard error mean of 1.30. The mean for the control group schools was 20.14 with a standard deviation of 2.35 and standard error mean of .65. See Table 23.

Table 23
Comparison of Treatment and Control Aggregated School Scores on Mathematics Achievement Examination

	Experimental Group							
	Treatment			Control			*t*-value	*p*
	n	Mean	SD	n	Mean	SD		
Aggregated School Scores	11	18.94	4.33	13	20.14	2.35	-.86	.40

Note: Experimental units were classes – not individual students.
Grand Mean (N = 24) was 19.55 with a standard deviation of 3.37.

The State of Texas reports test scores for subgroups based on ethnicity and socio-economic level and use that information to evaluate school performance. Therefore, this researcher felt that it was important to look at the performance of the ethnic subgroups in this math study.

Interestingly, Hispanics in the treatment group outperformed all other subgroups, including Caucasian, African American, and Others, in both the treatment and control groups. Table 24 represents the mean scores of subgroups based on ethnicity for both treatment and control groups. Because of relatively small numbers, students who identified their ethnicity as Asian American, Native American, or Other, were collapsed into one group and reported as “other.”

Table 24

Mean Scores of Subgroups in Treatment and Control Groups

Ethnic Subgroup	Experimental Group	Mean	Standard Deviation	n
Caucasian	Treatment	19.51	7.23	132
	Control	20.20	5.90	124
	Total	19.84	6.62	256
Hispanic/Latino	Treatment	20.61	7.07	49
	Control	19.29	5.01	14
	Total	20.32	6.65	63
African American	Treatment	14.82	4.79	11
	Control	16.50	5.04	10
	Total	15.62	4.86	21
Other	Treatment	15.60	5.95	20
	Control	17.50	6.94	14
	Total	16.38	6.34	34
Total	Treatment	19.15	7.13	212
	Control	19.66	5.93	162
	Total	19.37	6.64	374

Correlations and Cross-tabulation

In searching for any relationships that may have existed between students' test scores and students' characteristics, an analysis using Pearson product moment correlation coefficients was utilized.

Student variables for grade and ethnicity were not found to be statistically significantly related with students' test scores. Similarly, no statistically significant relationship was detected between the number of math warm-up problems used in treatment classes (see Table 18) and student achievement on math test scores.

Statistically significant relationships, both positive and negative, were found to exist for student variables based on mathematical courses currently taking and mathematical courses completed.

A statistically significant positive relationship was revealed for students who were currently taking geometry (r_{pb} = .249 at an alpha level of .01), while a statistically significant negative relationship was revealed for students who were currently taking math courses identified as "other" (r_{pb} = -.236 at an alpha level of .01). Most of the students had identified "other" as eighth grade math. No statistically significant correlations were found to exist between test scores and current enrollment in Algebra I, Algebra II, Pre-Calculus, Math Models, Independent Study, Advanced Placement-Statistics, Advanced Placement-Calculus A/B, or Advanced Placement-Calculus B/C.

The correlation coefficient derived from the student variable for math courses completed showed some statistically significant positive relationships for the following math courses: Algebra I (r_{pb} = .209 at an alpha level of .01), Algebra II (r_{pb} = .107 at an alpha level of .05), and Pre-Calculus (r_{pb} = .175 at an alpha level of .01). No statistically significant correlations were found to exist between test scores and the completion of Geometry, Math Models, Independent Study, Advanced Placement-Statistics, Advanced Placement-Calculus A/B, Advanced Placement B/C, or "other" math courses.

An analysis of school characteristics, using the Pearson product moment correlation, revealed no statistically significant relationships between school test scores and correlation coefficients derived from school variables based on school size classification, geographic location as identified by FFA Area designation, number of math warm-up problems used during the semester, school required TAKS math activities, or prior use of math warm-ups.

Due to the positive and negative relationships found in the correlation analysis of test scores and math background items, an analysis was done to see how students were distributed among the treatment and control groups. Table 25 contains the statistics resulting from the compositions of the treatment and control groups based on courses in which students were currently enrolled. The Chi-Square analysis showed that there was a statistically significant difference between the groups based on current enrollment in geometry.

Table 26 contains the statistics resulting from the comparison of the treatment and control groups based on courses which the students had already completed. The Chi-Square analysis showed that there was a statistically significant difference between the groups based on completion of "other" (8th grade math) courses.

Using any of the mathematics "history" or "current" situation variables as covariate(s) to explain mathematics performance did not change the results, that is, in all such analyses, there were no differences in the mathematics performance of treatment and control groups.

Table 25

Cross-tabulation of Groups with Math Courses in Which Students Were Currently Enrolled

Current Course Enrollment	Within Treatment Group		Within Control Group		df	Cramer's V	
	Frequency	Percent	Frequency	Percent		Value	Approx. Sig.
Algebra I	113	51.8%	75	44.5%	1	.077	.131
Algebra II	13	6.0%	10	5.9%	1	.002	.973
Geometry	44	20.2%	52	30.6%	1	.120	.018*
Pre-Calculus	1	.5%	1	.6%	1	.009	.860
Math Models	8	3.7%	9	5.3%	1	.039	.438
Independent Study	1	.5%	0	0.0%	1	.045	.377
A. P. – Statistics	0	0.0%	0	0.0%	1	---	---
A. P. – Calculus A/B	3	1.4%	1	.6%	1	.039	.446
A. P. – Calculus B/C	0	0.0%	0	0.0%	1	---	---
Other - (8th Grade Math)	29	13.3%	14	8.2%	1	.080	.115

*$p<.05$

Table 26

Cross-tabulation of Groups with Math Course(s) Completed by Students

Course(s) Completed	Within Treatment Group		Within Control Group		df	Cramer's V	
	Frequency	Percent	Frequency	Percent		Value	Approx. Sig.
Algebra I	90	41.3%	82	48.2%	1	.069	.171
Algebra II	19	8.7%	11	6.5%	1	.042	.411
Geometry	28	12.8%	27	15.9%	1	.043	.395
Pre-Calculus	4	1.8%	1	0.6%	1	.055	.280
Math Models	4	1.8%	3	1.8%	1	.003	.959
Independent Study	0	0.0%	0	0.0%	1	---	---
A. P. –Statistics	0	0.0%	0	0.0%	1	---	---
A. P. – Calculus A/B	0	0.0%	0	0.0%	1	---	---
A. P. – Calculus B/C	0	0.0%	0	0.0%	1	---	---
Other - (8th Grade Math)	76	34.9%	30	17.6%	1	.192	.000*

$*p<.05$

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In Texas and across the nation, teachers in all areas of curricula are responsible for students' performance in mathematics and other academics. As agricultural science teachers, we face a dilemma of keeping true to our agricultural focus, while incorporating mathematics, science and other academic skills into our curriculum in hopes of improving academic performance.

The purpose of this study was to examine the effect of mathematics practice problems with an agricultural context on students' mathematics performance. The goal of this study was to provide agricultural science teachers with an instructional strategy that incorporates practice of mathematical standards within the agricultural science curriculum.

To achieve the purpose and goal of this study, three objectives were established: (1) measure the differences in students' mathematical performance based on the use or non-use of math warm-up problems in the course Agriscience 101; (2) determine how students viewed the difficulty, enjoyment, and usefulness of math warm-up problems; and, (3) determine agricultural science teachers' attitudes about and desires for academic standards-based instructional materials with an agricultural context.

Teachers at the 2003 Texas Agricultural Science Teachers' Professional Development Conference were recruited to have their school participate in the study.

Once consent was received from the schools' administrators, the schools were randomly divided into treatment and control groups.

In the final analysis, a total of 24 schools participated in the study, of which 11 schools were designated as treatment group and 13 as control group. There were a total of 388 students participating in the study, of which 218 were designated treatment group and 170 were designated control group.

Conclusions

When evaluating the results of this study based on the first objective, which was to measure the differences in students' math performance based on the use or non-use of math warm-up problems in Agriscience 101, the *t*-test for treatment and control group scores revealed no statistically significant difference for individual sampling units or schools.

The *t*-test for schools' scores resulted in a mean of 18.94, with a standard deviation of 4.33, for the treatment group schools and a mean of 20.14, with a standard deviation of 2.35 for the control group schools. Because there was no statistically significant difference in mean scores, insufficient evidence existed to conclude that treatment and control groups differed in mathematical performance.

Studies on "applied academics" have shown mixed results for improvement of mathematics performance (Dare, 2000). The following studies showed negative or no statistically significant difference in mathematics performance when using applied academics: Basnight (1994), Harvey (1991), Keaton (1994) and Lai (1991).

Statistically significant improvement in mathematics performance when using applied academics was found in studies by Bottoms, Presson and Johnson (1992), Keif and Stewart (1996), Pepple and O'Connor (1992), and Tanner and Chism (1996), and Wang and Owens (1995).

Though the results of the *t*-test in this study were unable to substantiate improved mathematical performances based on the use of mathematical warm-up problems with an agricultural context, this researcher questioned the equality of students in the treatment and control groups.

The study was based on volunteer participation of teachers and volunteer participation of individual students. What accounted for the difference in the number of students who participated in the treatment group (218 students from 11 schools), which averaged 19.82 students per school, compared to the control group (170 students from 13 schools), which averaged 13.08 students per school?

This researcher was also concerned with the differences in the range of mean scores between schools in the treatment group and schools in the control group. Indeed, the treatment group (SD = 4.33), which had a range of school means scores from 25.88 to 10.87, had nearly twice the standard deviation for scores than did the control group (SD = 2.35), which had a range of school means scores from 26.4 to 16.81.

One of the teachers, (anonymous, July, 2004), whose students participated in the control group confirmed my suspicions that only his better students volunteered to participate in the study. Was this true of all schools (both treatment and control) or of only the schools in the control group? Self-selection, if related to ability in math, would have an effect on the equality of participants in the control and treatment groups.

Analysis revealed that there were correlations between test scores and math courses that the students were currently taking or had completed. Scores from students who had completed Algebra I, Algebra II, and Pre-Calculus or were currently enrolled in Geometry were positively correlated. Test scores from students who were currently taking math courses identified as “other” (which most students listed as 8th grade math) showed a negative correlation.

As a percentage of the group, more students in the control group had completed Algebra I and Geometry than did students in the treatment group. As a percentage of the group, more students in the treatment group had completed or were currently enrolled in a math course identified as “other” (8th Grade Math) than were students in the control group. A Chi-Square test revealed that there was a statistically significant difference between the groups based on students who were currently enrolled in Geometry. Students in the control group were more likely to be enrolled in Geometry than were students in the treatment group. Likewise, students in the treatment group were more likely to have completed only 8th Grade Math than were students in the control group. Both of these characteristics were correlated to math test score and could have affected the outcome of the study.

Though random assignments of schools were made to the treatment and control groups, did the volunteer aspect of the individual students within each school affect the compositions of the groups to such a degree that it impacted the group means?

Although there was no statistically significant difference between mean scores for students in the treatment group or in the control group, it was very interesting that when looking at scores for subgroups, Hispanic students in the treatment group outperformed all other subgroups in either the treatment or control groups. This is important because historically, Hispanics do not perform as well as Caucasian students on standardized tests like the TAAS and TEKS in Texas (TEA, 1994-2002; TEA, 2003-2005) or the NAEP nationally (NCES, 2000). Studies by Keaton (1994) showed that "applied academics" helped improve achievement of Black students and retained students (students held back at some point in their education).

The second objective of this study was to determine how students viewed the difficulty, enjoyment, and usefulness of the math warm-up problems. Students and teachers were asked to give their opinions about the warm-up problems based on three variables.

Students responded to a question of the level of difficulty of the warm-up problems with one of the following choices: very difficult, difficult, neutral, easy, very easy, or not applicable. Of the students to which the question applied (i.e. treatment group), most responded that the difficulty level was "neutral" (47.47%) or "easy" (30.81%). Therefore, it can be concluded that most students did not find the warm-up problems too difficult to work.

Students were asked if they enjoyed doing the math warm-up problems. Students could choose "yes," "no," or "not applicable" to answer the question. Of the students to which this question applied, only 27.89% answered "yes," they enjoyed doing the warm-up problems, while 72.11% answered “no,” they did not enjoy doing the warm-up problems.

In contrast, teachers in the treatment group who responded to the question about their students’ attitudes about doing the warm-up problems responded favorably that their students liked doing the warm-up problems (40%), or that their students were indifferent (40%) about doing the warm-up problems. Only 20% of the treatment group teachers said their students did not like doing the warm-up problems.

This researcher would like to know why there is such a difference in perception between students and their teachers about the enjoyment of doing the math warm-up activity. Is this difference in perception true of only the math warm-up activity or is it true of other instructional activities, where we as teachers think that students are enjoying an activity, when in reality they may not?

This researcher would also like to know if the students’ negative attitudes about doing the warm-up problems were because they viewed the warm-up problems as “just another math-testing problem” rather than an important component of the agricultural topic that they were to cover that day. In other words, was the agricultural context overshadowed by the fact that the warm-up was in the form of a math problem?

Perhaps if the mathematics class emphasized agricultural problems, then students interested in agriculture would have more positive attitudes. Research on “applied academics” reported that students had a positive attitude toward school and themselves (Bottoms, Presson, & Johnson, 2000) and a positive attitude about math courses (Burchett, 1995; Haynes, Law, & Pepple, 1991; and Keif & Stewart, 1996).

The third question related to the second objective of this study dealt with how beneficial students and teachers thought the warm-up problems were to improving math skills. Students were asked the question, "Do you believe math warm-up problems helped improve your math skills?" Of the students to which the question applied, over 40% responded that "absolutely yes" (4.33%) or "probably yes" (37.50%) the warm-up problems helped improve their math skills.

All teachers who answered the question about the level of benefit for students, responded favorably with 33.3% of teachers stating that the math warm-up problems were "very beneficial" for their students and the remaining 66.6% of teachers stating that the math warm-up problems were "beneficial" for their students.

All of the teachers and many of the students recognized the benefits of doing the math warm-up problems. Although the benefits were not proven in this study for the entire testing sample, there did appear to be benefits for Hispanic/Latino students in the treatment group, who outperformed all other subgroups and the overall mean score. These results cannot be ignored, when typically Hispanics/Latino students perform below the overall mean and below Caucasian students on state (TAAS and TAKS) and national (NAEP) standardized tests.

The third objective of this study was to determine agricultural science teachers' attitudes about and desires for academic standards-based instructional materials with an agricultural science context.

Eleven teachers responded “yes,” they were required by school administration to do some type of TEKS-related activities for math, but only five of the teachers stated that they had used math warm-up problems.

When asked if they would like to see more TAKS-related materials developed based on agricultural context, 23 of 24 teachers responded “yes.” Teachers were asked to select types of materials that they believed were needed. The following types of materials were selected by at least half of the teachers:

- Math warm-up problems (54.2%),
- Math worksheet with word problems (58.3%),
- Reading worksheets with paragraphs and multiple choice questions (50%),
- Science trivia questions (70.8%), and
- Social studies trivia warm-ups (58.3%).

In Texas, teachers are evaluated in part, through the Professional Development Appraisal System, by their contributions to improving academic performance. This researcher believes that agricultural science curriculum developers should incorporate academic standards into the agricultural context to provide both the documentation and methods for incorporating academics into agricultural courses. This study showed that teachers are in favor of such development of instructional materials.

In conclusion, this study provided some evidence that doing math warm-up problems with an agricultural context was beneficial to improving mathematics performance of Hispanic/Latino students, even though there was no statistically significant difference overall between the treatment and control groups. Had the groups been more similar in regards to the math courses in which students were currently enrolled or the math courses students had already completed, we may have seen a positive effect of the treatment.

Though students had a negative attitude about doing the warm-up problems, most students and teachers recognized the benefits of doing the math warm-up problems. Teachers were almost unanimous in voicing their desire for more TAKS-related materials with an agricultural context.

Recommendations

More research needs to be conducted to answer questions related to the following issues that were identified by this study:

- effectiveness of doing mathematical warm-up problems with an agricultural context,
- differences in students' perceptions and teachers' perceptions on enjoyment and effectiveness of instructional activities such as warm-up problems, and
- perceived benefits of doing mathematics warm-up problems with agricultural context for Hispanic/Latino students.

This researcher recommends a study of selected schools in which the teacher has 2 or more agriscience classes that can be randomly assigned to treatment or control groups and require all students to participate, or a study of selected schools in which all students within the Agriscience classes are required to participate. Equal participation by all students and consistency in presenting the warm-up problems would be needed. Warm-up problems should be part of the daily routine for the treatment group. Using a mandatory test system, such as the TAKS test in Texas or the equivalent state-mandated test for other states, would also alleviate the problems encountered from voluntary participation.

More research needs to be conducted to determine the potential benefits of TAKS-related activities with an agricultural context, including math warm-up problems, for improving academic performance of all students and students in sub-groups. Research should also be conducted to determine if it is the practice of doing warm-up problems or if it is the agricultural context that provides perceived benefits for Hispanic/Latino students.

There is little to no existing research in the field of agricultural education related to mathematics performance. Agricultural research-based TAKS materials need to be developed for all academic areas, especially mathematics.

With the *No Child Left Behind Act*, it is in the best interest of agricultural education that more attention be paid to how agricultural educators can help improve the academic performance of our students. Because teachers wanted more curriculum materials, it is recommended that additional curriculum materials be developed. However, those materials should be tested for efficacy.

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APPENDIX A

TIMELINE OF TESTING IN TEXAS

Timeline of Testing in TEXAS

1979 TABS (Texas Assessment of Basic Skills) Test:
The legislature passed a bill requiring basic skills competencies in math, reading, and writing for grades 3, 5 and 9. Because there was no state-mandated curriculum at that time, the learning objectives for the TABS were created by committees of Texas educators. In 1983, the Texas Legislature began requiring retesting. Although TABS was not a “diploma-denial test,” 9th grade students who did not pass the test were required to retake the exam each year thereafter while in school. Because results were reported, the TABS test was the beginning of “high stakes” accountability for school districts.

1984 TEAMS (Texas Educational Assessment of Minimum Skills) Test:
The legislature changed the wording of the Texas Education Code, requiring the assessment program to measure “minimum skills” rather than “ basic skills competencies.” The TEAMS test began in the 1985-86 school year, replacing the TABS. It sought to increase the rigor of the state assessment and added individual student sanctions for performance at the exit level. TEAMS tested math, reading, and writing, and was administered to students in grades 1, 3, 5, 7, 9 and 11, with the 11th grade testing being the “exit level” assessment. The class of ‘87 became the first class in which students were required to pass the exit level exam in order to receive a diploma.

1990 TAAS (Texas Assessment of Academic Skills) Test:
Changes in state law required the implementation of a new criterion-referenced program. The TAAS test shifted the focus from minimum skills to academic skills, which represented a more comprehensive assessment of the state-mandated curriculum, the Essential Elements. TAAS assessed higher-order thinking skills and problem-solving in math, reading and writing for grades 3, 5, 7, 9, and 11 exit level. The board considered the following factors when establishing the levels of satisfactory performance. First, the TAAS assessed a broader range of the Essential Elements than TEAMS did. Second, in comparison to TEAMS, the TAAS test items were more difficult. Third, the TAAS served multiple purposes by providing scores and consequences at the student level, the school level, and the district level. Due to these factors, the board set a one-year interim standard for satisfactory performance.

1992-1993 TAAS transitioned from a fall to a spring testing program, and in 1993- 1994 assessment was expanded to include grades 3-8 in reading and math. The writing test was moved to grades 4 and 8, and the exit level test was moved from grade 11 to grade 10.

1993 The legislature enacts the creation of a new statewide-integrated accountability system that includes the rating of campuses and districts. The inclusion of TAAS in the accountability system, the public release of performance results, and the exit-level requirement for graduation makes TAAS the most “high stakes” assessment in Texas history.

1994 The board voted to align the passing standards at grades 3-8, with the standard being established at the exit level. This new standard, the Texas Learning Index (TLI), allowed comparisons of achievement across grades while maintaining the same passing standards for exit level students. The TLI helped districts to determine whether each student was making the yearly progress necessary to meet minimum expectations on the exit level reading and math test in 10th grade.

1995 Science and social studies were added to the eighth grade TAAS test.

1999 TAKS (Texas Assessment of Knowledge and Skills) Test:
Development of the Texas Assessment of Knowledge and Skills (TAKS) test begins. The legislature passed bills ending social promotion and creating a more rigorous testing program (Texas Education Code, Chapter 39 and 28 respectively). As mandated by the 76th Texas Legislature, the Texas Education Agency begins to develop a new assessment program, the Texas Assessment of Knowledge and Skills (TAKS), to be aligned with the state-mandated curriculum, the Texas Essential Knowledge and Skills.
Under the new law, students in grades 3 (reading), 5 and 8 (reading and math) will be required to demonstrate proficiency on a state assessment test, and achieve passing grades in order to advance to the next grade level. At the 11th grade (reading, writing, math, science and social studies) students must pass the TAKS test , in addition to receiving the required number of credits, in order to receive their high school diploma. The Texas Education Code (TEC) charges the State Board of Education with establishing the passing standards (performance standards) on the new TAKS test.

2002 Spring of 2002 is the last administration of the TAAS test. Exit level students who fail any subject area test will continue to retest.
TAKS is field-tested across the state of Texas and will become the new statewide assessment program to be administered beginning in the 2003 school year.

February-May 2002 Statewide field testing for grades 3-11 is conducted in order to collect student performance data on test items.
November 2002 The State Board of Education is expected to set passing standards for the new TAKS test.
Spring 2003 is the first live administration of the TAKS test which will generate scores that count for students.

APPENDIX B

VOLUNTEER FORM

I NEED YOUR HELP!

Howdy! I am Mary Jasek, an agricultural science teacher at Bryan High School and a doctoral student at Texas A&M University. I am conducting an experimental study to see if students' performance on math tests can be improved by the use of math warm-up problems based on agricultural science topics in AGSC 101 classes. I need teachers from approximately 100 agricultural science programs to participate in the study, *Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics.*

Teachers who volunteer to participate in this study will receive the instructional materials at the beginning of either the fall or spring semester. Those who are randomly chosen from the volunteer pool to receive materials in the fall will be asked to allocate the first 3-5 minutes of class to the warm-up math problems.

Students will try to solve the problem at the beginning of the class period (1-3 minutes). During this time you, the teacher, can check roll and/or take care of other classroom managerial duties. When you and the students are ready to proceed, you will show students the solution to the problem and answer any questions they may have (1-2 minutes).

The total exercise should take no more than 3-5 minutes, after which you and your students will proceed with the lesson for the day. This exercise should be done each day during the fall semester.

Some teachers will be randomly chosen to receive the materials in the spring. However, both fall and spring groups will be tested in December. You will be asked to give students a 30-question math test. Students' scores will be anonymous and should not affect the students' grades or credits for the AGSC 101 course.

If you are chosen from all volunteers in a random drawing, I will send a letter to your principal/superintendent. Upon receiving their consent to the study, I will notify you of your participation and forward appropriate materials to you.

Please complete the attached form and return it to Mary Jasek.

Thank you for your time and cooperation!

Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th Street
Bryan, Texas 77802
(979) 731-7478
mjasek85@gigemaggies.net

Volunteer Form

Evaluating the Effectiveness of Mathematics Warm-Up Problems with Agricultural Science Context on Students' Performance in Mathematics

Name: ______________________________ **Area:** ___________________

School: __________________________ Phone: ________________

Address: ____
____

E-mail: ____

Principal's Name: ____

Superintendent's Name: _____________________________________

Are you teaching an AGSC 101 class this fall? **Yes** or **No**

How many students do you anticipate having in AGSC 101? _______

Return to:

Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th Street
Bryan, Texas 77802

APPENDIX C

LETTER TO ADMINISTRATOR AND ADMINISTRATOR CONSENT FORM

August 5, 2003

Name
Address
City, State, Zip

Dear __(Superintendent/Principal)___:

Success on standardized tests is one of the top priorities for school districts in the State of Texas. Finding ways to improve students' performance is a task that should be important to all educators. I am pleased to inform you that one of your teachers has volunteered to help in that task.

___(Teacher's_Name)____, agricultural science teacher at ___(school)_ High School, has volunteered to participate in a study that is designed to determine if practice on math warm-up problems based on agricultural science topics will improve students' performance on standardized math tests.

I, Mary Jasek, am a doctoral student in the Department of Agricultural Education at Texas A&M University and I am the primary investigator for the study, *Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics*. I am also an agricultural science teacher at Bryan High School in Bryan, Texas.

Dr. Gary Briers, professor and Associate Head of the Department of Agricultural Education at Texas A&M University, is my advisor for this research study, which will involve approximately one hundred schools and fifteen hundred students across the State of Texas.

Some teachers participating in the study will present their students with a math problem at the beginning of class each day, during the semester (either fall and/or spring). Some teachers will not be asked to do the math warm-ups. In December, all teachers will be asked to give students a 30-question math test.

Students in the study will need to sign an assent form and must also have a signed consent form from their parents to be eligible to participate in the study. Individual student scores will be anonymous, as only a school code will be used to identify answer sheets. Participation by teachers and students is strictly voluntary and either may choose to quit the study at any time.

I am requesting your permission for __(teacher's name)___ and students in his/her agricultural science classes be allowed to participate in this study. Please complete and return the enclosed permission form.

If you have any questions, please contact me. Thank you for your time and cooperation.

Sincerely,

Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th Street
Bryan, Texas 77802
(979) 731-7478 (school)
mjasek85@gigemaggies.net

Administration Consent Form

Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics

As ___(superintendent/principal)__ of _______________ ISD/High School, I give permission to _(teacher's name)___________, agricultural science teacher at _(school name)__________ High School and his/her agricultural science class to participate in the study, *Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics*.

I understand that, depending upon the group in which the agricultural science teacher is placed, some students will do math warm-up problems on an agricultural topic each day at the beginning of their agricultural science class and some will not. Students given the warm-up problem will take 1-3 minutes to solve the problem and then the teacher will present them with the solution. Afterwards, the class will continue with their regular class routine.

I understand that all students in the study will be given a 30-question math test in December. Individual student scores are anonymous. The only identification on the test form will be a school code.

I understand that no compensation or direct benefits will be given to the agricultural science teacher or students participating in this study. The teacher will be allowed to keep and use, free of charge, any instructional materials provided by the researcher for this study. I understand that whether or not the teacher chooses to participate in the study, will have no affect on his/her job status or position as agricultural science teacher.

If I have any questions or concerns, I may contact one or both of the following people responsible for this study:

Primary Investigator:
Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th Street
Bryan, Texas 77802
(979) 731-7478
mjasek85@gigemaggies.net

Research Advisor:
Dr. Gary Briers
Department of Agricultural Education
Mail Stop 2116
Scoates Hall
Texas A&M University
College Station, Texas 77843
(979) 862-3000
g-briers@tamu.edu.

I understand that this research has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through Dr. Michael W. Buckley, Director of Research Compliance, at (979) 458-4067.

I have read and understand the explanation provided to me. I have had all of my questions answered to my satisfaction and I agree to allow volunteers, both teacher and students, in the agricultural science program at __________ High School to participate in this study.

I have been given a copy of this consent form.

____
(Printed Name of Administrator)

____
(Signature of Administrator)

____
(Date)

__________________________________ ______________
Mary Jasek, Primary Investigator (Date)

APPENDIX D

TEACHER CONSENT FORM

Teacher Consent Form

Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics

The purpose of this study is to determine whether or not student performance on standardized math tests is improved by having students practice solving mathematical problems based on topics covered in Agricultural Science classes. Approximately 100 teachers and approximately 1500 students in agricultural science programs across the State of Texas will be participating in this study.

I understand that as a participant in this study, I may or may not be required to present students in my agricultural science class with a math problem on an agricultural topic each day, depending on the group in which I am placed. If given the math problem, students will take 1-2 minutes to solve the problem and then I will present them with the solution. Afterwards, I will continue with my regular class routine. Materials will be provided to me by the primary investigator, Mary Jasek, to carry out my role in this study, including overheads with math problems, 30-question math tests and scantrons.

In December, I will assist in giving my students a 30-question math test. Students' scores on this test will be anonymous, as only school codes will be used for identification. Students' scores will in no way affect their grade or credit for my agricultural science class. I also understand that test scores will not affect my position as an agricultural science teacher at my school. My job status will not be affected by whether or not I participate in this study.

If I have any questions or concerns, I may contact one or both of the following people responsible for the study:

Primary Investigator:
Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th St.
Bryan, Texas 77802
(979) 731-7478
mjasek@gigemaggies.net

Research Advisor:
Dr. Gary Briers
Department of Agricultural Education
Mail Stop 2116
Scoates Hall
Texas A&M University
College Station, Texas 77843
g-briers@tamu.edu

I understand that there is no compensation or direct benefits for participating in this study. I will be allowed to keep and use any instructional materials from this study at no cost to me.

I understand that this research has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through Dr. Michael W. Buckley, Director of Research Compliance at (979) 458-4067.

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction and I voluntarily agree to participate in this study.

I have been given a copy of this consent form.

______________________________ ______________
(Printed Name of Participant) (Date)

______________________________ ______________
Mary Jasek, Primary Investigator (Date)

APPENDIX E

STUDENT ASSENT FORM

Assent Form

Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance In Mathematics

I understand that I am being asked to participate in a study through my Agricultural Science class. Approximately 100 agricultural science teachers, with approximately 1500 students, across the State of Texas will be participating in this study. Depending on which group my agricultural teacher is assigned, I will be given a math warm-up problem at the beginning of my agricultural science class each day or I will not be given math warm-up problems to do.

I will be given a 30-question math test in December. My name will not be on the test and my test score will not affect my grade or credit in my agricultural science class. If I choose, I may quit participating in the experiment at any time and my grade or credit for my agricultural science class will not be affected. If I choose not to participate in this study, I will have a comparable activity available to me during the testing time.

If I have any questions, I may contact one of the following persons:

Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th St.
Bryan, Texas 77802
(979) 731-7478
mjasek85@gigemaggies.net

Dr. Gary Briers
Dept. of Agricultural Education
Mail Stop 2116
Scoates Hall
Texas A&M University
College Station, TX 77843
(979) 862-3000
g-briers@tamu.edu

I understand that this research study has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through Dr. Michael W. Buckley, Director of Research Compliance at (979) 458-4067 (mwbuckley@tamu.edu).

I understand that there are no direct benefits or compensation for participating in this study and that participation is voluntary.

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction and I voluntarily agree to participate in this study during the 90-day period of the Fall/Spring Semester, 2003-2004.

I have been given a copy of this consent form.

______________________________	______________________________
(Student's Name Printed)	Mary Jasek, Primary Investigator

____
(Student's Name Signed)

____
(Date)

APPENDIX F

PARENT CONSENT FORM

Parent Consent Form

Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics

The purpose of this study is to determine whether or not student performance on standardized math tests is improved by having student practice solving mathematical problems based on topics covered in Agricultural Science classes. This study will be conducted by Mary Jasek, a graduate student in the Department of Agricultural Education at Texas A&M University, under the supervision of Dr. Gary Briers, also of the Department of Agricultural Education.

Approximately 100 agricultural science teachers, with approximately 1500 students, across the State of Texas will be participating in this study. Depending on which group an agricultural teacher is assigned, some students will be given a math warm-up problem at the beginning of their agricultural science class each day and some students will not be given math warm-up problems. All students will take a 30-question math test in December. Students' scores will be anonymous, as no names and only school codes, will appear on tests forms. No risk should result from participation in this study. Students not participating in the study will have a comparable activity available the day of the test.

Parental Consent to Participate:

I agree to allow my child, ________________________________, to participate in this study, (Printed Name of Child)

Evaluating the Effectiveness of Mathematics Warm-up Problems with Agricultural Science Context on Students' Performance in Mathematics, in which he/she may be given warm-up math problems in his/her Agricultural Science class and will be given a 30-question math test in December.

I understand that the math test score will not affect my child's grade or credit for his/her Agricultural Science course(s) and that the math test score will be anonymous. I understand that this study will last approximately 90 days during the fall and/or spring semester and that my child may withdraw from participating in the study at any time.

If I have any questions or concerns, I may contact one or both of the following people responsible for the study:

Primary Investigator:	Research Advisor:
Mary Jasek	Dr. Gary Briers
Bryan High School	Department of Agricultural Education
3401 East 29th St.	Mail Stop 2116
Bryan, Texas 77802	Scoates Hall
(979) 731-7478	Texas A&M University
mjasek85@gigemaggies.net	College Station, Texas 77843
	(979) 862-3000
	g-briers@tamu.edu

I understand that this research has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067 (mwbuckley@tamu.edu).

I understand that there is no compensation for participating in this study and that there are no direct benefits.

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction and I voluntarily agree to allow my child, ___________________________, to participate in this study.

I have been given a copy of this consent form.

____________________________ ________________________________
(Parent's Printed Name) (Parent's Signature)

____________________________ _________________________
Mary Jasek, Primary Investigator (Date) (Date)

APPENDIX G

COVER LETTER FOR

RESEARCH PACKET

August 29, 2003

<Teacher's Name>
<School>
<Address>
<City, Texas Zip>

Dear <Teacher's Name>

First, let me **thank you** for agreeing to participate in my study, *Evaluating the Effectiveness of Mathematics Warm-Up Problems with Agricultural Science Context on Students' Performance in Mathematics.*

As you may recall, participating schools have been placed in one of two groups, treatment or control. Teachers in the treatment group will give their students warm-up problems each day during the fall semester, while teachers in the control group will not. Both groups will be tested in December with a 30-question math test.

You have been placed in the <**control/treatment>** group. **Enclosed** you will find the necessary materials for you to complete your assignment. Below is a list of materials you should receive based on your group assignment:

Control Group:

1. **Instructions**
2. **Teacher Consent Form**
3. **Student Assent Forms**
4. **Parent Consent Forms**

Treatment Group:

1. **Instructions**
2. **Teacher Consent Form**
3. **Student Assent Forms**
4. **Parent Consent Forms**
5. **Notebook of MathTransparencies**
6. **Sample Warm-Up Sheet**

Please **check** for all materials. If an item is missing, let me know and I will send it to you. Please **read** through all instructions. If you have any questions or concerns about performing your assignment please let me know and I will gladly address them.

I greatly appreciate your participation in this study. Thank you, again, for your time and cooperation.

Sincerely,

Mary Jasek
Agricultural Science Teacher
(979) 731-7478 (Bryan High School)
mjasek@bryanisd.org

APPENDIX H

INSTRUCTIONS FOR TREATMENT GROUP

Instructions for Treatment Group

1. Select a problem from the notebook for students to work.

   <u>Best Practice</u>: Choose a problem for each day that relates to the lesson that you are teaching that day. If you use all problems for a topic or if there is no problem that relates to your lesson, then choose another topic.

2. Place the transparency on an overhead with only the problem showing. As students come into class, they should try to answer the problem.

   <u>Best Practice</u>: Have students write the problem down in their notebook or on a "problem sheet." I have enclosed an example of the sheet that I use with my classes, of which you are welcomed to make copies. If students are required to write the problems and answers down, they are more likely to actually do the work and should have a better retention of the math skill. I have the students turn in their problems sheets each day and use them to verify attendance.

3. While students are working the math problems, you may check roll or care of other tasks. Students my work on the problems individually or with a neighbor.

   Students often are better at problem-solving, if they are allowed to collaborate.

4. When you and the students are ready to proceed, show them the answer and solution to the problem. If there are any questions or points of discussion, please take a minute or two to address these.

5. Continue with your normal class routine.

6. In December, I will send copies of the math test for you to administer to the students. Please make sure that you have a student assent form and a parent consent form for each student participating in the study.

APPENDIX I

INSTRUCTIONS FOR CONTROL GROUP

Instructions for Control Group

As a participant in the control group, you and your students will follow your normal class routine and not do the warm-up math problems for the agricultural science 101 class.

If your school requires that you do warm-up math problems, you may do so. You just will not use the warm-up problems from the

In December, you will be asked to administer the math test to your students participating in the study. Please make sure that you have a signed assent form from each student and a signed parent consent form from each student's parent.

You will receive the Agricultural Science 101 Math Problems at the end of the study (in December).

APPENDIX J

NOTEBOOK INCLUDING CONTENT PAGE AND TRANSPARENCIES OF PROBLEMS AND SOLUTIONS FROM *TAAS MATH PROBLEMS TEACHERS' GUIDE FOR INTRODUCTION TO WORLD AGRICULTURAL SCIENCE AND TECHNOLOGY*

Table of Contents

P1	Using a scale of 1-10, Curtis rated himself on some of the ideal personality traits as follows: Courteous – 9 Reliable – 8 Humorous – 4 Honest – 9 Moral – 10 Enthusiastic – 7 What is his mean score on ideal personality traits? A. 9 B. 8 C. 7.83 D. 6.78
A1	$\underline{9 + 4 + 10 + 8 + 9 + 7} = 7.83$ **Answer: C**
P2	Some decisions are made quickly and are habit forming, while others are not. Driving requires many decisions, approximately 20 decisions per mile traveled, according to researchers. If you travel from Dallas to Houston, 237 miles, how many decisions are you likely to make during the 3 hour and 45 minute trip? A. 60 B. 4,500 C. 4,740 D. 4,950
A2	237 x 20 = 4,740 **Answer: C**

P3	On average, a person with a college degree will earn nearly twice as much money as a person with a high school diploma and nearly three times as much as a high school drop-out. If a college graduate earns $60,000/year and a drop-out earns 20,000/year, how much more money will the college graduate earn over a 10-year period compared to the drop-out? A. $400,000 B. $180,000 C. $60,000 D. $40,000
A3	$60,000 - $20,000 $40,000 x 10 yrs. = $400,000 **Answer: A**
P4	Charlie the Greenhand raised broilers for his SAE project. He had a gross income of $975.00 and expenses that totaled $125.00. What was Charlie's net income? A. $125.00 B. $500.00 C. $850.00 D. $975.00
A4	$975.00 - $125.00 $850.00 **Answer: C**

P5 A Star Chapter FFA member had four enterprises for her SAE program. She had the following incomes and expenses for her projects:

Enterprise	Income	Expense
Steer	$1,062.50	$1,523.30
Pig	$900.00	$430.75
Lamb	$850.00	$415.60
Watermelons	$250.00	$81.32

Which enterprise had the greatest net income?

A. steer
B. pig
C. lamb
D. watermelons

A5 Steer: $1,062.50 - $1,523.30 = (-) $460.80

Pig: $900.00 - $430.75 = $469.25

Lamb: $850.00 – 415.60 = $434.40

Watermelon: $250.00 - $81.32 = $168.68

Answer: B

P6

To convert SAE activity points to hours, one must divide the number of points by 30. A freshman agricultural science student earned the following points for activities:

COURSE	**IN-CLASS**	**OUT-OF-CLASS**
AGSC 101	440 pts.	720 pts.
AGSC 102	390 pts.	830 pts.

What was the total of hours earned from out-of-class activities for both AGSC 101 and AGSC 102?

A. 27.67 hrs.
B. 51.67 hrs.
C. 24 hrs.
D. 55 hrs.

A6

AGSC 101:

$$\frac{720}{30} = 24 \text{ hours}$$

AGSC 102:

$$\frac{830}{30} = 27.67 \text{ hours}$$

Total hours:

$$24 + 27.67 = 51.67 \text{ hrs.}$$

Answer: B

P7

Using the chart, what is the total number of points that this freshman earned from both in-class and out-of-class activities for both AGSC 101 and AGSC 102?

COURSE	**IN-CLASS**	**OUT-OF-CLASS**
AGSC 101	440 pts.	720 pts.
AGSC 102	390 pts.	830 pts.

A. 1,160 pts.
B. 1,220 pts.
C. 1,550 pts.
D. 2,380 pts.

A7

440
720
390
+ 830
2,380 pts.

Answer: D

P8

In Texas, 1997 cash receipts for livestock and products were $8,184,000,000 and cash receipts for crops were $5,277,000,000. What were the total receipts for all agricultural commodities, in millions?

A. $135
B. $1,346
C. $13,461
D. $13,461,000

A8

$8,184,000,000
+ $5,277,000,000
$13,461,000,000
divided by 1,000,000
= 13,461

Answer: C

P9

The chart below shows the number of all cattle and calves in each of the top 5 states in the U.S.

STATE	# OF CATTLE / CALVES
California	4,600,000 head
Kansas	6,550,000 head
Nebraska	6,650,000 head
Oklahoma	5,450,000 head
Texas	14,300,000 head

Which shows the correct order of these states from greatest number of cattle to least number of cattle?

A. Nebraska, Kansas, Texas, California, Oklahoma
B. California, Kansas, Nebraska, Oklahoma, Texas
C. Texas, Kansas, Nebraska, California, Oklahoma
D. Texas, Nebraska, Kansas, Oklahoma, California

A9

14,300,000	Texas
6,650,000	Nebraska
6,550,000	Kansas
5,450,000	Oklahoma
4,600,000	California

Answer: D

P 10

In Texas, the total land area is 167.7 million acres and 129 million acres of this land is involved in agricultural production. What is the approximate percentage of land in agricultural production in Texas?

A. 13%
B. 43%
C. 75%
D. 77%

A 10

$$\frac{129}{167.7} = .7692$$

$$\underline{\times\ 100\%}$$

76.92 %
or approximately 77%

Answer: D

P 11	In 1997, there were 205,000 farms and ranches in Texas, with an average size of 629 acres. The average value of that farm and ranch land in 1998 was $650 per acre. What is the total value of the average farm/ranch land in Texas? A. $650 B. $40,885 C. $408,850 D. $133,250,000
A 11	629 acres x $650 = $408,850 **Answer: C**
P 12	According to the USDA, consumers spent 10.7% of their disposable personal income on food in 1996. If a person made $32,560, after taxes, approximately how much of those earnings was spent on food? A. $107 B. $325 C. $1,700 D. $3,484
A 12	$32,560 x 10.7% = $32,560 x .107 = $3,484 **Answer: D**

P
13

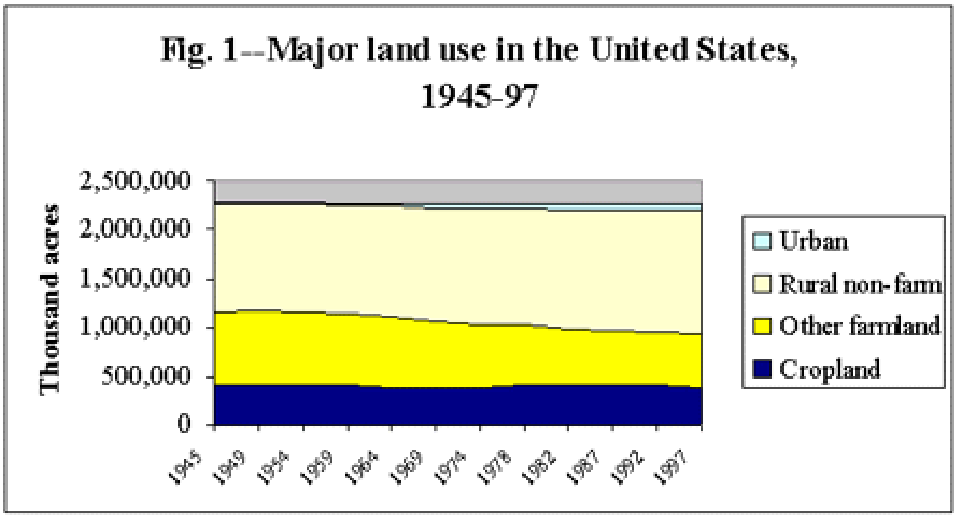


Fig. 1--Major land use in the United States, 1945-97

Which of the following statements is not a reasonable conclusion from the information on this graph?

A. There has been a dramatic decrease in the amount of rural non-farm land.
B. The size of the cropland base has remained stable.
C. Most urban land was converted from pasture, range, or forest land.
D. The total amount of land in the U.S. has remained the same.

A
13

Answer: A

"A" is incorrect because there has been an increase in the amount of rural non-farm land.

P
14

35,000 years ago, people lived to about 25 years of age. Today's average life span is about 63 years of age. What percentage of increase in life span has occurred over the past 35,000 years?

A. 40%
B. 152%
C. 60%
D. 252%

A 14	63 – 25 = 38 (years increase) $\frac{38}{25} = 152\%$ increase **Answer: B**
P 15	During the Bronze Age, world population increased to approximately 100,000,000 from the approximate 3,000,000 population before agriculture. Which number best represents the population increase in thousands. A. 9700 B. 103,000,000 C. 97 D. 97,000
A 15	100,000,000 $- \underline{\quad 3,000,000}$ 97,000,000 / 1,000 = 97,000 **Answer: D**
P 16	Domesticated cattle remains that dated back to 6500 B.C. were found in Turkey and other sites. This evidence proves that, as of the year 2000, cattle have been domesticated for at least how many years? A. 4,500 years B. 8,500 years C. 6,500 years D. 2,000 years

A 16	6,500 + 2,000 8,500 years **Answer: B**
P 17	During the Dust Bowl, the number of dust storms occurring in the Great Plains region included 70 storms in 1933, 22 storms in 1934, 53 storms in 1935, and 73 storms in 1936. In 1937, the largest number of storms, 134, occurred during a 9-month period. What is the mean number of dust storms per year for the 1933-1937 period? A. 22 B. 352.5 C. 134 D. 70.4
A 17	70 22 53 73 + 134 352 divided by 5 = 70.4 **Answer: D**
P 18	During the Dust Bowl, the number of dust storms occurring in the Great Plains region included 70 storms in 1933, 22 storms in 1934, 53 storms in 1935, and 73 storms in 1936. In 1937, the largest number of storms, 134, occurred during a 9-month period. What is the median number of storms that occurred during the 5-year period? A. 22 B. 70 C. 134 D. 5

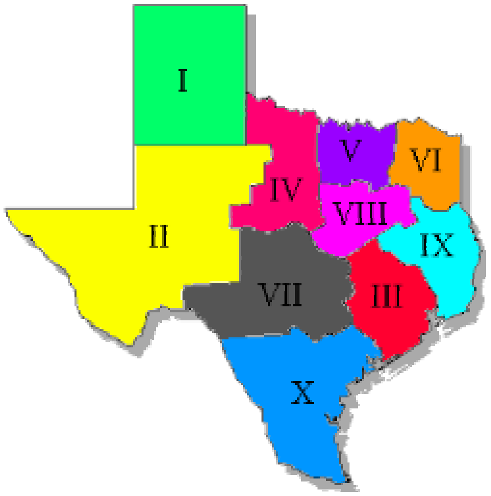
A 18	22 53 70 73 134 The median number is 70. **Answer: B**
P 19	In 1996, approximately 8 million acres of land in the United States was planted with genetically engineered crops. By 1998, 50 million acres were planted with genetically engineered crops. Which number best expresses the increase in genetically engineered crop acreage from 1996 to 1998? A. 4 times more acreage. B. 6 times more acreage. C. 16 times more acreage. D. 42 times more acreage
A 19	$\frac{50 \text{ million}}{8 \text{ million}} = 6.25$ **Answer: B**
P 20	The National FFA Organization began in 1928. As of the year 2000, how many years has it been in existence? A. 72 years B. 28 years C. 100 years D. 65 years
A 20	$\begin{array}{r} 2000 \\ -\ \underline{1928} \\ 72 \text{ years} \end{array}$ **Answer: A**

P 21	In 1928, National FFA dues were 10 cents. Dues have increased 50-fold since then. What is the current amount of dues for the National FFA membership? A. $0.50 B. $2.50 C. $5.00 D. $50.00
A 21	.10 x 50 = $5.00 **Answer: C**
P 22	A freshman Ag student must pay the following dues to become a member of the FFA: National dues ....$5.00 State dues ....$2.75 Area dues ....$1.00 District dues............$1.00 Local school dues...$3.75 How much will it cost the student, in dues, to be a fully-paid FFA member? A. $7.75 B. $9.25 C. $11.50 D. $13.50
A 22	$5.00 $2.75 $1.00 $1.00 + $3.75 $13.50 **Answer: D**

P 23	Girls were allowed to join the FFA in 1969. As of the year 2000, how many years have girls been allowed into the FFA? A. 31 years B. 28 years C. 69 years D. 41 years
A 23	2000 - 1969 31 years **Answer: A**
P 24	If there were 451,997 FFA members, nationally, and Texas had 56,354 members, what percentage of the National FFA membership would be from Texas? A. 15% B. 8% C. 12.5% D. 87%
A 24	$\frac{56,354}{451,997} \times 100\% = 12.5\%$ **Answer: C**

P 25	There are 7,268 FFA chapters, nationally, and slightly more than 13% of the chapters are in Texas. Estimate the number of FFA chapters that are in Texas? A. 268 B. 726 C. 920 D. 951
A 25	7,278 X .13 = 951 **Answer: D**
P 26	Sixty years after its inception in 1928, the Future Farmers of America changed its name to the National FFA Organization. What year did the name change take place? A. 1928 B. 1988 C. 1998 D. 2000
A 26	1928 + 60 1988 **Answer: B**

P 27	If you travel from the State Capitol of Texas, in Austin, to the site of the National FFA Convention in Louisville, Kentucky, you will travel approximately 1034 miles. At an average speed of 60 mph, approximately how long would it take to get from Austin to Louisville? A. 16 hours B. 17 hours C. 18 hours D. 34 hours
A 27	$\frac{1034 \text{ miles}}{60 \text{ mph}} = 17.2 \text{ hours}$ **Answer: B**
P 28	If you travel from the State Capitol of Texas, in Austin, to the site of the National FFA Center in Indianapolis, Indiana, you will travel approximately 1100 miles. If it takes 20 hours to make the trip, what is the average speed traveled? A. 55 mph B. 65 mph C. 75 mph D. 85 mph
A 28	$\frac{1100 \text{ miles}}{20 \text{ hours}} = 55 \text{ mph}$ **Answer: A**

P 29	The Texas FFA Association is divided into ten areas. In 1999-2000, Area III had the largest membership with 10,019 members, while Area II had the lowest membership with 3,055 members. What is the approximate ratio of members from Area III compared to Area II? A. 10:4 B. 3:1 C. 13:1 D. 1:2
A 29	$\frac{10,019}{3,055} = 3.28$ or approx. 3:1 **Answer: B**
P 30	**1999-2000 Membership of Texas FFA by Area**  Area I – 3,396 Area II – 3,055 Area III – 10,019 Area IV – 4,068 Area V – 6,837 Area VI – 5,428 Area VII – 5,721 Area VIII – 6,375 Area IX – 6,188 Area X – 5,158 Which are the top 5 areas in membership, ranked from highest to lowest? A. III, V, IX, VII, VI B. III, IX, VIII, II C. II, VIII, III, V, X D. X, IX, VIII, VII, VI

A 30	10,019 = Area III 6,837 = Area V 6,188 = Area IX 5,721 = Area VII 5,428 = Area VI **Answer: A**
P 31	According to Gray's Parliamentary Guide for FFA, a majority vote, or more than half the votes cast, is required to elect. If there are 173 members at an FFA meeting, how many votes must a candidate receive to get a majority vote and be elected? A. Up to 50 votes B. 55 – 65 votes C. 70 – 80 votes D. 87 or more votes
A 31	173 x 50% = 86.5 So, more than half would mean 87 votes or more. **Answer: D**
P 32	If a candidate for an FFA office received 26 of the 57 votes cast, while the other two candidates received 18 and 13, respectively, what kind of vote did the leading candidate receive? A. unanimous B. two-thirds C. majority D. plurality
A 32	$\frac{26}{57}$ x 100% = 45.6% **Answer: D**

P 33	A two-thirds vote is required to call the previous question. If you have 81 members at a meeting, what is the minimum number of votes required to call the previous question? A. 41 B. 54 C. 60 D. 75
A 33	$\frac{2}{3} \times 81 = \frac{162}{3} = 54$ **Answer: B**
P 34	The motion to rescind requires a two-thirds vote. If there are 54 members at an FFA meeting, how many members must vote to cancel the item of business in order for the rescind to pass? A. 18 B. 27 C. 36 D. 108
A 34	$54 \times \frac{2}{3} = \frac{108}{3} = 36$ **Answer: C**

P 35	A treasurer’s report includes the date of the report, balance on hand at date of last report, receipts since last report, disbursements, present balance, and treasurer’s signature. If the balance on hand at date of last report was $968.50, the total receipts since last report was $526.75, and the total of disbursements was $91.36, what would be the amount of the present balance? A. $435.39 B. $877.14 C. $1,403.89 D. $1,586.61
A 35	$968.50 +$526.75 $1,495.25 - $91.36 $1,403.89 **Answer: C**
P 36	A special committee was given the “power to act” on a motion to purchase a trim chute. The committee received 4 bids and decided to go with the cheapest bid. Which of the following bids was chosen? A. $320.00 with 20% school discount B. $295 C. $300.00 with 10% school discount D. $260
A 36	$320 – (320 x .20) = $256.00 $295.00 $300 – (300 x .10) = $270.00 $260.00 The $320 chute with a 20% school discount would be the cheapest bid. **Answer: A**

P 37	Joe received a plurality vote of 36 votes compared to Bob’s 24 votes and Sean’s 18 votes. How would you express the results of this vote in a ratio? A. 36:24:1 B. 3:2:1 C. 9:6:5 D. 6:4:3
A 37	The greatest common number by which each of the 3 numbers is divisible is 6, so divide each number by 6 to get the ratio: 36/6 = 6 24/6 = 4 18/6 = 3 **Answer: D**
P 38	According to the National Center for Policy Analysis, “the European Union’s agricultural tariffs average about 18% versus 8% in the United States...but duties on major commodities such as grain can be double the average.” If it costs $1.70 per bushel to produce corn in Texas, and the corn is exported to the E.U., with a 36% tariff, what would be the total expense of producing and exporting the corn to the E.U.? A. $2.31 per bushel B. $2.01 per bushel C. $1.84 per bushel D. $1.70 per bushel
A 38	($1.70 x .36) + $1.70 = $2.31 **Answer: A**

P
39

The U.S.D.A. estimated that approximately 3 million tons of exports are for food aid, of which approximately 75% will be wheat and wheat flour. If one ton equals 2,000 lbs., how many pounds of wheat and wheat flour will be used for food aid?

A. 6,000,000,000 lbs.
B. 2,250,000,000 lbs.
C. 7,500,000,000 lbs.
D. 4,500,000,000 lbs.

A
39

3,000,000
x .75
2,250,000 tons
x 2,000 lbs.
4,500,000,000 lbs.

Answer: D

The Currency Exchange Rate affects trade between countries, including the amount of agricultural products that can be bought or sold by countries. The following chart will be used for the problem:

JAN. 2000 CURRENCY EXCHANGE RATES

COUNTRY	**CURRENCY**	**U.S. $ Equiv.**
European Union	Euro	$1.02569
Germany	Deutsche Mark	$0.524398
Japan	Yen	$0.00951199
Mexico	Peso	$0.105876
Russia	Ruble	$0.0360620
Brazil	Real	$0.552486
United Kingdom	Pound	$1.63673
Czech Republic	Koruna	$0.0284900
Saudi Arabia	Riyal	$0.266645
South Africa	Rand	$0.164501

P
40

Which currency has the highest value compared with the U.S. Dollar ($)?

A. Euro
B. Peso
C. Rand
D. Pound

A
40

Answer: D

Pound = $1.63673

P
41

JAN. 2000 CURRENCY EXCHANGE RATES

COUNTRY	**CURRENCY**	**U.S. $ Equiv.**
European Union	Euro	$1.02569
Germany	Deutsche Mark	$0.524398
Japan	Yen	$0.00951199
Mexico	Peso	$0.105876
Russia	Ruble	$0.0360620
Brazil	Real	$0.552486
United Kingdom	Pound	$1.63673
Czech Republic	Koruna	$0.0284900
Saudi Arabia	Riyal	$0.266645
South Africa	Rand	$0.164501

Which currency has the lowest value compared with the U.S.$?

A. Yen
B. Ruble
C. Koruna
D. Deutsche Mark

A
41

Answer: A

Yen = $0.00951

P
42

JAN. 2000 CURRENCY EXCHANGE RATES

COUNTRY	**CURRENCY**	**U.S. $ Equiv.**
European Union	Euro	$1.02569
Germany	Deutsche Mark	$0.524398
Japan	Yen	$0.00951199
Mexico	Peso	$0.105876
Russia	Ruble	$0.0360620
Brazil	Real	$0.552486
United Kingdom	Pound	$1.63673
Czech Republic	Koruna	$0.0284900
Saudi Arabia	Riyal	$0.266645
South Africa	Rand	$0.164501

Which answer correctly ranks the exchange rates from the highest to the lowest?

A. Peso, Koruna, Real, Rand
B. Yen Riyal, Ruble, Euro
C. Pound, Real, Deutsche Mark, Rand
D. Rand, Pound, Ruble, Koruna

A
42

Answer: C

Pound = $1.64
Real = $0.55
Deutsche Mark = $0.52

Rand = $0.16

P
43

1997 VALUE OF TOTAL AGRICULTURAL EXPORTS

Country/Region	U. S. Export $ Value
China	$1,612,726,790
Russia	$1,204,307,267
W. Europe	$9,728,455,641
New Zealand	$112,582,953
Mexico	$5,183,882,414
Brazil	$578,737,096
Australia	$353,344,357

Which were the top 3 countries/regions receiving agricultural exports from the U. S. in 1997?

A. W. Europe, Mexico, China
B. Russia, Brazil, Mexico
C. Mexico, China, Australia
D. China, Russia, New Zealand

A
43

Answer: A

W. Europe - $9,728,455,641
Mexico - $5,183,882,414
China - $1,612,726,790

P
44

According to U.S.D.A., U. S. agricultural exports for January-December, 1999 were $48.3 billion. This is $3.5 billion below 1998 exports. What was the percent decline in export values from 1998 to 1999.

A. 18%
B. 9%
C. 7%
D. 3%

A
44

$$\begin{array}{rl} & 48.3 \text{ billion} \\ + & \underline{\ \ 3.5 \text{ billion}} \\ & \$51.8 \text{ billion for 1998} \end{array}$$

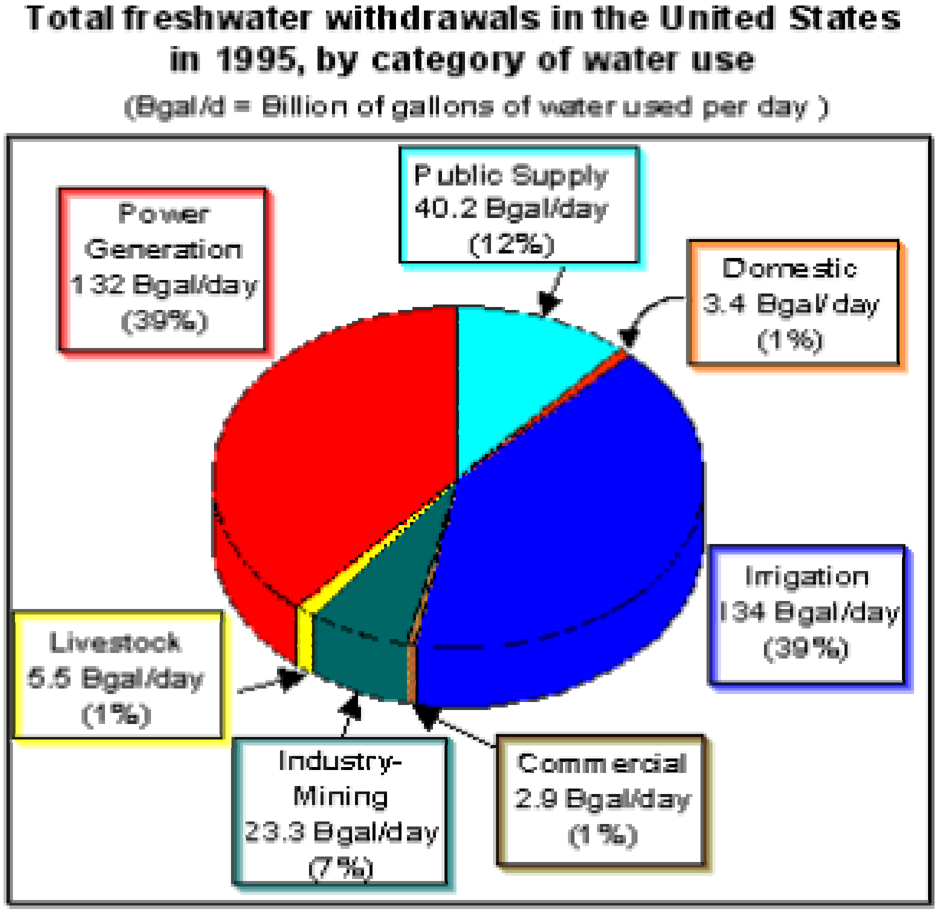
$$\frac{3.5}{51.8} = .0676$$

or approximately 7%

Answer: C

P 45	According to the U.S.D.A., U.S. agricultural imports for January-December, 1999 were $38 billion, up approximately 2% from 1998. What was the estimated import value for 1998? A. 800 million B. 37.2 billion C. 60 billion D. 75 billion
A 45	38 billion x .98 37.24 billion **Answer: B**
P 46	The U.S. agricultural exports were 48.3 billion and the imports were $38 billion for 1999, and the U. S. trade surplus decreased by about 30%. What was the U. S. trade surplus for 1999? A. $10.3 billion B. $14.8 billion C. $30 billion D. $86 billion
A 46	48.3 billion (exports) - 38 billion (imports) 10.3 billion trade surplus **Answer: A**

P 47	According to the E.P.A., the soft drink industry uses over 12 billion gallons of water per year to produce its products. How many pints of water is this? A. 48 billion pints B. 8 billion pints C. 192 billion pints D. 96 billion pints
A 47	8 pints/gallon 12 billion x <u>8</u> 96 billion pints **Answer: D**
P 48	According to the U. S. Geological Survey, the world's total water supply is about 326,000,000 cubic miles, of which 317,000,000 cubic miles are in oceans. What is the volume of water in cubic miles from other sources? A. 9,000,000 B. 6,000,000 C. 9,000 D. 3,000
A 48	326,000,000 - <u>317,000,000</u> 9,000,000 **Answer: A**

P 49	 According to the pie chart above, how much water is used for livestock and irrigation combined? A. 5.5 billion gallons/day B. 40 billion gallons/day C. 134 billion gallons/day D. 139.5 billion gallons/day
A 49	134.5 Bgal + <u>5.5</u> Bgal 139.5 billion gallons/day **Answer: D**

P 50	Approximately 12.8 billion pounds of soil are eroded from U.S. cropland, pastureland, forestland, and rangeland annually. How many tons of soil does this amount to? A. 6,400,000 tons B. 12,800,000 tons C. 64 tons D. 13,000,000 tons
A 50	$\frac{12,800,000,000}{2,000} = 6,400,000$ tons **Answer: A**
P 51	Biodiesel is made from vegetable oil and soybeans and can be used in diesel engines in heavy-duty vehicles. “Adding 20% biodiesel to regular diesel improves the cetane rating (similar to “octane rating”) by about 3 points.” If you have 35,000,000 gallons of diesel, how much biodiesel should be added to get the higher cetane rating? A. 175,000 gallons B. 2,333,333 gallons C. 1,750,000 gallons D. 7,000,000 gallons
A 51	35,000,000 (gal.) $\underline{\times \quad .20}$ (%) 7,000,000 gallons **Answer: D**

P 52	Feed efficiency is just one area of animal science where research is being conducted. A steer weighed 950 lbs. on February 1 and finished out at 1325 lbs. on May 11. What was the average daily gain for this steer? A. 2.00 lbs. B. 2.75 lbs. C. 3.00 lbs. D. 3.75 lbs.
A 52	Feb. 1 – May 11 = 100 days 1325 -950 375 lbs. $\frac{375}{100} = 3.75$ lbs./day **Answer: D**
P 53	Through genetic engineering, Monsanto developed the Bt Cotton, which could reduce insecticide usage for caterpillar-type pests by 80%. If 6 million pounds of insecticide are used each year to control these pests, what does the potential reduction, in pounds, equal? A. 6,000,000 lbs. B. 4,800,000 lbs. C. 750,000 lbs. D. 200,000 lbs.
A 53	6,000,000 lbs. x .80 4,800,000.00 lbs. **Answer: B**

P 54	If a fertilizer label shows an analysis of 13-13-13 (13% nitrogen, 13% phosphorus, and 13% potassium), how much of each element would be contained in a 50 lb. bag of fertilizer? A. 39 lbs. B. 26 lbs. C. 13 lbs. D. 6.5 lbs.
A 54	50 x .13 6.5 lbs. **Answer: D**
P 55	If a pesticide label recommends an application rate of 1 pint per acre, approximately how many gallons of pesticide are needed to treat a 350-acre field? A. 44 gallons B. 88 gallons C. 175 gallons D. 350 gallons
A 55	350 acres x 1 pint 350 pints/acre 350 pints 8 pints/gal. = 43.75 gallons or approximately 44 gals. **Answer: A**

P 56	If 62% of fresh meat's weight is water, how much water is in 200 lbs. of ground beef? (8 lbs. of water = 1 gallon) A. 124 gallons B. 62 gallons C. 15.5 gallons D. 7.75 gallons
A 56	200 x $\underline{.62}$ 124 lbs. $\frac{124}{8}$ = 15.5 gallons **Answer: C**
P 57	Dressing percent refers to the amount of marketable beef from the slaughtered animal. If an 1150 lb. steer dresses out at 63%, approximately how much marketable beef did the steer produce? A. 425 lbs. B. 725 lbs. C. 900 lbs. D. 1150 lbs.
A 57	1150 lbs. x $\underline{.63}$ (%) 724.5 lbs. or approximately 725 lbs. **Answer: B**

P
58

A dairyman’s cows give the following amounts of milk per year:

COW	**LBS. MILK/YEAR**
Bessy	14,526 lbs.
Belle	14,908 lbs.
Daisy	15,633 lbs.
Elsie	15,785 lbs.
Mable	15,893 lbs.

What is the herd average for these 5 cows?

A. 210 lbs.
B. 14,963 lbs.
C. 15,349 lbs.
D. 15,762 lbs.

A
58

$$\begin{array}{r} 14{,}526 \\ 14{,}908 \\ 15{,}633 \\ 15{,}785 \\ +\underline{15{,}893} \\ 76{,}745 \text{ lbs.} \end{array}$$

$$\frac{76{,}745}{5} = 15{,}349 \text{ lbs.}$$

Answer: C

P
59

If it takes 4.66 quarts of whole milk to make one pound of American cheese, approximately how many pounds of American cheese could be made from 2000 gallons of milk?

A. 1720 lbs.
B. 1700 lbs.
C. 932 lbs.
D. 466 lbs.

A 59	2000 gallons x $\underline{\quad 4}$ quarts/gal. 8000 quarts $\frac{8000}{4.66}$ = 1716.7 lbs. or approximately 1720 lbs. **Answer: A**
P 60	A hen lays nearly 250 eggs per year. If an egg producer has a flock of 8,750 hens, what is the producer's potential egg production for a year? A. 8,750 eggs B. 17,500 eggs C. 1,575,000 eggs D. 2,187,500 eggs
A 60	8,750 x $\underline{\quad 250}$ 2,187,500 eggs **Answer: D**
P 61	If wheat grain yields 70-75% of its weight in flour, how much wheat per person is required to satisfy the 110 lb. average annual per capita consumption of wheat flour products in the U.S.? A. 70 – 75 lbs. per person B. 77 – 83 lbs. per person C. 90 – 100 lbs. per person D. 147 – 157 lbs. per person

A 61	$\frac{110}{.70} = 157.14$ $\frac{110}{.75} = 146.66$ **Answer: D**
P 62	If a rice farmer averages 41 barrels per acre and farms 1250 acres of rice, approximately how many pounds of rice did the farmer produce? (1 barrel = 160 lbs.) A. 1250 lbs. B. 51,250 lbs. C. 8,200,000 lbs. D. 16,825,000 lbs.
A 62	1250 acres x $\underline{41}$ barrels/acre 51,250 barrels x $\underline{160}$ lbs./barrel 8,200,000 lbs. **Answer: C**

P
63

According to U.S.D.A.-N.A.S.S., in 1997, the following states' production of corn for grain (in bushels) were as follows:

STATE	**CORN FOR GRAIN**
Illinois	1,425,450,000 bushels
Indiana	719,550,000 bushels
Iowa	1,656,000,000 bushels
Minnesota	857,850,000 bushels
Nebraska	1,151,700,000 bushels

Which of the following lists of states show the correct rank, from highest to lowest, in production of corn for grain?

A. Illinois, Indiana, Nebraska, Iowa, Minnesota
B. Iowa, Illinois, Nebraska, Minnesota, Indiana
C. Iowa, Nebraska, Illinois, Indiana, Minnesota
D. Indiana, Minnesota, Illinois, Nebraska, Iowa

A
63

Answer: B

Iowa – 1,656,000,000 bu.
Illinois – 1,425,450,000 bu.
Nebraska – 1,151,700,000 bu.
Minnesota – 857,850,000 bu.
Indiana – 719,550,000 bu

P
64

Texas ranked #1 in total cotton production in 1997, with 5,355,000 bales. If 5,300,000 bales was Upland cotton and 55,000 bales was Pima cotton, what percentage of Texas' production was Upland cotton?

A. 98.97%
B. 97.96%
C. 10.28%
D. 10.38%

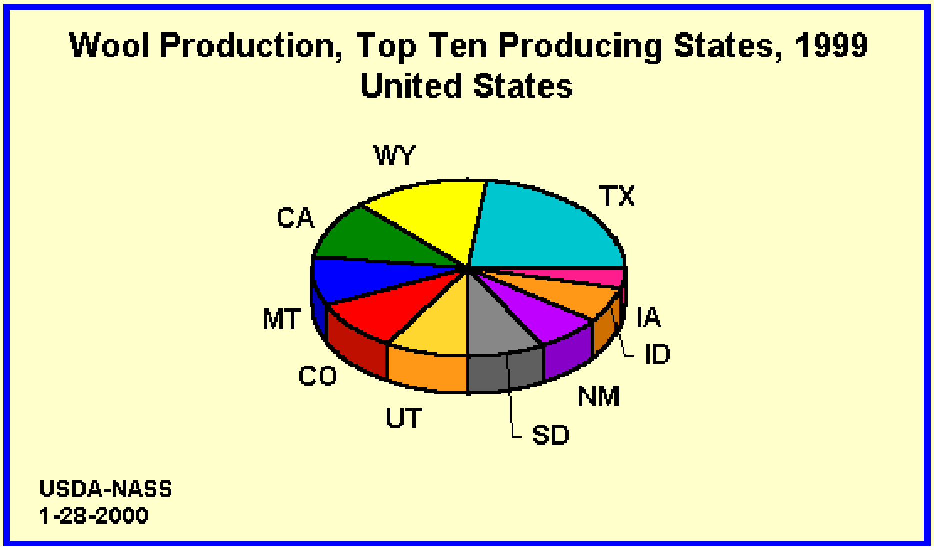
A
64

$$\frac{5{,}300{,}000}{5{,}355{,}000} = .989729$$

$$\underline{\times \quad 100\%}$$

$$98.97\%$$

Answer: A

P 65	 USDA-NASS 1-28-2000 According to the chart from the U.S.D.A.-N.A.S.S., which state had the highest wool production in 1999? A. Texas (TX) B. Wyoming (WY) C. Utah (UT) D. California (CA)
A 65	**Answer: A** Texas has almost 25% of production.
P 66	If a farmer borrows $500,000 annually for his operation, how much money could he save in one year, by getting a .5% reduction on his interest rate? A. $1,000 B. $250,000 C. $50,000 D. $2,500
A 66	$500,000 x .005 $2,500 **Answer: D**

P 67	According to Compton's Encyclopedia, 95% of today's cotton crop is harvested by machine. If there were 13,235,236 acres of cotton harvested in 1997, approximately how much was picked by hand? A. 12,573,474 acres B. 661,762 acres C. 6,617, 618 acres D. 10,564,973 acres
A 67	$\begin{array}{r} 13{,}235{,}236 \text{ acres} \\ \underline{\times \qquad .05} \\ 661{,}761.8 \text{ acres} \end{array}$ **Answer: B**
P 68	1998 OSHA statistics reported that there were 831 fatalities in the private agriculture, forestry and fishing industry. Of these 831 fatalities, 378 were related to the area of agricultural crop production. What percent of the industries fatalities were attributed to crop production? A. 45.5% B. 22% C. 2% D. 14.5%
A 68	$\frac{378}{831} \times 100\% = 45.5\%$ **Answer: A**

P 69	Ventilation is important for safety while welding or operating internal combustion engines. "All of the air should be replaced in 5 to 10 minutes...To calculate the fan size, divide the cubic feet in the building by 10 minutes. Ex. $\frac{10{,}800 \text{ cu. ft.}}{10 \text{ minutes}} = 1{,}080$ cu. ft./minute The proper exhaust fan would be capable of exhausting at least 1080 cubic feet per minute." If a shop measured 60'(w) x 100'(l) x 20'(h), what would be the fan requirement for proper ventilation of this shop? A. 10,800 cu.ft./min. B. 12,000 cu.ft./min. C. 60,000 cu.ft./min. D. 120,000 cu.ft./min.
A 69	60' x 100' x 20' = 120,000 cu. ft. $\frac{120{,}000 \text{ cu.ft.}}{10 \text{ min.}} = 12{,}000$ cu.ft. per min. **Answer: B**
P 70	Sledge hammers weigh between 80 and 320 ounces. What is the range in weight in pounds? A. 8 – 32 pounds B. 10 – 40 pounds C. 5 – 20 pounds D. 40 – 160 pounds
A 70	16 ounces = 1 pound $\frac{80}{16} = 5$ $\frac{320}{16} = 20$ range is 5 – 20 pounds **Answer: C**

P 71	“Mechanical advantage (MA) is the ratio between the force put into a machine and the force produced.” $MA = \frac{\text{Resistance Force}}{\text{Force of Effort}}$ Calculate mechanical advantage, if 50 pounds of force is used on a lever to lift 300 pounds. A. 6 B. 250 C. 350 D. 15,000
A 71	$MA = \frac{300}{50} = 6$ **Answer: A**
P 72	Wrenches come in different types and sizes. Place these socket wrench sizes in order from smallest to largest: 15/16”, 1 /2”, 21/32”, 5/8”, 3 /4” A. 1 /2, 3 /4, 5/8, 15/16, 21/32 B. 1 /2, 21/32, 5/8, 3 /4, 15/16 C. 15/16, 21/32, 1 /2, 3 /4, 5/8 D. 1 /2, 5/8, 21/32, 3 /4, 15/16
A 72	**Answer: D** 1 /2 = 16/32 5/8 = 20/32 21/32 3 /4 = 24/32 15/16 = 30/32

P
73

If a high-speed grinder operates at 10,000 RPM (revolutions per minute), approximately how many revolutions does the grinder make in 1 second?

A. 600,000
B. 2,500
C. 167
D. 100

A
73

$$\frac{10{,}000 \text{ RPM}}{60 \text{ sec/min}} = 166.67$$

Answer: C

P
74

Two systems of measurement commonly used in the United States include the *Customary Measurement System (or English System)* and the *Metric System*. Use the chart below to solve the problem.

Common Measurement Equivalents

CUSTOMARY	**METRIC**
1 inch (in)	2.54 centimeters (cm)
1 foot (ft)	30.48 cm
1 yard (yd)	0.9144 meters (m)
1 mile	1.6 kilometers (km)
1 sq. ft.	0.09 sq. m.
1 acre	0.4 hectare

Approximately, what is the metric equivalent, in centimeters, of a board that measures 2” x 6”?

A. 2 cm x 6 cm
B. 60 cm x 180 cm
C. 4 cm x 12 cm
D. 5 cm x 15 cm

A
74

2 x 2.54 = 5.08
6 x 2.54 = 15.24

Answer: D

P
75

Two systems of measurement commonly used in the United States include the *Customary Measurement System (or English System)* and the *Metric System*. Use the chart below to solve the problem.

Common Measurement Equivalents

CUSTOMARY	METRIC
1 inch (in)	2.54 centimeters (cm)
1 foot (ft)	30.48 cm
1 yard (yd)	0.9144 meters (m)
1 mile	1.6 kilometers (km)
1 sq. ft.	0.09 sq. m.
1 acre	0.4 hectare

If you build a pen for your broilers with 8.64 square meters of floor space, how much floor space would you have in square feet?

A. .78 sq. ft.
B. 17.28 sq. ft.
C. 96 sq. ft.
D. 192 sq. ft.

A
75

$$\frac{8.64}{.09} = 96$$

Answer: C

P
76

Two systems of measurement commonly used in the United States include the *Customary Measurement System (or English System)* and the *Metric System*. Use the chart below to solve the problem.

Common Measurement Equivalents

CUSTOMARY	METRIC
1 inch (in)	2.54 centimeters (cm)
1 foot (ft)	30.48 cm
1 yard (yd)	0.9144 meters (m)
1 mile	1.6 kilometers (km)
1 sq. ft.	0.09 sq. m.
1 acre	0.4 hectare

	If a rancher had to replace 3.2 kilometers of fencing, how many miles fencing would he have to replace? A. 1.6 miles B. 2 miles C. 3.2 miles D. 5 miles
A 76	$\frac{3.2}{1.6} = 2$ **Answer: B**
P 77	A metal worker's ruler is six inches long and marked in graduated increments. What would be the next increment on this measuring tool? 1/64, 1/32, 1/16, 1/8, __?__ A. 1/2 B. 1/4 C. 1 D. 1/5
A 77	**Answer: B** 1/64 + 1/64 = 2/64 = 1/32 1/32 + 1/32 = 2/32 = 1/16 1/16 + 1/16 = 2/16 = 1/8 1/8 + 1/8 = 2/8 = 1/4

P 78	When drawing to scale, the relationship between the size of the drawing and the object is referred to as “scale” or “inches to feet.” If you are drawing an object that measures 12’ x 32’, using a ¼” scale, what would the measurements of the drawing be? A. 1” x 4” B. 6” x 16” C. 3” x 8” D. 12” x 32”
A 78	12 x ¼ = 12/4 = 3” 32 x ¼ = 32/4 = 8” Drawing = 3” x 8” **Answer: C**
P 79	If you are building a feed storage shed that will measure 4’ x 8’, what is the amount of floor space that you will have, in square feet? A. 4 sq. ft. B. 8 sq. ft. C. 12 sq. ft. D. 32 sq. ft.
A 79	4’ x 8’ = 32 sq. ft. **Answer: D**

P 80	Concrete is purchased by the cubic yard. If you want to make a sidewalk 4' wide, 150' long, and 4" thick, how much concrete will be needed to complete the job? A. 7.41 cu. yd. B. 66.6 cu. yd. C. 199.8 cu. yd. D. 800 cu. yd.
A 80	$\frac{4' \text{ x } 150' \text{ x } 1/3'}{27} = 7.41$ cu. yd. **Answer: A**
P 81	When determining how much paint is needed to complete a paint job, one must calculate the size of the area to be covered. "Generally, one gallon of paint will cover 400 square feet." If you need to paint a room that is 20' x 14', with 8' ceilings, and 37 sq. ft. of window and door space, approximately how many gallons of paint are needed for the job? A. ½ gallon B. 2 gallons C. 4 gallons D. 6 gallons
A 81	20' x 8' x 2 = 320 sq.ft. 14' x 8' x 2 = 224 sq.ft. 320 + 224 = 544 – 37 = 507 sq.ft. $\frac{507}{400} = 1.27$ gallons **Answer: B**

P 82	The speed of a drill is calculated by determining how many feet the outer surface of the drill will travel per minute. Complete the following equation for determining the speed of a ½” drill traveling at 229 revolutions per minute: $\frac{1”}{2} \times \frac{3.1416}{12} \times 229 = \underline{\ ?\ }$ A. 29.976 ft./min. B. 4,316.55 ft./min. C. 437.36 ft./min. D. 119.90 ft./min.
A 82	(.5) x (.2618) x 229 = 29.976 ft./min. **Answer: A**
P 83	“A watt is a measure of energy used by an electrical device. The wattage of a device is found by a simple formula: w = v x a,” where “v” is voltage, “a” is ampere, and “w” is wattage. If the voltage is 115v. and the amperage is 20a., what is the wattage of the electrical device? A. 2,300 w B. 235 w C. 570 w D. 5.75 w
A 83	W = 115 x 20 = 2,300 **Answer: A**

P 84	One horsepower is 746 watts. If a motor is 5 horsepower, what is the wattage for the motor? A. 149 w B. 751 w C. 3,730 w D. 74,600 w
A 84	5 h.p. x 746 watts/hp = 3,730w **Answer: C**
P 85	When using a wrench 1 foot long and applying a pulling force of 50 pounds, the torque is 50 foot-pounds. Convert this measurement to inch-pounds. A. 4.17 inch-pounds B. 12 inch-pounds C. 600 inch-pounds D. 1200 inch-pounds.
A 85	50 foot-pounds x 12 inch-pounds 600 inch-pounds **Answer: C**

P 86	The melting temperature of mild steel is between 1315.56 and 1537.78 Degrees Celsius. What would be the melting temperature in degrees Fahrenheit? $F = C \times 1.8 + 32$ A. 1347 – 1569 F B. 2400 – 2800 F C. 763 – 886 F D. 300 – 400 F
A 86	1315.56 C x 1.8 + 32 = 2400 F 1537.78 C x 1.8 + 32 = 2800 F **Answer: B**
P 87	The duty cycle is the amount of time the welding machine can safely operate at its maximum rated amperage during a ten-minute period of time. If a 225 A – AC-output/transformer type welder has a 20% duty cycle rating, how many minutes in each 10-minute period can a welder safely operate at the maximum 225 amperage setting? A. 1 minute B. 2 minutes C. 4 minutes D. 10 minutes
A 87	10 minutes x $\underline{.20}$ 2 minutes **Answer: B**

P
88

AWS# Polarity Electrode Size Amperage Range

		3/32”	**1/8”**	**5/32”**	**3/16”**
E-6011	A/C D/C+	50-85 45-75	75-120 70-110	90-160 80-145	120-200 110-180
E-6013	A/C D/C±	75-105 70-95	110-150 100-135	160-200 145-180	205-260 190-235
E-7018	A/C D/C+	80-120 70-100	110-170 90-150	135-225 120-190	200-300 170-280

If you are using an E-6013 – 5/32” electrode, at what amperage range will your AC welding machine be set?

A. 90 – 160
B. 110 – 150
C. 160 – 200
D. 205 – 260

A
88

Answer: C

	5/32”
E-6013	A/C 160-200

P 89	“Acetylene, when burned alone, can produce a flame temperature of about 4000 degrees F. With the addition of oxygen, a flame temperature in excess of 6000 degrees F. can be achieved.” What percent increase in temperature is obtained by adding oxygen to acetylene? A. 33% B. 50% C. 67% D. 150%
A 89	6,000 – 4,000 = 2,000 $\frac{2000}{4000} \times 100\% = 50\%$ **Answer: B**
P 90	A ranch hand needs to put up a 5-strand barbed wire fence, with a total length of 350 yards. What is the minimum amount of wire needed for the job? A. 350 ft. B. 1050 ft. C. 1750 ft. D. 5250 ft.
A 90	350 yds. x 3 ft./yd. 1050 ft. x 5 strands 5250 ft. **Answer: D**

APPENDIX K

WEEKLY PROBLEM SHEET

Name: ______________________________ **Date:** ________________ **Period:** ______

DAY:	**PROBLEM:**
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	

APPENDIX L

LETTER TO TREATMENT GROUP

SEPTEMBER 10, 2003

September 10, 2003

Teachers in Treatment Group:

I hope that your school year is off to a great start. My classes are all filled to capacity and our first FFA meeting was successful. So, I guess the start of my year has been okay.

You should have received a large package from me about a week or two ago that contained a notebook of transparencies, a cover letter, instructions and consent forms for you, the teacher, your students, and your students' parents.

If you have not already done so, please begin using the warm-up problems. It would be helpful to use a problem that relates to what you are teaching that day, if one is included.

You may also distribute the consent forms for your students and their parents. However, it is not necessary to have collected all of the consent forms to begin using the warm-up problems. The consent forms will need to be returned with the test materials in December. I am enclosing an envelope in which you may keep the consent forms (I had forgotten to do that in the first mailing – sorry). Each student taking the math test in December will need consent forms (student and parent) on file.

If you would like to use the warm-up problems with your other classes, please feel free to do so. However, only the AGSC 101 students will be tested, as the warm-up problems relate to AGSC 101 curriculum.

Thank you for your cooperation. If you have any questions or concerns, please let me know.

Sincerely,

Mary Jasek
Agricultural Science Teacher
Bryan High School
3401 East 29th Street
Bryan, Texas 77802
(979) 731-7478 (school)
mjasek@bryanisd.org
or mjasek85@gigemaggies.net

APPENDIX M

E-MAIL LETTER TO TREATMENT GROUP

OCTOBER 13, 2003

October 13, 2003

Dear

I just wanted to check with you to see how it is going with the math warm-up problems. Are you using them daily? What has been the students' reaction to doing the math warm-ups?

Please let me know if you have any questions or concerns. I appreciate your cooperation in helping to identify ways of improving math performance through agricultural science classes.

Thanks,

Mary Jasek
Agricultural Science Teacher
Bryan High School
(979) 731-7478

APPENDIX N

LETTER TO TREATMENT AND CONTROL GROUP

NOVEMBER 14, 2003

November 14, 2003

Dear

Howdy! It's hard to believe, but the Fall Semester is getting down to the last six weeks. With that in mind, I wanted to let you know my intentions for the math study, so that you could plan accordingly.

I am hoping to ship the test packages and instructions by November 26, so that you could receive your package by the first of December. I would like for you to administer the test to your students during the first week of December. Tests and consent forms will need to be returned to me by December 12.

Remember that students taking the test will need to have signed student assent forms and parent consent forms in order for tests to be used. If you have not already done so, please distribute the student assent forms and the parent consent forms and have them returned to you before testing begins.

If you have any questions or concerns, please feel free to call or e-mail me. Thank you for your cooperation in making this math study meaningful and valuable research. I am so very grateful for your participation.

Sincerely,

Mary Jasek

APPENDIX O

COVER LETTER FOR TEST ADMINISTRATION

NOVEMBER 26, 2003

November 26, 2003

«Teachers_First_Name» «Teachers_Last_Name»
«School»
«Address»
«City», «State» «zip»

Dear «Teachers_First_Name»:

The final phase of the math study, *Evaluating the Effectiveness of Math Warm-up Problems with an Agricultural Context at Improving Math Performance,* is the administration of the 30-question math test. The test administration is crucial to the outcome of the study. Your help in administering the test, following the enclosed instructions, is of vital importance and is greatly appreciated.

I would like for you to give your students the test during the first week of December if possible and return the tests by December 12. Enclosed in the test package are the following materials:

- Student Scantron Answer Sheets
- 30-question Math Tests
- Instructions for Administering the Test.

Also enclosed for you are the following:

- Teacher Survey
- Copies of Student Assent Form and Parent Consent Form
- Copy of Teacher Consent Form
- Return envelope
- Checklist of materials that need to be returned by December 12.

Please read the instructions for administering the test very carefully. If you have any questions or concerns, please let me know as soon as possible. There are two parts that students will need to complete: survey questions and math questions. Encourage students to take the test seriously and do their best.

Remember that each student taking the test will need to have a signed student assent form and parent consent form on file. Because the tests are anonymous, I am relying on you to verify that each test returned has signed consent forms.

Also, please complete and return the Teacher Survey. The information collected will not only be beneficial to the study, but will also help direct the development of new curriculum materials for agricultural science teachers.

Thank you for your cooperation and let me know if you have any questions. Please note that my phone number at school has changed.

Sincerely,

Mary Jasek
Agricultural Science Teacher
Bryan High School
(979) 731-7478
mjasek@bryanisd.org

Dr. Gary Briers
Research Advisor
Department of Agricultural Education
(979) 862-3000
g-briers@tamu.edu

APPENDIX P

MATHEMATICS TEST

30 WORD PROBLEMS

DIRECTIONS

Read each question and choose the best answer. Then on the scantron answer sheet bubble in the letter for the answer you have chosen. If a correct answer is not here, bubble in the letter for "Not Here." Note that problems are numbered from top to bottom in two columns.

FORMULA CHART
EXIT LEVEL

Perimeter	square	$P = 4s$
	rectangle	$P = 2(l + w)$
Circumference	circle	$C = 2\pi r$
Area	square	$A = s^2$
	rectangle	$A = lw$ or $A = bh$
	triangle	$A = bh / 2$
	trapezoid	$A = \frac{1}{2} (b_1 + b_2)h$
	circle	$A = \pi r^2$
Surface Area	cube	$S = 6s^2$
	cylinder (lateral)	$S = 2\pi rh$
Volume	rectangular prism	$V = lwh$
	cylinder	$V = \pi r^2h$
	cube	$V = s^3$
Pythagorean Theorem	right triangle	$a^2 + b^2 = c^2$

MEASUREMENT CONVERSIONS

	METRIC	CUSTOMARY
Length	1 kilometer = 1000 meters	1 mile = 1760 yards
	1 meter = 100 centimeters	1 mile = 5280 feet
	1 centimeter = 10 millimeters	1 yard = 3 feet
		1 foot = 12 inches
Volume and Capacity	1 liter = 1000 milliliters	1 gallon = 4 quarts
		1 gallon = 128 ounces
		1 quart = 2 pints
		1 pint = 2 cups
		1 cup = 8 ounces
Weight and Mass	1 kilogram = 1000 grams	1 pound = 16 ounces
	1 gram = 1000 milligrams	1 ton = 2000 pounds
Time		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

1

In 40 baseball games Juan's team has scored 50 runs. If the team continues at this rate, how many runs could the team expect to score in a 160-game season?

A 128

B 170

C 200

D 250

2

During 4 nights of working as a waiter, Billy earned \$9.50, \$14, \$9.50, and \$11.50 in tips. What was the median amount of money Billy earned in tips for those 4 nights?

A \$9.50

B \$10.50

C \$11.50

D \$11.75

3

The amount of time that it takes to fill the empty tank of a 30-gallon water heater can be determined by the formula

$$t = \frac{30}{f}$$

where *t* is the time in minutes and *f* is the rate of water flowing into the tank in gallons per minute. If it takes 12 minutes to fill the tank, what is the rate of the water flowing into the tank?

A 0.4 gal per min

B 1.8 gal per min

C 2.5 gal per min

D 3.6 gal per min

4

A softball-throwing contest was held on field day. The top 4 distances were recorded in meters. Which lists the distances in order from shortest to longest?

A 53.257 m, 53.432 m, 54.97 m, 53.25 m

B 53.25 m, 54.97 m, 53.432 m, 53.257 m

C 53.25 m, 53.257 m, 53.432 m, 54.97 m

D 54.97 m, 53.432 m, 53.257 m, 53.25 m

5

Mr. Barnes needed to paint a rectangular wall that was 125 feet long and 6 feet tall. When he stopped to rest, he still had 100 square feet of wall unpainted. How many square feet of wall did he paint before he stopped to rest?

A 150 ft^2

B 162 ft^2

C 650 ft^2

D 750 ft^2

6

Which expression should be next in this pattern?

$$2a + 3,\ 4a + 6,\ 8a + 12,\ 16a + 24,\ \ldots$$

A $10a + 15$

B $12a + 18$

C $24a + 36$

D $32a + 48$

7

A storm brought more than 2 inches of snow to 4 different towns. The chart shows the amount of snow each town received.

Snow

Town	Number of Inches
Brackville	2 5/8
Cannon	2 7/10
Odem	2 1/2
Shelton	2 3/4

Which list shows the towns in order from the greatest amount of snow received to the least amount of snow received?

A Odem, Brackville, Cannon, Shelton

B Shelton, Odem, Brackville, Cannon

C Cannon, Brackville, Shelton, Odem

D Shelton, Cannon, Brackville, Odem

8

Gracie has scored 18, 21, 12, 18, 22, 20, 19, 18, 19, and 16 points in her last 10 basketball games. What was the mode of these scores?

A 17

B 18

C 18.3

D 18.5

9

The average daily temperature for the first 6 days in July was recorded for the town of Grandville. The temperatures were 78°F, 75°F, 71°F, 66°F, 73°F, and 75°F. What was the mode of these temperatures?

A 66°F

B 72°F

C 73°F

D 75°F

10

A florist uses 8 carnations, 3 lilies, 6 daisies, and 4 roses for a certain spring flower arrangement. Last week between 700 and 730 flowers were used to make these arrangements. About how many of these arrangements were made?

A 20

B 25

C 35

D 40

11

Raúl selected 12 CDs at Joe's CD Exchange and Resale Store. The CDs were priced from $2.99 to $5.49. Which is a reasonable amount that he paid for the CDs before tax was added?

A Less than $35

B Between $35 and $70

C Between $70 and $95

D Between $95 and $110

12

Connie's Cookie House sells a gift box of chocolate chip cookies. The charge is 50¢ per cookie plus 75¢ for the gift box. Waylon bought a gift box of 1 dozen cookies for his aunt. Which equation could be used to find his cost, c, before sales tax was added?

A $c = 12 + 0.50 + 0.75$

B $c = 12(0.50)(0.75)$

C $c = 12(0.50 + 0.75)$

D $c = 0.50(12) + 0.75$

13

To pass an amendment to the Constitution, at least $^2/_3$ of the members of the legislature must vote in favor of the amendment. Which inequality describes v, the number of votes required to pass an amendment if there are m members of the legislature?

A $m \geq \frac{2}{3}v$

B $v \geq \frac{2}{3}m$

C $m \leq \frac{2}{3}v$

D $v \leq \frac{2}{3}m$

14

The County Clipper Bus Line sets the ticket prices for various destinations using this formula.

$$p = 8.25 + 0.12d$$

Which is the best estimate of the ticket price, p, when the destination, d, is 460 miles away?

A $13

B $35

C $45

D $60

15

Camilla bought 8 yards of fabric at the regular price and 19 yards of the same fabric on sale. She needs $2\frac{1}{4}$ yards of the fabric to make 1 costume for the school play. Which expression could Camilla use to determine how many costumes she could make with the fabric she has?

A $(19 - 8) \times 2\frac{1}{4}$

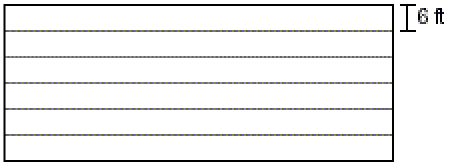
B $(8 + 19) \div 2\frac{1}{4}$

C $(19 \times 2\frac{1}{4}) + 8$

D $(19 - 2\frac{1}{4}) + (8 - 2\frac{1}{4})$

16

A community swimming pool is 2½ times as long as it is wide. There are 6 swimming lanes running the length of the pool. Each lane is 6 feet wide. What is the length of the pool?



A 30 ft

B 36 ft

C 51 ft

D 90 ft

17

On days when pizza is being served, a school cafeteria manager plans the number of meals to prepare using the formula

$$m = 0.85s$$

where m is the number of meals and s is the number of students enrolled in the school. If the school has an enrollment of 352 students, which is a reasonable number of pizza meals prepared?

A 50

B 150

C 200

D 300

18

Carver High School has a total enrollment of 756 students. Approximately 35% of the students ride the school bus daily. Which is the best estimate of the number of students who ride the bus daily?

A 450

B 350

C 250

D 150

19

Raymond and his mother picked all the peaches from their tree to make peach preserves. They used 15 peaches for each jar of preserves. They made 12 jars of preserves and still had 40 peaches left over. How many peaches did they get from their tree?

A 140

B 180

C 220

D 495

20

Anthony ran the 100-meter dash in 12.13 seconds. Manuel ran the 100-meter dash in 11.87 seconds. How much faster was Manuel's time than Anthony's time?

A 0.26 sec

B 0.34 sec

C 1.26 sec

D 1.74 sec

21

Mr. Hernández bought his wife 3½ dozen roses, which cost $22.80 per dozen. How much did the roses cost, not including tax?

A $68.40

B $77.40

C $79.80

D $89.80

22

Ann's car gets 27.5 miles per gallon of gas. How far can Ann drive if she uses 15 gallons of gas?

A 42.5 mi

B 137.5 mi

C 302.5 mi

D Not Here

23

Andy participated in a neighbor's garage sale. He sold 3 items: a picture frame for $8.50, a teapot for $3.75, and a set of 6 cups for $4.75. What were his total sales?

A $9.35

B $15.00

C $15.90

D $17.00

24

Paula works for a tax accountant. She earns $42 for each tax return that she completes for a client. On the average, she can complete a return in 3½ hours. At this rate, how much does Paula earn per hour?

A $6

B $12

C $14

D $21

25 The chart shows the height of several mountains.

Height of U.S. Mountains

Mountain	Height	Rank
McKinley (Alaska)	20,230 feet	1
St. Elias (Alaska)	18,008 feet	2
Foraker (Alaska)	17,400 feet	3
Bona (Alaska)	16,550 feet	4
Whitney (California)	14,494 feet	18
Elbert (Colorado)	14,433 feet	19

Which statement is ***not*** supported by the data?

A The highest mountains in the United States are found in Alaska.

B The highest mountain is about 2200 feet taller than the next highest.

C There are 13 U.S. mountains with heights between 14,494 feet and 16,550 feet.

D The first 17 tallest mountains in the United States are located in Alaska.

26

Malcolm spent $85.43 on wallpaper, $21 on paint, and $7.84 on brushes and other supplies for redecorating a bathroom. How much did he spend in all, not including tax?

A $114.27

B $103.27

C $95.37

D $93.48

27

Kerry earns $9.75 per hour. If he works 40 hours in 1 week, how much will he earn before deductions?

A $390.00

B $380.00

C $360.75

D $49.75

28

An hour of vacuuming or making beds uses 240 calories. This is 40% of the number of calories burned by jogging for 1 hour. What is the total number of calories burned by jogging for 1 hour?

A 60 calories

B 96 calories

C 600 calories

D 960 calories

29

Lisa put $455 into an interest-bearing savings account. After 1 year there was $481.66 in the account. If she made no deposits or withdrawals during that year, how much interest did Lisa's account earn?

A $25.34

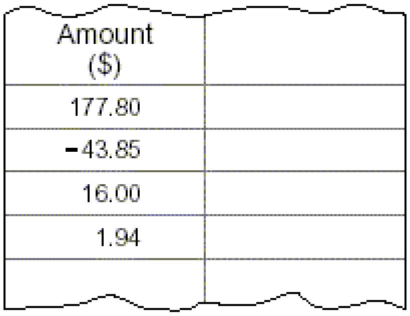
B $25.66

C $26.34

D $26.66

30

Elton had 4 entries on his spreadsheet. What is the sum of these entries?



Amount ($)	
177.80	
-43.85	
16.00	
1.94	

A $239.59

B $151.89

C $136.05

D $116.01

APPENDIX Q

STUDENT SCANTRON ANSWER SHEET

Answer Sheet - Students

1. Chapter #:

⓪	⓪	⓪	⓪
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

2. Grade:

- ☐ 8
- ☐ 9
- ☐ 10
- ☐ 11
- ☐ 12

3. Ethnicity:

- ☐ African American
- ☐ Asian American
- ☐ Caucasian
- ☐ Hispanic/Latino
- ☐ Native American
- ☐ Other

4. Math Courses Currently Taking:

Check all that apply

- ☐ Algebra I
- ☐ Algebra II
- ☐ Geometry
- ☐ Precalculus
- ☐ Mathematical Models with Applications
- ☐ Independent Study in Mathematics
- ☐ Advanced Placement Statistics
- ☐ Advanced Placement Calculus AB
- ☐ Advanced Placement Calculus BC
- ☐ Other:

____

5. Math Courses Completed:

Check all that apply

- ☐ Algebra I
- ☐ Algebra II
- ☐ Geometry
- ☐ Precalculus
- ☐ Mathematical Models with Applications
- ☐ Independent Study in Mathematics
- ☐ Advanced Placement Statistics
- ☐ Advanced Placement Calculus AB
- ☐ Advanced Placement Calculus BC
- ☐ Other:

____

6. Group Assignment:

- ☐ Treatment
- ☐ Control

7. Math Grades:

What grade average do you normally make in your math classes?

Check only one

- ☐ 100 - 95
- ☐ 94 - 90
- ☐ 89 - 85
- ☐ 84 - 80
- ☐ 79 - 75
- ☐ 74 - 70
- ☐ below 70

8. Level of Difficulty:

In your opinion, what was the level of difficulty of the math warm-up problems?

- ☐ Very difficult
- ☐ Difficult
- ☐ Neutral
- ☐ Easy
- ☐ Very easy
- ☐ Not applicable

9. Attitude:

Did you enjoy doing the math warm-up problems in AgSc 101?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

10. Usefulness:

Do you believe that doing the math warm-up problems helped you to improve your math skills?

- ☐ Not applicable
- ☐ Absolutely yes
- ☐ Probably yes
- ☐ Not sure
- ☐ Probably not
- ☐ Definitely not

11. Answers

1	Ⓐ Ⓑ Ⓒ Ⓓ	6	Ⓐ Ⓑ Ⓒ Ⓓ	11	Ⓐ Ⓑ Ⓒ Ⓓ	16	Ⓐ Ⓑ Ⓒ Ⓓ	21	Ⓐ Ⓑ Ⓒ Ⓓ	26	Ⓐ Ⓑ Ⓒ Ⓓ
2	Ⓐ Ⓑ Ⓒ Ⓓ	7	Ⓐ Ⓑ Ⓒ Ⓓ	12	Ⓐ Ⓑ Ⓒ Ⓓ	17	Ⓐ Ⓑ Ⓒ Ⓓ	22	Ⓐ Ⓑ Ⓒ Ⓓ	27	Ⓐ Ⓑ Ⓒ Ⓓ
3	Ⓐ Ⓑ Ⓒ Ⓓ	8	Ⓐ Ⓑ Ⓒ Ⓓ	13	Ⓐ Ⓑ Ⓒ Ⓓ	18	Ⓐ Ⓑ Ⓒ Ⓓ	23	Ⓐ Ⓑ Ⓒ Ⓓ	28	Ⓐ Ⓑ Ⓒ Ⓓ
4	Ⓐ Ⓑ Ⓒ Ⓓ	9	Ⓐ Ⓑ Ⓒ Ⓓ	14	Ⓐ Ⓑ Ⓒ Ⓓ	19	Ⓐ Ⓑ Ⓒ Ⓓ	24	Ⓐ Ⓑ Ⓒ Ⓓ	29	Ⓐ Ⓑ Ⓒ Ⓓ
5	Ⓐ Ⓑ Ⓒ Ⓓ	10	Ⓐ Ⓑ Ⓒ Ⓓ	15	Ⓐ Ⓑ Ⓒ Ⓓ	20	Ⓐ Ⓑ Ⓒ Ⓓ	25	Ⓐ Ⓑ Ⓒ Ⓓ	30	Ⓐ Ⓑ Ⓒ Ⓓ

APPENDIX R

INSTRUCTIONS FOR ADMINISTERING TEST

Instructions for Administering Math Study Test

Students should be given at least 30 minutes to complete the math portion of the study. If you feel that students will not be able to answer the survey questions and still have 30 (or more) minutes to complete the math test, you may allow students to complete the survey one day and complete the test the next day.

If two days are used to complete the survey and math test, distribute the scantron answer sheets the first day, allow students to complete items 1-9 (survey questions), collect answer sheets, and then redistribute answer sheets the next day, so that students may complete the test. VERY IMPORTANT – make sure students get the same (their own) answer sheet.

Complete the following steps when administering Math Study Test:

1. Use #2 pencil to complete the survey answer sheet.

2. Students need to complete survey questions:

Item #1 – Chapter Number – instruct students to write and bubble-in your FFA Chapter Number.

Item #2 – Grade – instruct students to write and bubble-in their grade level.

Item #3 – Ethnicity – instruct students to bubble-in their ethnicity. If appropriate ethnicity is not listed, bubble-in "other" and write ethnicity in blank.

Item #4 – Math Courses Currently Taking – instruct students to bubble-in math courses that they are currently taking during the Fall, 2003 semester. If taking a course that is not listed, bubble-in "other" and write in the name of the course.

Item #5 – Math Courses Completed – instruct students to bubble-in math courses they have already completed. Mark all that apply. If a math course is not listed, bubble-in "other" and write in the name of the course.

Item #6 – Group – instruct students to bubble-in the _ group.

Item #7 – Math Grades – instruct students to bubble-in the grade average that they usually get in their math class(es). Students should estimate as best as possible what is their grade average.

Item #8 – Level of Difficulty – instruct your students to bubble-in how difficult they thought the math warm-up problems were.
If students were in the **control group**, they should mark "not applicable".

Item #9 – Attitude – instruct students to bubble-in whether or not they enjoyed doing the math warm-up problems. If students were in the **control group**, they should bubble-in "not applicable".

3. **Students need to take the 30-question math test:**

- Students work independently to complete the math test.
- Students may use a calculator.
- Students should try to complete as many problems as possible.
- Students should carefully record their answers on the scantron answer sheet, using a #2 pencil.
- Students may use blank spaces on test package to do calculations (i.e. students may write on test pages).

4. Collect all answer sheets and test packages.

5. Return students' answer sheets, teacher survey, and consent forms (student assent and parent consent) in enclosed return envelope.

6. Test questions may be disposed of when testing is complete.

APPENDIX S

TEACHER SURVEY

Teacher Survey

Chapter #:			
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

FFA Area:

1
2
3
4
5
6
7
8
9
10

Size of School:

- ☐ 1A
- ☐ 2A
- ☐ 3A
- ☐ 4A
- ☐ 5A

Group Assignment:

- ☐ Treatment
- ☐ Control

Questions for the Treatment Group ONLY:

How often did you use the math warm-up problems?

- ☐ Every day
- ☐ 3-4 days per week
- ☐ 1-2 days per week

How beneficial was doing marth warm-up problems with an agricultural context to the students?

- ☐ Very beneficial
- ☐ Beneficial
- ☐ Not beneficial
- ☐ Totally Useless

In your opinion, what were your students' attitudes about doing the warm-up problems?

- ☐ Students liked doing warm-up problems.
- ☐ Students were indifferent about doing problems.
- ☐ Students did not like doing the warm-up problems.

Questions for BOTH groups - treatment and control:

Does your school administration require you to do TEKS-related activities for math?

- ☐ Yes
- ☐ No

Before participating in this study, had you used math warm-up problems in your classes?

- ☐ Yes
- ☐ No

Would you like to see more development of TAKS-related curriculum materials based on agricultural contexts?

- ☐ Yes
- ☐ No

If yes, what types of TAKS materials based on agricultural contexts do you feel are needed? (Check all that apply)

- ☐ Math warm-up problems
- ☐ Math worksheets with word problems
- ☐ Reading worksheets with paragraphs & multiple choice quesitons
- ☐ Science trivia warm-ups
- ☐ Science worksheets with paragraphs & multiple choice questions
- ☐ Social Studies trivia warm-ups
- ☐ Social Studies worksheets with paragraphs & multiple choice questions
- ☐ Other (please explain)

____

____

APPENDIX T

CHECKLIST FOR RETURN MATERIALS

Checklist for Return Mailing

Check-off each of the following items as you include it in the return envelope.

_________ STUDENTS’ ANSWER SHEET SCANTRONS

_________ STUDENTS’ ASSENT FORMS FOR EACH STUDENT TAKING THE TEST

_________ PARENTS’ CONSENT FORMS FOR EACH STUDENT TAKING THE TEST

_________ TEACHER CONSENT FORM

_________ TEACHER’S SURVEY SCANTRON

Please return materials by December 12, 2003.

RETURN TO: DEPARTMENT OF AGRICULTURAL EDUCATION
Attention: MARY JASEK
2116 TAMU
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS 77843-2116

Place all items in the envelope that was enclosed in testing package. Do not fold or bend scantrons.

Remember that the test copies do not have to be returned, only the answer sheets.

If you have any questions, please call Mary Jasek at (979) 209-2613 (school).

APPENDIX U

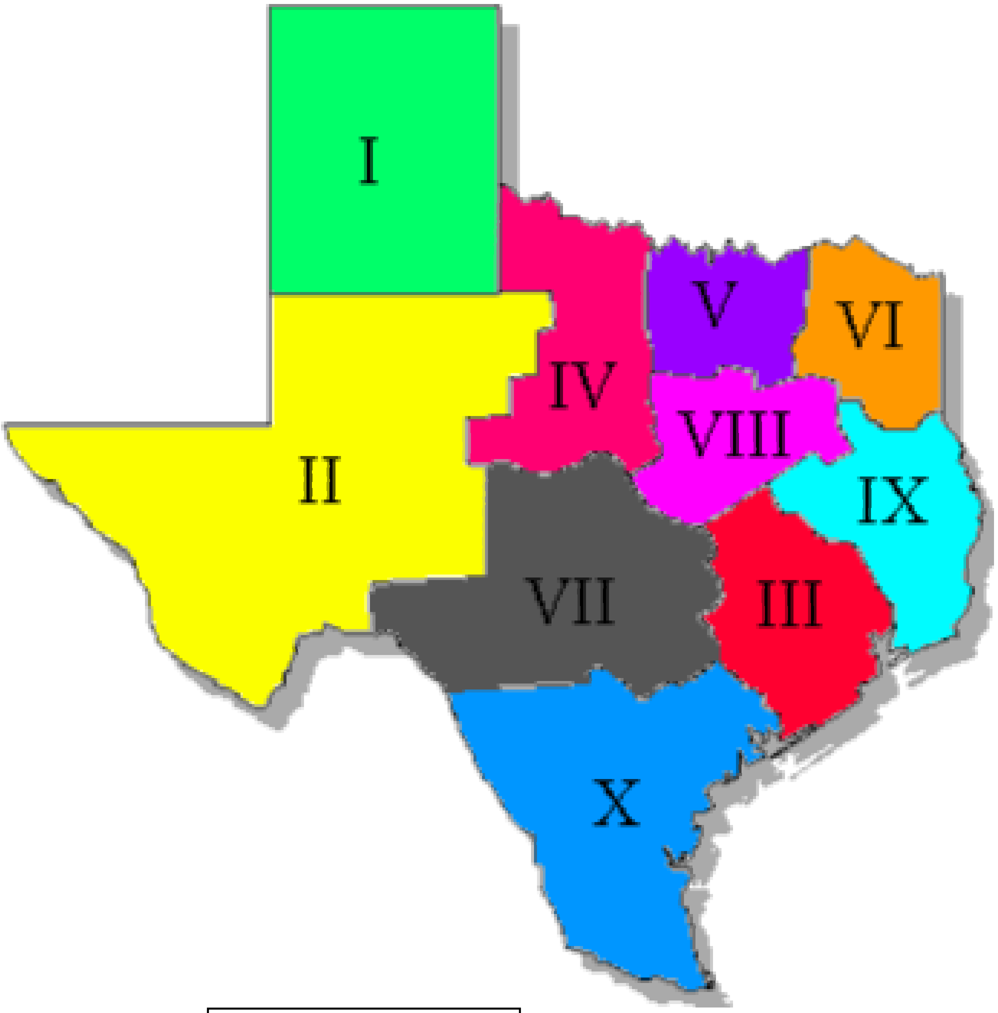
TAAS OBJECTIVES AND NUMBER OF TEST ITEMS COVERING OBJECTIVES

TAAS Objectives Addressed In Math Test

Objective:	Description:	Test Item Numbers Covering the Objective:
1	Number Concepts	4, 7
2	Algebraic/Mathematical Relations and Functions	1, 6
3	Geometric Properties and Relationships	5
4	Measurement Concepts	No Items Covering This Objective
5	Probability and Statistics	2, 8, 9
6	Use of Addition to Solve Problems	23, 26, 30
7	Use of Subtraction to Solve Problems	20, 29
8	Use of Multiplication to Solve Problems	21, 22, 27
9	Use of Division to Solve Problems	24, 28
10	Problem Solving Using Estimation	10, 14, 18
11	Problem Solving Using Solution Strategies	12, 15, 16, 19
12	Problem Solving Using Mathematical Representation	3, 13
13	Evaluation of the Reasonableness of a Solution	11, 17, 25

APPENDIX V

TEXAS FFA AREAS



Area I – 3,396
Area II – 3,055
Area III – 10,019
Area IV – 4,068
Area V – 6,837
Area VI – 5,428
Area VII – 5,721
Area VIII – 6,375
Area IX – 6,188
Area X – 5,158

VITA

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Major Subject: Agricultural Education

Biographical:

Educational: Graduated form Tidehaven High School, El Maton, Texas, May, 1981; graduated with a B.S. in Agricultural Education from Texas A&M University, College Station, Texas, May, 1985; received M.Ed. in Agricultural Education from Texas A&M University, in May, 1986; and fulfilled requirements for Ph.D. from Texas A&M University, December, 2005.

Professional: Graduate teaching assistant for AGED 301 and AGED 427, Department of Agricultural Education, Texas A&M University, College Station, Texas, 1985-1986 and 1999-2001.

Agricultural Science Teacher at Bryan High School, Bryan, Texas, 2001-present;
El Campo High School, El Campo, Texas, 1991-1999; Murchison Middle School, Austin, Texas, 1986-1989.