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Effect of Computer-Aided Instruction on Grades in Middle School Algebra

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EFFECT OF COMPUTER-AIDED INSTRUCTION ON GRADES IN MIDDLE SCHOOL ALGEBRA

by

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ABSTRACT

Computers and targeted software are increasingly common in the middle school algebra classroom, but the efficacy of computer-aided instruction on classroom achievement in middle school algebra remains unclear.

Participants were 1452 middle-school algebra students who were seldom, occasionally, or often exposed to the algebra modules of *Destination Math*, an interactive mathematics software designed to be appropriate for in-school use. Data were collected over three years (2002-04) and included the cooperation of the algebra teachers, who were subsequently interviewed. Data were analyzed with ANOVA, ANCOVA, and multiple regression. Statistically significant effects were localized using pairwise tests with Bonferroni correction for multiple comparisons. Findings were considered statistically significant at $p < .05$.

Students who received the greatest exposure to *Destination Math* achieved higher first and second semester algebra grades than participant groups who received less treatment, even when parent education, Gifted and Talented Education (GATE) program status, subsidized lunch status, teacher, and grade in which the student took algebra (7_{th} or 8_{th}) were included as covariates. No significant differences were seen in the California Achievement Test (CAT4SS), a standardized statewide test of general mathematics, possibly because of content validity in that the statewide test was not algebra specific. Multiple regression revealed that parent education, gender, exposure to *Destination Math*, and GATE program status may be predictive of higher first and second semester grades for middle school students in algebra. Interviews with algebra teachers (n=6) generally revealed support, and suggested that improved

performance came from improved compliance, specifically because interactive software captures and holds student attention and thereby increases focused time on task.

Increased exposure to *Destination Math* computer software was associated with increased first and second semester classroom achievement in middle school algebra students. These findings provide empirical evidence supporting the efficacy of developmentally appropriate computer-aided instruction on achievement in the middle school algebra classroom.

DEDICATION

To my friend and mentor
Mary Louise Zahm
1927 - 2005

The love, laughter, and goodness that you brought
into the lives of those around you
reflect back upon you today and for eternity.

It is said that some people come
into our lives and quickly go.
But others come, and we are never the same.
Mary, you were one of the 'others'.
Life changed when you came into my life.

This dissertation is dedicated to you with
love and gratitude for friendship shared,
for inspiration, for endless
encouragement and support.

Today you would be so proud!

Your friend,
Pat
May, 2007

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CHAPTER I

INTRODUCTION TO THE STUDY

The National Council of Teachers of Mathematics' (NCTM) 1989 publication, *Curriculum and Education Standards for School Mathematics,* challenges a tradition of low expectations, changing work force needs, economic necessity, and shifting demographics. The document, often referred to as *The Standards*, represents a major effort to develop mathematically literate citizens and stresses the need to provide all students "opportunities to share the new vision of mathematics and to learn in ways consistent with it" (NCTM, 1989, p. 6). *The Standards* was developed in response to a recognized need for change in the teaching and learning of mathematics. It is a powerful plea for unprecedented reform in mathematics education. To ensure that mathematics education is compatible with a world that has become more mathematical – more technological, restructuring is necessary. Today, students are surrounded by mathematical situations and are regularly required to make mathematical decisions.

Statement of the Problem

Computers and targeted software are increasingly common in the middle school algebra classroom, but the efficacy of computer-aided instruction on student achievement in the middle school algebra classroom remains unclear.

Statement of Purpose

The primary purpose of the present study was to determine the efficacy of computer software on student achievement in a comprehensive middle school first-year algebra program.

Statement of Significance

The findings of the present study could potentially: (a) change the way algebra instruction is delivered, (b) ensure that equity in algebra education complies with *No Child Left Behind* (NCLB), and (c) provide empirical evidence towards addressing the gap in mathematics achievement that threatens the economic future of under-performing students. Further, the present study may assist in breaking down barriers among faculty by providing an existence proof that teachers can effectively collaborate in quasi-experimental studies of algebra interventions. Lastly, given that math instruction/learning is the civil rights issue of the new millennium (Moses, 1999), and critical for economic success, the findings of the present study may potentially benefit society by fostering a more successful, better prepared citizenry.

Preface

The Introduction to NCTM's Professional Standards for Teaching Mathematics (1991) explains what The *Standards* means by the term "all students."

> "By this phrase we mean to set the mathematical education of every child as the goal for mathematics teaching at all levels, K-12 . . . by 'every child' we mean specifically students who . . . have been denied access in any way to educational opportunities as well as those who have not been denied access

> and students who have not been successful in school and in mathematics as well as those who have been successful" (NCTM, 1991, p. 4).

Subsequent to the NCTM publication, *Principles and Standards for School Mathematics* (2000b), concepts of equity have been progressively developed, defined, and articulated to school communities across the country. The five principles defined in that document include equity, curriculum, teaching, learning, and assessment. Capitalizing on the importance of high expectations, effective instruction, and support, the Equity Principle further warrants that equity does not mean equality – it does not mean that every student should receive identical instruction or the same quantity of instruction (Sutton, 1991). In practice, the principle calls for appropriate accommodations, learning opportunities, high expectations, adequate resources, and support, so that outcomes are equitable for every student. It requires an assessment of fundamental expectations about what children can learn and can do, in order to create learning environments in which raised expectations for children can be met.

Effective practices for equity continue to be shaped by multiple factors in today's schools. The world is changing rapidly; this change is extraordinary and accelerating - it pervades each level of the education system. "The ultimate goal of mathematics programs in California is to ensure universal access to high-quality curriculum and instruction so that all students can meet or exceed the state's mathematics content standards" (California Department of Education, 2000).

Educators have traditionally designated algebra as the gateway to professional success in the 21st century (California Education Code 60850-60659, 2003). Previously, algebra courses were reserved for college-bound students of above-average ability, but now many states, including the State of California, require that all students, regardless of their ability or special needs, have an opportunity to learn algebra; furthermore, first-year algebra has become a requirement for graduation from any California public high school beginning with the class of 2004 (California Education Code 51224.5, 2003). As a measure of continuity of student achievement across the state of California, all students are also required to pass the California High School Exit Exam (CAHSEE), which measures achievement of mathematics content through first-year algebra.

"There is a very simple reason why California demanded algebra for all: it is a necessity for virtually every single young person, no matter what career path they might choose. Indeed, research now tells us that young people need even higher-level courses to succeed" (Education Trust, 2004 p. 3). Consequently, all students are now given the mathematical opportunities and responsibilities once reserved for a few. Students are no longer denied their right to learn and to develop the skills required of effective citizens. How sad to think that we would shut the door for any young person at the age of fourteen! In the past, students often left high school without adequate preparation for college or for the world of work; they were missing the key or the required academic courses. Some students did not have access to rigorous coursework; no one had given them the opportunity. Students' choices were eliminated or reduced one by one when students' access to courses such as algebra was denied.

This present study scrutinizes the response of one school district in southern California to the challenge of designing a comprehensive course of study in first-year algebra that provides an equitable mathematical experience with high expectations, effective instruction, and all the support necessary to achieve the desired outcomes for all students. The Covina-Valley Unified School District (C-VUSD) adopted a textbook aligned to California Mathematics Content Standards, employed state-designated competent mathematics teachers to provide classroom instruction, and purchased the software program, *Destination Math*, to provide both appropriate technology and the foundation for an effective intervention program to give every student an opportunity to receive the support necessary for success in first-year algebra.

The C-VUSD has served five communities in eastern Los Angeles County for more than a century. Established in 1896, the C-VUSD serves approximately 14,700 students in kindergarten through twelfth grade on a traditional school calendar. It is comprised of twelve elementary schools, three middle schools, three comprehensive high schools, a continuation high school, an independent study school, and an adult education program. South Hills High School, located in the southern section of the five communities, opened its doors in 1964 and currently serves over 1,860 ninth- through twelfth-grade students. Sierra Vista Middle School, located in the southwestern section of the district, opened its doors to students in 1962 and currently serves over 1,260 students. The Sierra Vista Middle School / South Hills High School feeder cohort is one of three such feeder cohorts in C-VUSD. Both schools have developed educational programs designed to provide the skills and tools necessary for students to explore their creativity while developing a strong educational base. Each school has been recognized as a California Distinguished School: South Hills High School in 1990, 1992, and 2005; Sierra Vista Middle School in 2001.

The District's plan for a comprehensive first-year algebra program was affirmed by the results of a study published by the Education-Trust West (September 27, 2004). In their summary of *What to Learn from Places Where the Results Are Good*, the researchers report that the attributes common to schools and districts boasting positive results include: (a) well-prepared teachers, (b) clear goals, (c) a challenging curriculum aligned with the standards, and (d) the availability of further instruction for students when needed. The summary acknowledges and supports the notion that some students in first-year algebra may require additional time and support strategies from educators (Education Trust, p. 4-5). Those four attributes and the fact that some students may require additional time and support are the foundation of the C-VUSD's plan for a comprehensive first-year algebra program

The compelling cry that resonates from *Principles and Standards for School Mathematics* (NCTM, 2000b) under "A Vision for School Mathematics" ultimately became the driving force behind the present study.

> Imagine a classroom . . . [in which] all students have access to high-quality, engaging mathematics instruction . . . [with] ambitious expectations for all, with accommodations for those who need it. Knowledgeable teachers have adequate resources to support their work . . . The curriculum is mathematically rich . . . Technology is an essential component . . . [as] students confidently engage in complex mathematical tasks . . . [students] value mathematics and engage actively in learning it (NCTM, 2000b, p. 3).

History of the Study

At the California Mathematics Council Southern Section (CMC-SS) annual meeting in Palm Springs, California in early November 1999, Riverdeep, a software company with its home base in Dublin, Ireland gave demonstrations of its new software, *Destination Math.* Company representatives also distributed invitations to teachers and technology coordinators to attend the company's first annual User's Conference. C-VUSD representatives attended that conference and recognized the potential of the software to truly enhance mathematics instruction in first-year algebra for the District's students.

Destination Math is a visually oriented, computer-based mathematics curriculum compatible with California Mathematics Standards. It is a carefully sequenced, comprehensive mathematics curriculum that demonstrates mathematical issues that arise from real-life situations. The *Destination Math* Mastering Skills and Concepts courses are correlated to the California State Content Standards and offer full on-line teacher support with printable student worksheets. The program enables teachers to supplement classroom instruction in a computer lab environment to facilitate differentiated instruction for individual students' dynamic levels of proficiency (Riverdeep, 1999/2000). In the lab, each student can work independently at a computer, reinforcing concepts previously taught in class, learning new concepts, and enhancing basic math skills. Even the most capable students can find enrichment on a familiar topic or pursue a new one. The interactive format of *Destination Math* imitates the popular video game format that attracts and holds young people's attention.

Company representatives visited the C-VUSD and made a presentation at the district office to a large number of middle and high school mathematics teachers. The District agreed to an initial purchase that allowed *Destination Math* to be used on two individual computers at each of its three high schools. Within three months' time, it was determined that the mathematics departments in two of the three high schools were not yet ready for the introduction of technology in the algebra curriculum. All of the licenses from the initial purchase were then *quasi-experimental* transferred to South Hills High School where teachers had begun to use the software and to Sierra Vista Middle School where teachers were expressing interest in using the software. Within six months, the transfer of those licenses, together with the resolution of several technical problems between the Company and the District, proved to be the necessary catalyst for the expansion of licensing from six individual computer stations to two 36-station computer labs, one at South Hills High and the other at Sierra Vista Middle School. The new labs, readily available to the mathematics department, had an immediate positive effect on teacher response. The number of teachers taking their classes to the lab at frequent intervals increased daily.

While teacher/student use of *Destination Math* increased at the licensed sites, it still remained somewhat occasional, rather than usual; some teachers felt they already knew how to teach first-year algebra, and the District had recently purchased new textbooks aligned with California State Standards. Following the first year of *Destination Math* usage, the District made the decision to fund two release periods to support a teacher, this researcher, as coordinator for teacher training and site implementation of *Destination Math* in the District's three middle and three high schools. Riverdeep subsequently provided a series of training sessions for all mathematics teachers at each of the six target schools.

Two years into the trial program, algebra teachers at South Hills High School and at Sierra Vista Middle School came to consensus regarding the implementation of a formal intervention program. Any student who received a grade of C, D, or F on a chapter test would be required to attend intervention. Teachers from the department would supervise the sessions three days a week, 3:00-4:00 p.m., and one morning a week, 7:00-8:00 a.m. The District agreed to compensate teachers for their participation. During intervention students would log in to the course and section of the interactive software program, *Destination Math*, compatible with the content standards in the current chapter of their text. After engaging in several tutorials and practice tests, students would have an opportunity to retake the chapter test whose standards they had not previously mastered. A definite change in the philosophy of test efficacy was collaboratively achieved when teachers agreed that students could retake exams until standards had been achieved. Teachers demonstrated a dramatic attitude shift when they further agreed that students would receive replacement grade credit for their achievement. Such intervention supports the notion that at any one time, no student need be more than one chapter behind the District pacing guide.

In spring of the second year, the Assistant Superintendent for Instruction informed the researcher that the district manager of Technology System Services (TSS) wanted members of his department to learn more about *Destination Math* to more appropriately support teachers at their site. After receiving training from the technology coordinator, the manager of TSS proposed to the assistant superintendent that the appropriate projector be installed in every classroom in which first-year algebra was taught to enable teachers to enrich their lessons by actually bringing the computer program directly into their classrooms. Through this dual reinforcement program, intervention in the lab, and enriched lessons in the classroom, maximum benefits from *Destination Math* would be possible. When school opened the following autumn, a projector had been mounted in every classroom in each of the six school sites where *Destination Math* is used.

During the third year of the trial program, budget constraints dictated a change in the District's ability to support the on-going implementation of *Destination Math*. The release of the District-wide resource teacher from two teaching periods was no longer an option. The District did designate the researcher and two additional algebra teachers, one from each of the other high schools, as resource teachers funded by Title II, to facilitate the use of *Destination Math* in the first-year algebra curriculum in their respective middle school / high school feeder cohorts. The elimination of the release time periods, together with the designation of three on-site/feeder support teachers, caused the use of *Destination Math* to become cost effective.

Destination Math continues to be used at both middle and high school levels for reinforcement and intervention during regular class time, and for teacher-supervised intervention before and after school. It is also available for independent student reinforcement on computers in the school libraries before and after school and in the evening.

The purchase and implementation of *Destination Math* in the C-CVUD was teacher-initiated, District-supported, and teacher-driven by the threefold commitment: (a) to raise expectations, (b) to provide access and opportunity, and (c) to make available all necessary support to ensure that outcomes are equitable for every C-VUSD student in first year algebra.

The Present Study

The present study examined: (a) the efficacy of the technology-based program, *Destination Math,* as an intervention tool to increase the success rate for students in first-year algebra, (b) the effect of teachers' attitude toward the overall purpose and potential of *Destination Math* as an intervention program, (c) the role of the teacher using *Destination Math* including the individual teacher's integration of *Destination Math* into daily practice, (d) the teachers' perception of the training and support received throughout the implementation process, and (e) the extent to which standardized test scores and semester course grades are a function of demographics, ability, and the use of *Destination Math* as an intervention tool at Sierra Vista Middle School.

Research Questions

This study used mixed-methodology to determine the efficacy of computer software on student achievement in a comprehensive middle school first-year algebra program.

Question One

The quantitative research question was, "Does greater use of *Destination Math* positively correlate with higher student semester course grades in first-year algebra and with higher standardized test scores in first-year algebra after controlling for select demographics and teacher differences?"

The primary hypothesis in research question one was that groups who received the greatest amount of treatment with *Destination Math* would achieve significantly higher grades in both first and second semester of first-year algebra. The secondary hypothesis was that groups who received the greatest amount of treatment with *Destination Math* would receive higher standardized test results than students who received a lesser amount of treatment with *Destination Math.*

Question Two

The qualitative research question focused on teacher perceptions of *Destination Math* including (a) Do teachers like the program and find it useful? (b) What specifically do they like about it? (c) What do they consider its advantages? (d) Do teachers believe *Destination Math* will affect student achievement? (e) How do teachers describe the response of students to *Destination Math*? (f) How well do teachers feel they were trained to use the program? (g) What suggestions do teachers have to improve teacher training and the use of *Destination Math*?

Overview of the Study

From an organizational perspective, the presentation of this study is divided as follows. Chapter 1 will: (a) give the historical background and purpose of the study, (b) introduce the research questions, and (c) provide a chapter-by-chapter overview of the dissertation. Chapter 2 will review the theoretical and empirical context surrounding the research questions. The review of the literature will include four topics that are relevant to this study. Chapter 3 will describe the research design and methodology used to address the research questions. Chapters 4 and 5 will present the results. Chapter 4 will present the results of the quantitative analysis. Chapter 5 will present the qualitative results of the interview responses from the teachers. Chapter 6 will summarize the major findings, discuss the implications, and conclude with directions for future research.

Limitations of the Study

This three-year study included in its sample all the students enrolled in first-year algebra at one middle school site. However, the 1,452 students in the sample represent only a small fraction of the students enrolled in first-year algebra in all of Los Angeles County, and an even smaller fraction of the hundreds of thousands of students in the total population of students enrolled in first-year algebra across the nation during the time of the study.

The researcher acknowledges certain limitations and potential bias stemming from her position as a teacher leader actively involved in the implementation of *Destination Math* in the District prior to and throughout the study.

Definition of Terms

The following terms are important to fully understanding this study.

Standards (a) express clear expectations for what all students, except perhaps for those with seriously disabling conditions, should know and be able to do while addressing the different needs of a school's constituencies, (b) set clear performance expectations for students, helping them understand what they need to do to meet the standards, (c) provide a focus for developing new ways to organize curriculum content, instructional-delivery systems, and assessment plans, (d) serve as a common reference tool for ensuring that the components of the educational system work together, (e) make good learning evident from district to district and from school to school, (f) communicate shared expectations for learning and provide a common language for talking about the processes of learning and teaching, and (g) allow people other than just the students to understand how students are progressing in their education.

Content standards (a) specify the essential knowledge, skills, and habits of mind that should be taught and learned in school; and (b) are often set by local, state, and national groups, i.e., District standards, California Content Standards, National Council of Teachers of Mathematics Standards (Harris, 1996).

Student performance standards (a) express the degree or quality of proficiency that students are expected to display in relation to the content standards, and (b) answer questions about quality and degree, whereas the content standards define what students should know and be able to do.

Equity includes actions, treatment of others, or a general condition characterized by justice, fairness, and impartiality.

Intervention (a) is an action undertaken in order to change what is happening or might happen in another's affairs, especially in order to prevent something undesirable, (b) commonly refers to the support strategies teachers provide to assist students in achieving standards.

Educational software includes computer programs and applications, such as word processing or database packages, that can be run on a particular computer system for the purpose of education.

Site license is a document that gives official permission to a specific person or group to use a particular product at a particular location.

Computer lab is a room with multiple computers connected to a server.

Computer literacy includes the ability to use computers competently and to understand computer terminology.

LCD projector is a projection device mounted on the ceiling or on a cart that makes it possible to project on a screen the application or program installed on an individual computer.

Mathematics literacy includes: (a) knowledge of or training in mathematics, (b) having a good understanding of mathematics, (c) well-educated and cultured, particularly with respect to mathematics; (d) showing skill in the techniques of mathematics.

California High School Exit Exam (CAHSEE): (a) was created to significantly improve pupil achievement in public high schools and to ensure that pupils who graduate from public high schools can demonstrate grade-level competency in reading, writing, and mathematics, (b) helps identify students who are not developing skills that are essential for life after high school and encourages districts to give these students the attention and resources necessary to help them achieve these skills during their high school years, (c) has two parts: English language arts (ELA) and mathematics, (d) test questions assess a range of difficulty levels, consistent with good testing practices, (e) all questions on the examination have been evaluated for their appropriateness for measuring the designated ELA and mathematics academic content standards, (f) is not a timed-test, which means it has no fixed time limit in which students must complete the examination, and (g) CAHSEE results are used at the high school level to show whether students are performing at or above the proficient level.

California Achievement Tests, Sixth Edition Survey (CAT-6) are national norm-referenced tests that measure achievement of basic academic skills and provide national comparisons. Their results are: (a) used to assess the accomplishments of individual students, schools, and school districts, and are c) key elements in determining whether or not school districts and schools are meeting the goals established under the Public School Accountability Act (PSAA) that requires schools to meet yearly growth targets based on an Academic Performance Index (API).

No Child Left Behind (NCLB): is (a) legislation that requires school districts and schools to demonstrate "adequate yearly progress" (AYP) by meeting established goals, and (b) requires all students in kindergarten through grade twelve to achieve state academic standards for English-language arts and mathematics by 2014.

Summary of Remaining Dissertation Chapters

In Chapter II the literature review will focus on four major topics: (a) the historical background of algebra for everyone as depicted in the mathematics reform movement embedded in issues of equity and opportunity, (b) the essential components of a comprehensive first-year algebra program, (c) computer-assisted technology as it supports learning, and (d) the role of the teacher as change agent particularly in the implementation of computer-assisted technology as a tool for intervention.

In Chapter III the methodology discussion will include separate sections for the quantitative and qualitative methodologies. Each section presents the rationale for the choice of methodologies, followed by a description of the participants, instruments and materials, procedures, and the design and analysis used. The chapter ends with a summary of the methods employed in the present study.

In Chapter IV the quantitative data and findings will address research question one, "Does greater use of *Destination Math* positively correlate with higher student semester course grades in first-year algebra and with higher standardized test scores in first-year algebra after controlling for select demographics and teacher differences?"

The chapter begins with participant descriptives including gender, grade level, parent education, Gifted and Talented Education (GATE), disability, ethnicity, subsidized lunch, and home language. Teacher differences and student performance on a statewide standardized test follow. The findings from the primary hypothesis are provided for both first semester and second semester algebra course grades. Findings from the secondary hypothesis relate to student achievement on a statewide mathematics test. The exploratory analyses utilize multiple regression to investigate whether demographics can account for the variance in algebra grade outcomes, and explores whether teacher differences can account for the major findings. This chapter ends with a summary of major findings.

In Chapter V the qualitative data and findings will address research question two, the qualitative research question, that focused on teacher perceptions of *Destination Math* including: (a) Do teachers like the program and find it useful? (b) What specifically do they like about it? (c) What do they consider its advantages? (d) Do teachers believe *Destination Math* will affect student achievement? (e) How do teachers describe the response of students to *Destination Math*? (f) How well do teachers feel they were trained to use the program? (g) What suggestions do teachers have to improve teacher training and the use of *Destination Math*? Question two was intended to supplement and support the quantitative outcomes of research question one described in Chapter IV. The chapter begins with a description of the participants and an overview of the qualitative methodology. It is organized around five broad topics that were addressed in the seventeen questions from the guided interview protocol. The topics include: a) teacher qualifications; (b) technical training and support; (d) effectiveness of *Destination Math*, the computer assisted software; and (e) teacher perceptions. Each section begins with an introduction followed by a statement of the specific interview questions that relate directly to the given topic. Participant responses to the interview questions immediately follow the statement of each question. Every section is summarized, and this chapter concludes with a summary of qualitative findings.

In Chapter VI the discussion will begin with an introduction, a review of the major findings, and the strengths and limitations of the present study. The major findings will be presented in their theoretical context as well as in the context of recently published empirical research. The discussion includes technology in education the No Child Left Behind (NCLB) Act, computer software in the classroom, and the role of algebra teachers. A summary of the general discussion is followed by implications of their present findings, limitations and suggestions for future research. The discussion chapter ends with the conclusions.

CHAPTER II

REVIEW OF RELATED LITERATURE

The primary purpose of this study was to determine the efficacy of computer software on student achievement in a comprehensive middle school first-year algebra program. This chapter reviews the literature and focuses on four broad topics relevant to the concept of algebra for everyone.

The topics include: (a) the historical background of algebra for everyone as depicted in the mathematics reform movement embedded in issues of equity and opportunity, (b) the essential components of a comprehensive first-year algebra program, (c) computer-assisted technology as it supports learning, and (d) the role of the teacher as change agent particularly in the implementation of computer-assisted technology as a tool for intervention.

Historical Background of Algebra for Everyone

The pedagogue Mary Everest Boole promoted the use of cooperative learning, manipulatives, and hands-on activities long before the NCTM existed. In *Philosophy and Fun of Algebra*, Boole (1909) writes, "Always remember that the use of algebra is to free people from bondage" (http://www.moa.cit.cornell.edu/dieinst/moabrowse.ests). Boole continued as an advocate for mathematics education, but the expression of her thoughts was interrupted by the Roaring Twenties, the Depression, and the World War. The idea of an "aristocracy of the intellect" (Moses and Cobb, 2001) arose in the midst of the Depression. A national selection process that utilizes Scholastic Aptitude Test scores

(SAT) was put in place at the end of World War II to determine who was eligible to attend the best schools. Consequently, the concept of public education as a place where everyone in the democracy is given an equal opportunity to advance became skewed toward the idea of public education as a means of selecting a national elite.

As an early advocate for equity, Robert Moses, a young man from New York, traveled to Mississippi in the 1960s to help organize the voter registration movement that changed the political landscape of the South. Later in the 1980s, as a parent in a Cambridge (Massachusetts) public school, Moses started a project to help advance African-Americans in education, another arena with vast political consequences that led to a national network of schools and communities whose aim today is to create a self-sustaining movement for math literacy among students. When speaking about his book, *Radical Equations* (2001), Moses reiterates that his activist role is not just about voting or about mathematics; it is about the fact that certain people in this country are part of a caste system which espouses the expectation that some people are only going to do a certain kind of work and, therefore, need only a certain kind of schooling. In a technical era when the most pressing civil rights issue is economic access, Moses sees a crisis in mathematics literacy in poor communities that is as urgent as the crisis of political access was in Mississippi in 1961. For Moses, the solution requires, as it did in the 1960s, organizing people, community by community, school by school.

Moses (1995) defines equity in mathematics reform as the obligation to provide the opportunity to learn algebra for all students regardless of background, race, or ability. In this context, he declares equity the new civil right, demanding, therefore, that the essential components in a comprehensive first-year algebra course for the new millennium reflect a paradigm shift from the traditional version of a male-dominated, high-achieving first-year algebra student to a dynamic program that includes strategies necessary for students, regardless of gender or innate mathematics ability, to internalize the recommended concepts and skills (Heid & Zbiek, 1997). A comprehensive first-year algebra course must, therefore, include all the support required for students to meet mandated state content standards. Computer-assisted technology, which has dramatically changed the face of school algebra, has assumed a significant role in shaping a comprehensive course for the 21st century. Embracing all considerations, the role of the teacher as primary change agent in subject matter modification, instructional strategies, and increased student achievement, continues to evolve and to require training and support (NCTM, 2000a).

An understanding of the classic inequity inherent in traditional mathematics education programs in the United States is essential to understanding Moses' (1995) declaration that algebra is the new civil right. In the April 2001 issue of *The Mathematics Teacher,* Lee Stiff, then president of NCTM, supports Moses' declaration that algebra is the civil rights issue of the new millennium stating that Moses' declaration is critical for change. Stiff further affirmed that algebra means access; algebra unlocks doors to productive careers; and algebra is the "engine of equity" (Steen, 1992, p. 1). Moses and Cobb further argue that "algebra . . . once solely in place as the gatekeeper for higher math, is now the gatekeeper for citizenship, and people who don't have it are like the people who couldn't read and write in the industrial age . . . . [I]t has become not a barrier to college entrance, but a barrier to citizenship. That is the importance of algebra that has emerged with the new higher technology" (Moses and Cobb, 2001, p. 14). The NCTM gave further support to Moses' position, as did several prominent mathematics educators including Steen, Jacobson, and Usiskin. Moses emphatically states that educators must see education and literacy as a civil rights issue in order to effectively organize themselves and to ensure that significant progress in education reform is accomplished. We are in an era in which "knowledge" is replacing the industrial worker, and illiteracy in math must be considered as unacceptable as illiteracy in reading and writing in the past. The core idea in public schools should be that education is an opportunity structure for every student. Public education should mean quality public education for all students.

For Moses, such an education remains an unfulfilled promise in this country as school reform often revolves around designing education as a sorting machine rather than using education as an opportunity structure. On April 4, 2005, during the NCTM annual conference in Anaheim (California) the researcher conducted a personal interview with Moses. Moses encourages today's educators: (a) to see students as individuals capable of learning, (b) to find the key that will unlock the personal barriers that impede the road to mathematics literacy within every student, (c) to make mathematics real for each student through applications that are meaningful, (d) to engage the students in their mathematics learning, (e) to think globally yet be specific, and (f) to organize school-by-school, community-by-community.

Steen (1992) writes that algebra was, for many years, the province of the high school elite, the invisible filter, a gateway to critical thinking, higher math and science courses, and a necessary first step on the path to trade school, four-year college, or university (Steen, 1992). Zalman Usiskin, professor of education and director of the University of Chicago Mathematics Project, believes first-year algebra is the keystone subject in all of secondary mathematics (1992). The NCTM 1990 Yearbook, *Teaching and Learning Mathematics in the 1990s*, focuses on removing the computational gate to the study of mathematics in high school in order to provide all students the opportunity to study the more advanced forms of mathematics that will be critical for their participation in society (NCTM, 1990). Bivins lent support to Moses' premise in his report on research that shows tracking students into college prep and non college prep courses of study continues to fundamentally limit students' opportunity. Grouping practices for math instruction widen the gap in achievement among students in different class levels. Students in higher level classes typically receive higher level instruction, a more enriched curriculum, less drill with basic skills, and more challenging critical thinking activities than students in lower level classes. The education gap threatens the economic future of today's students, since mastery of mathematics is critical for equal opportunity in the world of employment (Bivins, 2002).

It must be noted, however, that not all members of the mathematics education community endorse a common methodology embedded in mathematics education reform. Usiskin reports that educators differ regarding the best methods for the delivery of instruction of algebra in one year, over two years, in three semesters, in middle school, or in high school (Usiskin, 1987). He maintains that regardless of the methodology teachers need to provide all additional support necessary for all students to meet appropriate content standards.

While their methodology may vary, teachers are cautioned never to accept failure from a student at any level. The response to poor performance in mathematics, independent of the racial and ethnic background of students, should not be the removal of the opportunity to learn important and useful mathematics; the response should be to do whatever is necessary to reach the goals that have been set (NCTM, 1990).

"Mathematics, although previously thought to be culture-free, is not" (Lowery, 2003, p. 19). Cultural filters screen all learning experiences. The vision of inclusive equity requires teachers of mathematics to acknowledge and incorporate a multicultural perspective to instruction which includes understanding mathematics learning, the importance of a multicultural perspective, and insights for implementing a perspective that enhances mathematics understanding and promotes equity for all students. Lowery cautions further, "Children learn from the cultures of home, community, media and through the cultures in school. These cultural filters are different for each student. This creates a tremendous challenge to the teacher" (p. 15). Such a model of culturally relevant pedagogy in mathematics classrooms relates directly to the NCTM standards and proposes that culturally relevant teaching according to the NCTM standards involves thinking critically. "Although a relationship between culturally relevant teaching and *The Standards* documents is possible, they are not linked without conscious action" (Gutstein, Lipman, Hernandez, and de los Reyes, 1997, p. 718).

One can conclude therefore, in light of the mathematics education reform movement, that a comprehensive first-year algebra program should include as essential components: (a) a quality textbook aligned to state content standards, (b) excellent classroom instruction, (c) appropriate use of technology to support student learning, (d) interventions for students outside of class, and (e) training and support for teachers designed to inform their attitudes regarding student learning, to deepen their content knowledge, to heighten their awareness of technology, to enhance their instruction, and, ultimately, to increase student achievement.

Warren Simmons (1994), former New Standards Project (NSP) director of equity, who serves on the NSP Governing Board and chairs the Equity committee, considers equity essential to the work of the NCP, rather than a casual consideration. He further claims that equity at NSP begins with performance tasks to demonstrate skills in mathematics and language arts accessible to students of different racial, ethnic, and linguistic backgrounds. Simmons maintains that performance tasks should be inclusive and provide access for students to display competence in a variety of ways and should not discourage performance from different groups.

While its methodology may not yet be solidified, Moses reports that the mathematics education community universally believes in equity in first-year algebra for all students. Within the community, discussion is shifting from whether to include algebra in a required curriculum, to topics such as: (a) why elementary algebra can, should, and must be an eighth-grade course for average students; (b) whether everybody needs to study algebra; (c) what we should teach and how we should teach it; (d) what the minimum standard is that all students can be expected to achieve; and (e) what algebra skills people need for the 21st century (Moses, 1999, pp. 22-52).

Essential to each topic is the belief that algebra is an important skill to master for lifelong success (Usiskin, 1995). Every day, throughout the country, a plethora of students sit in algebra classes wondering why they are studying linear and quadratic equations. "What's the point? I'll never use any of this stuff," they say (Usiskin, 1995, p. 22). McCarthy asks, "Why teach algebra to those who don't or can't appreciate it? Is it useless torture?" in response to "Does Everybody Need to Study Algebra?" (McCarthy, 1992, as cited in Steen, 1992). Challenged by the 1989 document, *Curriculum and Evaluation Standards*, members of NCTM continued to rally to implement the standards. However, critics, including *Washington Post* columnists William Raspberry and Coleman McCarthy, signaled alarms such as, "How absurd to require algebra of all students when ordinary people don't use algebra in their life or work. Should we not let students choose whether to take algebra?" (as cited in Steen, 1992, p. 49). The standards document called for a three-year core curriculum for all students. *Everybody Counts* (1998) urged students to study mathematics each year while enrolled in secondary school. Lynn Arthur Steen, former president of the Mathematical Association of America, and past chair of the Conference Board of the Mathematical Sciences, reports that critics of required algebra for all students argue, "Algebra is a boring, irrelevant impediment that turns off more students than it helps" (Steen, 1992, p. 89). For many students, the traditional school approach to algebra was a complete disaster; one in every four students never took algebra, and half those who did, left the course with a lifelong distaste for mathematics. It is notable that no major voice for change in school mathematics urged that their present version of first-year algebra be a requirement for all students. Steen (1992), also warned that, "*The Standards*, *Everybody Counts,* even President Bush's America 2000 Plan, all speak broadly in terms of outcomes for high school graduates, not of particular course requirements" (p. 258).

It is true that the value of algebra is not as obvious as the value of arithmetic. However, an understanding of its usefulness seems to be directly proportional to the level of one's training to recognize its presence in applications. Usiskin, in his 1995 article, "*Why Is Algebra Important to Learn?,* says that for those who do not know where or how to look, the presence of mathematics is often hidden. While the newer textbooks demonstrate applications of algebra better than the older texts, most do so in a haphazard manner. This poses no problem for students who love math, are good at it, and never question its value or appeal, but for other students the whys and wherefores need to be set forth in a convincing manner. In the past decade an increasing number of school districts replaced traditional consumer math or general math courses with a requirement that all students take algebra (*Course Selection & Program Planning Guide,* 2003-2004), and the consumer mathematics courses are, today, considered to be electives. Mathematics educators have continued to develop the case for the study of post-arithmetic mathematics, and Usiskin (1987) addresses several reasons for the importance of algebra as a requirement for entry to virtually every college, and why more and more school districts require all students to study algebra, even those who may not be college bound. His primary beliefs for the importance of algebra are based on the reality that without knowledge of algebra: (a) students are denied jobs or entrance to programs that will get them jobs; (b) students have less control of their options after high school graduation and grow more dependent on others; (c) students may be less prepared to make wise financial decisions; (d) students may not have the necessary background to understand concepts in courses such as chemistry, etc. (Usiskin, 1987).

Usiskin further reports that one of the most commonly accepted reasons for the successful study of algebra, namely to do well for aptitude tests and other national exams for college, fails to explain the totality of algebra as a beautiful field in its own right (Moses, 1999). Usiskin focuses on understanding which concepts should be emphasized in today's algebra curriculum and claims that with algebra, as with reading, writing, and arithmetic, a lack of knowledge limits opportunities. Some specific characteristics that Usiskin believes show algebra to be of such great importance are that algebra: (a) is the language of generalization, (b) is the language of relationships between quantities, (c) is a language for solving certain kinds of numerical problems, (d) includes the study of many useful topics, such as linear equations, slope, exponents, quadratic equations, logarithms, and permutations and combination, (e) includes deduction, the logical process used throughout mathematics, by which the truth of one statement follows from the truth of prior statements (Usiskin, 1995, p. 23).

Most students learn to read without asking why they must read. We do not teach the reading of literature because it is needed for jobs, or because literature may help in solving everyday problems; we teach the reading of literature because many people find good books enjoyable, relaxing, and exciting. Reading is fun, and the same may be posited about mathematics. Not everyone studies mathematics because of its usefulness; many people study mathematics because they enjoy its puzzle, much as people read for pleasure. Others study mathematics because they like the way it all fits into an organized structure, just as people appreciate fine architecture, yet others study mathematics because of its harmonic beauty, beauty they may have experienced through participation in music (Usiskin, 1995).

Educators in the new millennium are obligated by the concept of equitable access embedded within the ideal of democracy to offer all students an algebra course that is rigorous, important, and accessible; traditional algebra classes have been unsuccessful in this regard. Usiskin, in "*If Everybody Counts, Why Do So Few Survive?*" claims that only a small percentage of students in the past survived their school mathematics experience; that is, completed the equivalent of two years of algebra and a year of geometry (as cited in NCTM, 1993, p. 7). The mathematics community and its critics agree that first-year algebra in its present form is not essential for a quality mathematics education that must include the essentials of algebra to prepare students to use a rich variety of mathematical skills whether they enter the work force directly after high school or continue their studies in higher education. Students need to learn a new set of mathematics basics that enable them to compute fluently and to solve problems creatively and resourcefully. The level of mathematical thinking and problem solving needed in the workplace has increased dramatically in the past decade, and those who understand and can successfully solve mathematical equations will have opportunities that others do not. Mathematical competence opens doors to productive futures; a lack of mathematical competence closes those doors (NCTM, 1994). There may be some truth to what critics, such as McCarthy and Raspberry, have to say. Rarely will high school graduates be faced with problems presented in the language of algebra; however, they will have to use a mathematical process to think about issues densely filled with incomplete data, ambiguous graphs, uncertain inferences, and hasty generalizations. To perform well when confronted with problems at an increased level of complexity, students will need even more tools than mere algebra.

Principles and Standards for School Mathematics describes a two-pronged approach to mathematics reform, a future in which all students have access to rigorous, high-quality mathematics instruction, including four years of high school mathematics, and to knowledgeable teachers with adequate support and ongoing access to professional development (NCTM, 2000b).

Students' progress toward the goal of mathematical power is rarely, if ever, uniform. Students are very different from one another as their interests and preoccupations shift unpredictably. To achieve the desired outcome of mathematical power for all students, mathematics educators must therefore be prepared to abandon the rigid curricular structures that treat all students as if they were cloned from a single entity. Thomas Jefferson argued, "that there is nothing more unequal than the equal treatment of unequal people" (The Primary Source, 2006). The lock-step approach of the traditional required courses provides effective mathematics education only for the few who are independently motivated and will learn under most any conditions.

The NCTM standards, embedded in educational research, indicate the personal nature of mathematical knowledge; each student's mathematical insight is developed as he or she engages with the material and uses it in productive ways. Context, community, and connections make such engagement productive; thus all students, not just the gifted, can and should benefit from the rich environment of open-ended problems, group problems, active discussion, and multidimensional learning (Steen, 1992).

Everybody Counts (1998) stresses the nation's need to achieve both excellence and equity in mathematics education. "Changing demographics have raised the stakes for all Americans. Never before have we been forced to provide true equality in opportunity to learn" (p. 1). "Equity for all requires excellence for all; both thrive when expectations are high" (p. 6). *The California Standards* and critics such as McCarthy and Raspberry echoed the challenge. *The Curriculum and Education Standards for School Mathematics* (NCTM, 1989) and the critics of the mathematics curricula of the time seek a course richer than the traditional first-year algebra of the past, and claim that only when such an enriched course is offered for all students would educators have a legitimate argument for a new requirement of additional years of school mathematics.

Michael Fullan, Dean of the Ontario Institute for Studies in Education of the University of Toronto, maintains that productive educational change is a lifelong journey, and that non-confrontational conflict is essential to any successful change effort (p.27). The capacity to think and work independently is essential to educational reform (Fullan and Hargreaves, 1991). The freshest ideas often come from diversity and those marginal to the group. Keeping in touch with our inner voice, personal reflection, and the capacity to be alone are essential under conditions of constant change. Solitude also has its place as a strategy for coping with change (Storr, 1988 p. 35).

Jeff Howard from the Efficacy Institute sums up our responsibility in equity to each child in these words, “Each child should finish every academic year not only with a increased knowledge base, but with a stronger faith that ‘I am the kind of person who can learn whatever is taught to me in school’” (Howard, 1992).

The Components Essential for a Comprehensive First-Year Algebra Program

In his 1987 article, "*Why Elementary Algebra Can, Should, and Must Be an Eighth-Grade Course for Average Students,*" Usiskin identified first-year algebra as the keystone subject for all of secondary mathematics, while he challenged the mathematics community's timing for the study of first-year algebra. Students study algebra from grade levels as early as grade seven and as late as college, but more begin and complete their study in grade nine than at any other grade level. Usiskin’s article preceded the NCTM Standards document by two years, and strongly argues that most students should begin their study of algebra one year earlier than the commonly accepted ninth grade. Over the next decade, many mathematics educators came to a consensus with regards to the timing of first-year algebra for average students. Usiskin also recommends specific content for such a first-year algebra course in a 1980 article, "*What Should* Not *Be in the Algebra and Geometry Curricula of Average College-Bound Students.*" His research article targets the preservation of such topics as: (a) operations with positive and negative numbers, evaluation of expressions, (b) solving of linear equations, linear inequalities, and proportions, (c) age, digit, distance, work, and mixture word problems, (d) operations with polynomials and powers; (d) factoring of trinomials, monomial factoring, special factors, (e) simplification and operations with rational expressions, (f) graphs and properties of graphs of lines, (g) linear systems with two equations in two variables, (h) simplification and operations with square roots, and (i) solving quadratic equations by factoring and completing the square (pp. 413-24).

Later, in collaboration with seven other mathematics educators, Usiskin strongly recommends four major variants from his previous description of content for first-year algebra: (a) the use of real-life applications in place of contrived word problems, (b) preservation of monomial factoring and special factors, but the deletion of factoring trinomials, (c) the deletion of operations using rational expressions that require factoring, and (d) the use of the quadratic formula to solve quadratic equations (McConnell et al., 1986).

Usiskin suggests that the time formerly used studying topics not deleted from the algebra curriculum might be better spent on geometry or statistics, or with computers choosing to emphasize statistics because statistics is so compatible with algebra (McConnell et al., 1986). The noted mathematics educator defends the increasing importance of algebra, but emphatically says that the algebra that is taught is not always the algebra of importance (Usiskin, 1980). Furthermore, Usiskin calls for a preponderance of real applications of algebra that render traditional phony word problems obsolete.

The mathematics curriculum in countries outside the United States includes opportunities for students to gain mastery of far more arithmetic in the primary grades than that which is offered in the United States (Hashimoto and Sawada, 1979). The course analogous to the traditional first-year algebra course in the United States is considered appropriate for all students and usually occurs at grades 7 and 8. During the past several decades, mathematics teachers in the United States have gone to extreme lengths to avoid teaching algebra in the primary and early middle grades, while students in other countries were learning the language of algebra in those same early grades. For many years, educators in the United States have believed that students had to learn all the basic skills and procedures before they could progress to activities that required conceptual understanding (TIMSS, 1998). However, current reforms stress goals that allow students to learn the basic skills for mathematics, and how to reason through activities and problems that incorporate concrete materials and language, as integrated goals for all students (NCTM, 1991). Singapore and Japan offer adequate demonstration that variables in algebra can be made as concrete as letters in reading or numbers in arithmetic; their curricula also dispel the notion that students should know all of arithmetic before algebra (TIMSS, 1998). It is to be noted, however, that only the United States attempts to educate all its youth through high school.

The experiences from the other countries show that elementary algebra content, equal in difficulty to what is taught in first-year algebra, can be learned by some students in grade seven and by most students in grade eight. No other country requires that all the content of algebra be learned in a single year (http://www.llri.org/html/pubvs99.asp).

(TIMSS 1999 Video Study) © Copyright 2005 Lesson Lab Research Institute llri.org. First-year algebra can be an eighth-grade subject if students are prepared through experiences with variables in expressions, equation, formulas, and graphing during previous years of study. Usiskin (1987) cautions that, as an eighth-grade subject, the same amount of material might not universally be covered for several reasons. Eighth graders are not accustomed to the amount of homework given ninth graders, and more school days seem to be lost in the eighth grade due to field trips and assemblies than are lost in ninth grade, suggesting that, all other things being equal, an eighth-grade course taught from the same book as a ninth-grade course might cover only about 80% of the material. However, the experience of the University of Chicago School Mathematics Project suggests that, with a strong course as a precursor, average students could be ready for algebra about 1 year earlier than is customary. Therefore, one might expect about 40-50% of students to learn algebra in the eighth grade (McConnell et al., 1986).

When educators consider a developmental approach to teaching algebra with the timely inclusion of symbols, teachers would need to be prepared to recognize algebraic thinking as it emerges, and to structure authentic situations that encourage children to use symbols to represent patterns and relationships and therefore, the need to create ‘real-life’ situations that engage children in algebraic reasoning and representations. "The operant word," according to Sydney Schwartz and David Whitin (2000), faculty in the Department of Elementary and Early Childhood

Education at Queens College of the City University of New York, "is not *wait* [for...] but rather *scaffold*, that is, stimulate the building of bridges from the concrete to the abstract" (p. 4).

John Thorpe in, "*What Should We Teach, and How Should We Teach It,*" recalls that mathematics and its applications have changed dramatically in the past fifty years, and more recently, in the past ten years, while the teaching of algebra has failed to reflect a similar degree of change. Thorpe suggests that the emergence of calculators and computers as tools in both computational and abstract mathematics has changed the way mathematicians use mathematics, and the way scientists, engineers, and social scientists use mathematics. He further writes that the time has come for algebra instruction in the schools to reflect those changes in technology. The time has also come to reevaluate the content of the algebra curriculum and the instructional strategies used in teaching algebra. To ignore the potential for using tools such as calculators and computers to revolutionize the teaching of algebra would be irresponsible (Thorpe, 1989). Thorpe's position is further supported by Tim Kanold, Superintendent of Illinois' Stevenson High School District, award-winning mathematics educator, and noted author of mathematics texts, in his presentation at the 2003 National Council of Supervisors of Mathematics (NCSM) Conference in San Antonio (Texas). Kanold argues that, "failure to use technology, at least in demonstration, is evidence of malpractice."

An important current assumption in public education is that the goals of school algebra have changed. Previously, a primary goal of beginning algebra curricula was the refinement of pencil-and-paper symbolic manipulation; today, technology empowers students to use fundamental algebraic ideas, multiple representations, and technology-assisted methods to study important applied problems and mathematical ideas (Heid & Zbiek, 1997). A challenge before today's teachers is to discover the vehicle and the route by which students who have not developed basic competence through a traditional course can overcome the barrier of a notation system and gain access to the realm of important algebraic ideas.

Equity demands that all children have the educational opportunities once reserved for a few. It is hard to oppose such a generous gesture, but some points are raised in opposition. Algebra, which Moses (1995) and others consider to be a civil right for all Americans, has traditionally been a civil right for a select few. Moses insists that the struggle for equality for minorities is directly linked to mathematics and scientific literacy. In their article, "*Algebra For All: It's a Matter of Equity, Expectations, and Effectiveness,*" Dorothy Strong and Nell B. Cobb (2000) maintain that the successful completion of algebra should ensure that "all students are prepared for college level mathematics or mathematics related careers" (p. 3). Susan Frey, in a 2002 article, writes that for this to become a reality, all of society, students, parents, teachers, and administrators, must believe and expect that all children can and must learn algebra. "A multitude of players need to achieve a singleness of purpose" (p. 12).

The literature further states that the mastery of algebra must be a K-12 commitment; that all children, at all schools, can have algebra competence; and, as a society, educators are obligated by the ideals of democracy to offer all students an algebra course that is rigorous, important, and accessible. Traditional algebra classes have been unsuccessful in this regard.

"Whose ideas count?" was the subject of a 1994 study at the University of Nebraska that examines the dilemma facing secondary mathematics teachers working to change the nature of the high school mathematics experience for urban students. It emphasizes the struggle for educational equity for all students, with a particular concern to increase math, science, and technology accessibility for young women and students of color. Since 1989, the process of mathematics education reform has included recognition of the need for a more student-centered learning environment, a focus on developing students' abilities as problem solvers, and the need for students to demonstrate critical thinking as central components of the learning of mathematics. There remains an ongoing struggle to redefine the specific mathematics content that high school students should study in the 21st century (Thorpe, 1989).

The transformation of the traditional algebra curriculum into a comprehensive curriculum of algebra for everyone in the 21st century is a work in progress. Consensus about the topics to be emphasized and topics to be minimized will not be easily achieved among authors of textbooks, and certainly not among colleagues teaching the same course at a school site or in a school district. Teachers often teach in the manner in which they prefer to learn or have been taught. Professional development that encourages teachers and provides opportunities for teachers to be actively involved in learning about attitudes, instruction, curriculum, and assessment components from a multicultural perspective is therefore a necessity (Lowery, 2003).

Several unresolved questions remain. Among them are: (a) what are the major ideas from algebra that all students should know, (b) are there topics that technology has made obsolete, (c) has algebra itself become another kind of barrier for some segments of the population, (d) what special problems arise for implementing algebra in middle school, (e) what changes are necessary in teacher preparation if algebra is to be a K-12 commitment (NCTM, 2000a).

On the other hand, critics ask whether educators can claim to offer an opportunity through coercion. Are they tolerating, perhaps even encouraging, courses that bear little resemblance to what was previously accepted as algebra? When students achieve a grade on a transcript and then find themselves unprepared for college-level work, is the reality a practice bordering on fraud and scarcely representing equal opportunity?

The frequently asked question, "If mathematics beyond arithmetic is so important, why have many adults been able to get along without it?" elicits a variety of responses. Many adults avoid mathematics whenever they can and go through life much like people who go to a foreign country but do not know enough of the language to converse with native speakers. Educators counter that such folks get along, but do not appreciate the richness of the culture and, more significantly, may not even know what they miss. A person can live without algebra, but will not appreciate the reality of mathematics in his world to the same degree as one who is trained in at least the fundamentals of algebra will appreciate that same world. One might not be eligible for a specific job or training program or be able to take particular courses, or even be able to participate fully in today's technological society.

Lacking the fundamentals of algebra, one may be less in control over her/his life than others who have the required knowledge. While all will live in the same world, some will not see or understand as much of its beauty, structure, and mystery. Quite possibly, some may not even have as much fun (Usiskin, 1995).

Steen (1992), in the article, "*Does Everybody Need to Study Algebra*?" references the theme of the Standards, mathematical power for all students, and its implication that each student may grow throughout each school year in the ability to perform effectively in a variety of authentic settings, rich with detail, surrounded by ambiguity, and embedded in a context that is both realistic and significant. This is the essence of outcome-based performance assessment. It is the educational equivalent of what the business world calls the bottom line.

Students' progress toward the goal of mathematical power is rarely, if ever, uniform. Students are very different; their interests and preoccupations shift unpredictably. Ludholz, in "*The Transition from Arithmetic to Algebra,*" suggests that all students should be able to master algebra; it is a question of pacing that may vary from student to student" (as cited in Moses, 1999). To achieve the desired outcome of mathematical power for all students within the reality of real students in real schools, mathematics educators must be prepared to abandon the rigid curricular structures that treat all students as if they were alike. The lock-step approach of the traditional required courses continues to provide effective mathematics education only for the few who are independently motivated and will learn under most any conditions.

The NCTM standards are embedded in educational research that shows the personal nature of mathematical knowledge; each student's mathematical insight is developed as he or she engages the material and uses it in productive ways. Context, community, and connections make such engagement productive. Thus all students, not just the gifted, can and should benefit from the rich environment of open-ended problems, group problems, active discussion, and multidimensional learning.

It is clearly stated in the NCTM (1985) publications, "The type of mathematics instruction that involves students actively and intellectually requires much from the teacher" (p. 13). Using activities focused on ideas as well as procedures, teachers can open the door to a new conception of mathematics that allows students to internalize and take ownership of the mathematics they are studying. When students' conceptions about mathematics expand to include an understanding of the ideas, their expectations and goals in the classroom change. They begin to see mathematics as a discipline generated by human thought, discovery, and invention. Through continued experience with exploration, questioning, conjecture, and experimentation, students can evolve into good problem solvers who appreciate the beauty of mathematics (NCTM, 1994).

Alan Schoenfeld in *Mathematical Problem Solving* says that school districts, through well-planned professional development, can make certain that teachers are in an environment that does not allow them to fall back into the familiar processes of recording and memorizing (Schoenfeld, 1985). Teachers need to acquire subject-matter knowledge and to acquire it in ways that will be usable in practice. A teacher needs to study mathematics by working at the intersection of good curriculum materials and student responses to those materials (Darling-Hammond, 1994; Lampert, 1998).

In an era of mathematics education reform, one must be mindful that new wine is not successfully poured into old wine skins. Teachers' knowledge, attitudes, and conceptions, as well as the learning environment, need to be adjusted to accommodate the new focus on mathematics content. Heaton (2000) made clear that making changes in the practice of teaching would involve more than the intellectual challenge of subject matter. Using Heaton's imagery of the dance, dancing the dance might actually challenge a teacher's identity as a teacher as he/she would be required to observe others and be observed. Teaching and learning is no longer to be viewed as a lone, silent practice (Heaton, 2000). Students' learning of mathematics is enhanced in a learning environment that is built as a community of people collaborating to make sense of mathematical ideas (NCTM, 1989).

Computer-Assisted Technology as it Supports Learning

The introduction of the Teaching Machine by B.F. Skinner in 1954 prefigured the 21st century use of technology in the classroom (Skinner, 1954). Skinner's critics claimed his teaching machine would replace the teacher. There are those today who criticize the use of technology in education. NCTM maintains the position that technology is an essential tool for teaching and learning mathematics effectively, one that extends the mathematics that can be taught and enhances students' learning (NCTM, 2003). Technology is playing an increasingly important role in the teaching and learning of mathematics at all levels according to the Technology-Supported Mathematics Learning Environments Sixty-seventh Yearbook (NCTM, 2005).

Teacher characteristics and teacher expectations of student ability and student achievement have a strong effect on students' mathematical confidence. That confidence, in turn, is a key determinant of students' success or failure in school mathematics. How teachers within a school view technology also clearly influences the success of any educational technology program. The most challenging aspect of creating a digital environment is the integration of technology into the teaching of the academic subjects. Effective integration requires extensive teacher training, a shift in pedagogy, and a reinvention of the classroom process (Schiff & Solomon, 1999).

Computer-assisted technology, as it supports learning, includes the definition of a digital environment, how research supports computer-assisted technology, and teacher attitudes toward computer-assisted technology. A digital environment extends the boundaries of learning from the classroom to the computer lab, to the library, and even to the home. A digital environment promotes experiential learning that integrates learning with the real world, and the predominant source of content then shifts from the teacher and textbook to a variety of other sources. In the digital environment, individualization and student choice acquire new dimensions (Relan & Gillani, 1997).

"Constructivist" teachers are more likely to encourage, even require, students to use new technology, and consequently, there is the need to convince "traditional" teachers of the value, that through the use of effective strategies for teacher growth and support that include professional growth programs, students can be effectively engaged in the study of mathematics through the incorporation of technology in the classroom. Professional growth programs would include curriculum development, technology coaches, mentors, on-the-spot help available in minutes, school visits, conferences. The California Math Council (CMC), NCTM, Computer Using

Educators (CUE), and the online learning opportunities through the California teachers' network (CTAP) provide many such opportunities for professional growth.

Technology has the potential to help students develop diverse skills from the basics to higher-order thinking. However, to be truly successful, schools need to maximize the effectiveness of their investment in technology by using it in a variety of ways. Effective technology requires research and best practices to match technology software to the curriculum and the developmental needs of learners; to customize content area learning; to enrich learning experiences with communications and links to others beyond the school walls; to offer new learning opportunities; and to help learners see the value of learning by applying knowledge and skills to real-world tasks.

The extent to which teachers are trained to use computers to support learning plays a role in determining whether technology has a positive impact on student achievement. The success, or failure, of technology requires teachers to view technology as a valuable resource and to determine where and when it can have the highest payoff, and then to match the design of the application with the intended purpose and learning goals. Moursand (2001) states that the combination of mind and the computer system provides both information to be learned and feedback to be acquired during the learning process. This is consistent with such learning theory that supports placement of the learner in a rich, real-world, problem-solving environment. Computers are a valuable component of such a learning environment (Moursand, 2001). The use of multiple representations, graphs, tables, algebra, natural language, Venn diagrams, bar graphs, and other teaching aides linked within a software program, bring variety to the classroom and allow students to initiate their investigation with the representation of their choice (Borba, 1994).

Computers in the classroom may be seen as a way to connect students' lives in school with their lives outside school, as video games, interactive-TV, and computer games become increasingly popular. Professor Papert expresses additional support with her statement, "Today's kids bring a new culture to the family landscape. Children understand computers because they can control them. They love them because they can make their own windows of interest (Negroponte, as cited in Papert, 1998).

Attention tends to lapse 15 minutes into a lecture (Middlendorf, 1996), so it is desirable for teachers to re-engage student interest at regular intervals with active and collaborative learning experiences that help to diminish student attention lag and to enhance learning. This is one clear advantage of computer-assisted instruction. However, computer tools are only one piece of a design package consisting of many elements that must act together to engage students in the task of learning and to make learning both interesting and entertaining. A school can have the best software ever made and access to the web on every computer, but experts say it will not see much difference in student learning unless its teachers know how to use the digital content in their classrooms. Most teachers spend considerable time adjusting the curriculum to be compatible with the needs of their students. It is likely that even the teachers who are enthusiastic about using technology run into difficulties balancing the time spent teaching academic content with the time necessary for their students to learn the necessary technical skills for such technology enrichment.

A statistical analysis of problem-solving ability demonstrated that experimental groups using problem-solving software demonstrated significantly better performance on standardized tests of mathematics content. While cognitive science offers a definition, instrumentation, and pedagogy for the development of problem-solving ability, available computer software suggests a mean of implementing all three. The use of computer-augmented mathematics instruction may have significant positive side effects on content performance in mathematics classes. Rather than diminishing student achievement in traditional coursework, activities related to problem-solving software appear to enhance student performance on standardized tests of mathematics content (Liu, Reed, & Phillips, 1992).

As a result of his dissertation research in 2001, Rivet reports that in spite of variability in performance in individual type of fraction operations, the overall improvement scores were significantly greater in computer-assisted classrooms than in the traditional classrooms. He further notes that students in computer-assisted classrooms performed better than those in traditional classroom. The replication of this pattern across two schools strengthens the evidence in support of his hypothesis (Rivet, 2001).

The 1989 NCTM document suggests providing students with experiences that prepare them to appreciate the importance of mathematics as a discipline. Teachers must facilitate alternate learning experiences that foster positive attitudes in their students, first about themselves as students of mathematics and then about mathematics as a subject. Students who use problem-solving software tend to develop a more positive view of their own mathematical abilities and a more positive disposition toward mathematics as a subject. The use of software appears to enhance both content mastery and problem-solving ability to a significant degree (Liu et al., 1992).

What impact has computer technology had on public education in the United States? That is the question journalist Todd Oppenheimer set out to answer in *"The Flickering Mind."* Contrary to opinions of others previously stated in this review, Oppenheimer concludes that putting computers in the classrooms has been almost entirely wasteful, and the rush to keep schools up-to-date with the latest technology has been largely pointless. "While the technology business is creatively frantic, financially strapped public schools cannot afford to keep up with the innovations" (Blaisdell, 2003). Oppenheimer recalls that this is not the first time schools in the United States have been seduced by new technology. He charges further that, despite technology's lack of success in classrooms in the United States, many Americans still prefer to invest in computers rather than in teachers. On the other hand, Oppenheimer cites Seymour Papert, a computer-science professor at the Massachusetts Institute of Technology, who beats the drum for more technology and urges a revolutionalized concept of school. "School has probably changed less than other major institutions," says Professor Papert. "The evidence that we got it right in school and got it wrong everywhere else is pretty slight." While Papert's argument is at least debatable, Oppenheimer leaves any serious discussion of it behind to focus on the regrettable role of those he sees as charlatans in the computer and testing industries.

Role of the Teacher as a Change Agent Particularly when Implementing Computer-Assisted Technology

The most challenging part of any change effort subsequent to its design is confronting the inevitable opposition. Change agents, especially fellow teachers, must have a strategy for winning people over, or they cannot implement their programs. The change factor of human dynamics is both complex and compelling as resistance can have many faces. Often there is some hostility, but rarely is it openly confrontational. Usually, resistance is passive-aggressive, it is far more underground: people hear your words but do not listen to the message and therefore avoid change.

Fullan, recognized as an international authority on educational reform, in his 2001 book *Leading in a Culture of Change* calls the transformation of culture *reculturing* and declares that reculturing is a contact sport that involves hard, labor-intensive work that takes time and never ends. He reminds teacher-leaders that their role is to pull rather than to push their colleagues along. He advises teacher-leaders to recruit supporters and invest time in building relationships, making clear their willingness to listen and respond to criticism. Fullan also encourages teacher-leaders to accept and learn from resistance, not to automatically oppose it (Fullan, 1993).

How mathematics teachers move from principles to practice to create and sustain meaningful change is not easily determined, and it appears that the teacher as change agent acts as the catalyst in creating the bridge between policy and implementation. Ideally, the definition of how to build this bridge would generate from the school acting as the professional learning community in which teacher teams become the fundamental unit for implementing change that is designed to create equity and access for all students. Future leadership will need to reflect a process that pursues a shared vision while developing people rather than programs. As Joseph Rost (1993) states in *Leadership for the Twenty-First Century*, "The industrial paradigm of leadership reflects the leadership of the past" (p. 28). Tomorrow's educational leader will need to focus on developing people to their full potential, rather than on the traditional industrial model of leader knows best.

Sergiovanni (2000) observed, "The institutional leader then, is primarily an expert in the promotion and protection of values" (p. 3). These words suggest that the educator's role has shifted from bureaucratic authority, leading change by telling and selling, to a leadership style of a commitment to shared values determined by a "collaborative, co-creative process" (Senge, 1990, p. 314). This further supports Sergiovanni's references to a professional or moral authority culture.

In her book, *Using Data/Getting Results,* Nancy Love discusses the process necessary to build a professional learning community with teachers who work in a collaborative way to improve student learning (Love, 2002). She maintains that the power of using data collaboratively lies in a process that gives all faculty a clear view of where they are headed and why. The reasons for change should be based on the student needs identified through the lens of student work. In such a community, all teachers would participate in professional development and dialogue about students' learning data, and collaboratively identify areas for improvement. Working together, teachers would have the opportunity to share their practices and experiences with colleagues involved in the same process. It would be inconsistent, and therefore not acceptable, in such a learning community for one teacher to teach competently in concert with other teachers who struggle.

Sergiovanni (2000) supported Woks' thoughts about capacity building. "Building capacity among teachers and focusing that capacity on students and their learning is a critical factor. Continuous capacity building and continuous focusing is best done within communities of practice" (p. 140). These words create an image of leadership that develops the capacity of teachers as the teachers themselves develop the capacity of their students.

Tomorrow's leaders must celebrate success while they perpetuate discontent with the status quo and must be strong leaders who empower others. The ultimate paradox occurs when educators abandon positional authority as they assume the moral authority of shared values that continually develops commitment and purpose in the school; the role of the teacher then transcends the classroom to new forms of collaboration as teaching and learning of, and by, all students becomes the focus for all adults in the school. The "power" of the professional learning community will lie in the ability of the leadership base to create a culture that broadens the "teacher as leader" idea (Kanold, personal communication, April 9, 2003).

Fullan (1995) provides further insight into the future practices of teachers as change agents. "The goal is to engage the majority of teachers in creating collaborative work cultures by deepening the focus on inquiry, assessment, teacher interaction and sharing and continuous problem solving" (pp. 9-10). The result of gaining greater equity and access for all students will be evident for generations to come.

Research on *Destination Math*

In his 2001 doctoral dissertation, Rivet studied the effect of using computer-assisted technology versus traditional instruction to teach 6^{th} grade students fractions. His sample included two groups of approximately thirty students in two different schools in the Desert Sands Unified School District in Palm Desert, California. Rivet used a 30-question pre-test/post-test. Two of the four groups were considered control groups. He used the fraction modules in the computer software program *Destination Math* as the non-traditional teaching strategy for the study. All students took the pre-test. The treatment group used *Destination Math* twice a week for six weeks. At the end of the unit all students took the post-test. Rivet used analysis of variance, ANOVA, to measure the significance of achievement with or without treatment. Class differences from one school to the other were used as covariates. These results demonstrate the efficacy of *Destination Math* in teaching fractions over a six-week period, but whether it is effective in teaching middle school algebra over an entire academic year remains unclear.

Fitzpatrick (2001) demonstrated that *Destination Math* increased student interest in her study of thirty-two 8^{th} grade pre-algebra students. She hypothesized that computer-assisted technology twice a week for one semester would increase students' interest in mathematics. She further hypothesized that the heightened interest would motivate students to spend additional time on task and result in an increase in achievement in algebra. Fitzpatrick's (2001) findings suggest that the pre-algebra modules from *Destination Math* increased student interest in mathematics.

O'Dwyer (1999) measured the mathematics achievement of 7th grade students pre- and post-treatment with *Destination Math* pre-algebra modules twice a week for ten weeks serving as the treatment to investigate the effects of *Destination Math* with at-risk students. O'Dwyer's study (1999) showed that the at-risk students scored ten points higher than the state average. Riverdeep (2005) reported the results of using *Destination Math* with forty 7th and 8th grade mathematics students every day for one semester. Their SAT-9 test results showed that 1/3 of the lowest achieving students gained sufficient skills to return to their regular classroom following treatment. These findings demonstrate that *Destination Math* can improve standardized test scores with at-risk students.

Together these empirical findings suggest that *Destination Math* may increase short-term learning of fractions (Rivet 2001), may increase interest in math (Fitzpatrick 2001), and may increase standardized test scores among underachieving students (O'Dwyer 1999, Riverdeep 2005). However, whether *Destination Math* can increase course grades among middle school algebra students remains unclear.

Summary of Literature Review

This literature review focused on four major topics: (a) the historical background of algebra for everyone as depicted in the mathematics reform movement embedded in issues of equity and opportunity; (b) the essential components of a comprehensive first-year algebra program; (c) computer-assisted technology as it supports learning; and (d) the role of the teacher as change agent particularly in the implementation of computer-assisted technology as a tool for intervention. Then the literature review included several studies that specifically focused on the use of *Destination Math.*

The next chapter will describe the quantitative and qualitative methodologies used in this study. Separate sections for the quantitative and qualitative methodologies will present the rationale for the choice of methodology, a description of the participants, instruments and materials, procedures, and the design and analysis.

CHAPTER III

METHODOLOGY

Computers and targeted software are increasingly common in the classroom, but the efficacy of computer-aided instruction on student achievement in the middle school algebra classroom remains unclear. The present study used mixed-methodology to determine the efficacy of a designated computer software program on student achievement in a middle school comprehensive first-year algebra program. This chapter includes separate sections for the quantitative and qualitative methodologies. Each section presents the rationale for the choice of methodology followed by a description of the participants, instruments and materials, procedures, and the design and analysis methods used. This chapter ends with a summary of the methods employed in the present study.

The noted educator Linda Darling-Hammond states that the single most important factor in any classroom is the teacher (Darling-Hammond, 1997). It would, therefore, be insufficient to do only a quantitative study of the effect of a computer-assisted software program as an intervention tool implemented by teachers in the classroom. Darling-Hammond's powerful statement suggests that a quantitative study be informed by the credentials, experience and competence of the teachers teaching the concepts studied through the use of those quantitative methods. No matter the quality or quantity of textbooks, support materials, and technology, the decision to use specific coursework materials, such as *Destination Math*, remains the prerogative of the teacher. Therefore, determining teacher opinions in the qualitative portion of the present dissertation was necessary as a supplement to quantitative methods and findings.

Qualitative and quantitative methods have differing strengths and weaknesses. They comprise alternative, but not mutually exclusive, strategies for research. Both qualitative and quantitative data can be collected in the same study (Patton, 1990; Merriam, 1998). With a quantitative approach it is possible to measure the reactions of a large group of participants to a limited set of questions and achieve a broad, generalizable set of findings that are presented succinctly and parsimoniously, while qualitative methods typically produce a large amount of detailed information about a much smaller number of people and cases (Glesne, 1999; Patton, 1990), such as in the present study. These elements were considered complimentary and necessary to achieve the goals of the present study.

Quantitative methodology was used to study Research Question One, "Does greater use of *Destination Math* positively correlate with higher student semester course grades in first-year algebra and with higher standardized test scores after controlling for select demographics and teacher differences?"

Qualitative interview methodology was used to investigate Research Question Two, "(a) Do teachers like the program and find it useful? (b) What specifically do they like about it? (c) What do they consider its advantages? (d) Do teachers believe *Destination Math* will affect student achievement? (e) How do teachers describe the response of students to *Destination Math*? (f) How well do teachers feel they were trained to use the program? (g) What suggestions do teachers have to improve teacher training and the use of *Destination Math*?"

Quantitative Methodology

The quantitative portion of the present study measured student performance in first-year algebra, and the present methodology allowed the researcher to determine the relationship between use of *Destination Math* and algebra outcomes.

Rationale for Choice of Quantitative Methodology

Research Question One asked, "Does greater use of *Destination Math* positively correlate with higher student semester course grades in first-year algebra and with higher standardized test scores after controlling for select demographics and teacher differences?" The primary hypothesis in research question one is that groups who received the greatest amount of treatment with *Destination Math* would achieve significantly higher grades in both first and second semester of first-year algebra. The secondary hypothesis is that groups who received the greatest amount of treatment with *Destination Math* would receive higher standardized test results than students who received a lesser amount of treatment with *Destination Math.*

Answering this research question required quantitative methods. Quantitative methods produce findings by means of statistical procedures (Strauss, 1990). The goal of this inquiry was to make quantitative conclusions based on measured variables and objective thresholds of statistical significance. "The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships" (http://en.wikipedia.org/wiki/Quantitative_research). The present study used numeric measures as data. It included quantitative measures of student performance, and sought to make quantitative conclusions by means of statistical procedures, so it was appropriate to use quantitative methodology to investigate the efficacy of *Destination Math* on student performance.

Participants

Students. Participants were 1452 middle-school algebra students from the Covina-Valley Unified School District that includes three comprehensive high schools, three middle schools, twelve elementary schools, two alternative high schools, and an adult education program. The present study's sample included 1452 of the 1460 students in grades 7 and 8 enrolled in first-year algebra during school years: 2001-2002, 2002-2003, and 2003-2004. The sample included only those students whose permanent records provided a full complement of information regarding demographics, standardized test scores and course grades.

Teachers. Teachers are important here as a quantitative variable because portions of the investigation studied the effects of *Destination Math* above and beyond teacher differences. Participants were six mathematics teachers at the same middle school as the 1452 students introduced in the previous paragraph. Three teachers taught first-year algebra to the participating students while the other three taught the same students their pre-requisite mathematics. All of the mathematics teachers at the targeted middle school used the designated software, *Destination Math*, and all participated in the interview process. All students and teachers used the same first-year algebra textbook, District-generated pacing guides, District-generated end-of-course exams, and State standardized tests.

Quantitative Instruments and Materials

Instruments and materials for the quantitative methodology included the first and second semester course grades given by the teachers, the scores on the California Achievement Test 1SS (CAT1SS), a test of reading ability, score on the California Achievement Test 4SS (CAT4SS), a test of general mathematics ability, and *Destination Math.* Teacher course grades, CAT1SS scores and CAT4SS scores are outcome variables. *Destination Math* was the independent variable, in that participating groups received different amounts of treatment with *Destination Math.*

Student Course Grades. This study measured course grades on a scale from 0 to 12, wherein zero corresponded to a grade of "F" and 12 corresponded to a grade of "A+." Student grades in algebra were acquired for both 1st and 2nd semester course work.

CAT1SS. California Achievement Test 1ss (CAT1SS) is a standardized test of reading ability. It was used as a participant demographic as a surrogate for general intelligence. Student achievement was reported as a raw score.

CAT4SS. California Achievement Test 4 (CAT4SS) is a standardized test measuring general mathematics skills, not the skills peculiar to those mastered in a first year algebra course. CAT4SS data were reported as a raw score.

Destination Math. Destination Math is a comprehensive K-12 mathematics curriculum with objectives that align to state and national mathematics standards. The presentation is engaging and mathematically sound (Riverdeep, 1999; 2000). The software provides helpful hints and humor that engage student interest and keep students on task. *Destination Math* is designed for multiple uses including; (1) use in the classroom for whole class instruction, (2) use in a school computer lab for individual use by students, and (3) for use by teachers and students at home (at the discretion of the school). *Destination Math* focuses on mastering skills and concepts and on their application in solving meaningful problems (Riverdeep, 1999; 2000). The software gives students an opportunity to engage in open-ended interactivities that include animation and graphics. Individual sessions include a lesson, workout, and practice questions. *Destination Math* provides students with explanatory feedback after each interactivity or question, and is easily correlated to topics taught in major textbooks (Riverdeep, 2000).

Quantitative Procedures

Data Acquisition. All student data including demographics, standardized test scores and course grades were downloaded from ARIES, the Covina-Valley Unified School District's student tracking system. The Director of Research and Program Evaluation in the C-VUSD facilitated the transfer of the data from the Technology System Services (TSS) to the researcher via a compact disc (CD).

Data Management. Quantitative data were transferred from EXCEL (Microsoft Corp., Redmond, WA.) into SPSS, Statistical Package for the Social Sciences, (Chicago, Inc. Chicago, IL.). SPSS is a statistical software package subsequently used for data management and analysis. All quantitative data and their analyses were backed up electronically in multiple locations, on the hard drives and on compact discs.

Quantitative Design and Analysis

The present study employed a quasi-experimental design, in that there was a controlled experimental manipulation, but participants were not randomly assigned to treatment groups (Campbell & Stanley 1963). Groups Y02, Y03, and Y04 were exposed to differing amounts of the computer assisted software, *Destination Math,* with Y02 receiving the least amount and Y04 receiving the greatest amount. To test the primary hypothesis of the present study, "Is greater use of *Destination Math* associated with higher student semester course grades and standardized test scores in first-year algebra, after controlling for select demographics and teacher differences, one-way analysis of variance (ANOVA) was used, followed by a pairwise comparisons to localize effects (Howell 1997, Keppel 1991). Pairwise comparisons underwent Bonferroni correction to correct for multiple comparisons (Howell 1997, Keppel 1991). Analysis of covariance (ANCOVA) was used to determine whether the effects were evident after demographic variables and teacher differences were statistically removed from the comparison of interest (Howell 1997, Keppel 1991). The data are expressed as means and standard deviations (SD) unless otherwise noted (Tukey 1977), and differences in demographics were determined using Chi-Square statistic (Howell 1997, Keppel 1991). The demographic data are expressed as frequencies and percentages (Tukey 1977). Exploratory analyses were conducted using multiple regression (Howell 1997, Keppel 1991), and all differences were considered statistically significant at $p < .05$ (Howell 1997, Keppel 1991, Tukey 1977).

Qualitative Methodology

Research question two of the present study focused on teacher perceptions of *Destination Math* including (a) Do teachers like the program and find it useful? (b) What specifically do they like about it? (c) What do they consider its advantages? (d) Do teachers believe *Destination Math* will affect student achievement? (e) How do teachers describe the response of students to *Destination Math*? (f) How well do teachers feel they were trained to use the program? (g) What suggestions do teachers have to improve teacher training and the use of *Destination Math*?

Qualitative methodology, in the form of guided interviews with teachers, was conducted to supplement the quantitative methodology. By interviewing teachers who actually teach algebra and who use the *Destination Math* software, it was thought that it could be determined whether the software is teacher-friendly and practical. Both qualitative and quantitative data can be collected in the same study (Patton, 1990).

Rationale for Choice of Qualitative Methodology

Qualitative research seeks to understand the meaning people have constructed (Merriam, 1998). Qualitative research "implies a direct concern with experience as it is 'lived' or 'felt' or 'undergone'" (Sherman and Webb, 1988, p. 7). Qualitative research is, "any kind of research that produces findings not obtained by means of statistical procedures" (Strauss, 1990, p. 17-18). "The essence of good qualitative research is a good thorough, yet sensitive and creative approach to interviewing respondents, and analyzing and interpreting what they say, in a way which is relevant to the research brief" (Robson & Foster, 1989, p. 14).

Participants

Participants were six mathematics teachers at Sierra Vista Middle School, the same middle school where the quantitative data were acquired. Three taught first-year algebra to the participating students while the other three taught the same students their pre-requisite mathematics. All of the mathematics teachers at the targeted middle school used the designated software, *Destination Math*, and all participated in the interview process. All students and teachers used the same first-year algebra textbook, District-generated pacing guides, District-generated end-of-course exams, and State standardized tests.

The present study used interview methodology, a common means of collecting qualitative data, to learn from the participants those things that could not be directly observed, such as their feelings, thoughts, and intentions (Kvale, 1996; Merriam, 1998; Patton, 1990; Spradley, 1979). Interview methodology was chosen over other qualitative methods such as survey methodology, document analysis methodology, direct behavioral observation methodology, and focus group methodology because the present investigation sought complete answers to questions which cannot be obtained using survey techniques, direct behavioral observation or document analysis (Libarkin, 2002; Patton, 1990; Strauss & Corbin, 1990). Further, the interview ensures that the targeted interviewee is the respondent, which cannot be ensured using surveys (Libarkin, 2002, Strauss & Corbin, 1990). Those interviewed in the present study were a small, targeted group at the same school and each was a mathematics teacher who used the software, which was an advantage over focus groups selected from the general population in determining the usefulness of the software for teaching middle-school algebra (Libarkin, 2002, Strauss & Corbin, 1990). For these reasons, interview methodology was preferable to survey, document analysis, direct behavioral observation, and focus group methodologies as the appropriate qualitative methodology to achieve the goals of the present study.

Qualitative Instruments and Materials

Interview. Qualitative data were acquired using interview methodology suggested by Patton (1990). The qualitative interview data were gathered using a semi-structured interview methodology in a cross-sectional observational design. The present study combined an interview guide approach (Patton, 1990), supplemented with open-ended interview questions (Guba & Lincoln, 1981; Patton, 1990). The interview guide served as a basic checklist during the interview to be certain that all relevant topics were covered, and to ensure that all respondents had an opportunity to respond to the same questions (Guba & Lincoln, 1981; Patton, 1990). This general interview guide approach involved outlining a set of issues to be explored with each respondent before interviewing began (Patton, 1990). At the end of the survey, participants were asked open-ended questions so that they could express any thoughts or feelings that were not covered by the interview guide (Guba & Lincoln, 1981; Patton, 1990). This combination of guided interview and open-ended questions provided "flexibility, insight, and ability to build on tacit knowledge that is the peculiar province of the human instrument" (Guba and Lincoln, 1981, p. 113). This flexibility allowed for systematic information, while remaining sensitive to other areas of interest suggested by the participants (Guba and Lincoln, 1981; Merriam, 1998; Patton, 1990).

The interview instrument used to acquire qualitative data in the present study was a series of seventeen questions. The researcher used previously prepared questions to ensure that all respondents had an opportunity to respond to the same questions. The first three questions asked for factual information related to the participating teachers' credentials and years of experience. The next fourteen questions were open-ended questions that centered around five main themes including (a) teacher qualifications, (b) technical training and support, (c) effectiveness of *Destination Math*, the computer-assisted software, (d) the role of the teacher, and (e) teacher perceptions. At the end of the interview, participants were asked open-ended questions so that they could express any thoughts or feelings that were not covered by the interview guide. The interview questions are displayed in Appendix C. The qualitative interview data were gathered using a semi-structured interview methodology in a cross-sectional observational design. Interview methodology was chosen over direct observation because the present research sought to discover teacher preferences. Interview methodology was chosen over the survey because the present research sought complete answers to inquiry. The interview affords data-gathering a professional ambiance and assures that the intended respondent is the actual respondent. A similar level of assurance is not necessarily achieved in the survey. Interview methodology allows for control of the environment during data gathering, and can bring a depth and richness to data gathering not possible with either the survey or direct observation techniques. The guided interview technique was chosen over the structured interview and the open-ended interview because the research inquiry was narrow in scope and the goal was to keep participants on task.

The present study was interested in teacher attitudes and feelings. Data gathered during the guided interview were tape-recorded to ensure their accuracy when presented for analysis. Respondents were given written verbatim transcripts of her/his interview. Each was encouraged to make any changes necessary to ensure that the written response was the intended response.

Qualitative Procedures

Recruitment of Teachers. In fall of 2002, prospective respondents were invited personally and by letter to participate in the present study. All teachers who were invited to participate accepted the invitation; however, one teacher accepted under the condition that the interview not be recorded.

Prior to each interview the researcher talked in person with each respondent to introduce the study, to determine the willingness of the respondent to participate, and to schedule a convenient time for the interview.

Interviews were conducted in December 2002, following receipt of approval from the University of San Diego's Committee on the Protection of Human Subjects. The application for Institutional Review Board approval is found on page iii. Informed consent was acquired for each participant. Appendix A contains the informed consent form.

Data Acquisition. Data were acquired from the transcribed responses to the tape-recorded interviews. Interviews were held with teachers in a familiar, comfortable setting at their own school site. Teachers were met at the door of the conference room and invited to join the interviewer at the table. Chairs were arranged at right angles and the tape recorder was on the table equidistant from the teacher and the interviewer.

Following the initial friendly conversation, the purpose of the study was explained and permission to record was re-confirmed. With one exception all the teachers agreed to be recorded. Handwritten notes were taken during that non-recorded interview.

Teachers were reassured that pseudonyms would be used to assure the confidentiality of their participation and responses. They were reminded that they would be provided a written transcript for their clarification and amendment. The tape recorder was checked and a voice test conducted.

The interview protocol began with questions regarding the teacher's credentials and experience, and then explored the teacher's experience with, and expectations of, the computer-assisted software, *Destination Math.* From previous experience working together on curriculum development and textbook selection a degree of rapport had been established among participants and interviewer. That may have significantly reduced the likelihood of unwarranted tension developing during the interview. At the conclusion of the interview teachers were thanked for their participation and were asked to sign the consent form.

Within the week following the interviews teachers were again thanked on the telephone for their participation. Arrangements were made to transcribe the taped dialogues. Each teacher was then personally given the transcript of her/his interview and asked to clarify or amend the transcript as needed.

Qualitative Design & Analysis

The present study employed a cross-sectional design in that the participants were addressed at a single moment in their lives (Campbell & Stanley 1963). Cross-sectional research involves the measurement of all variable(s) for all cases within a narrow time span so that the measurements may be viewed as contemporaneous (Creswell, 1998).

A semi-guided interview technique was used. Teacher responses to the interview questions were coded according to these five categories: (a) teacher qualifications, (b) training and support, (c) effectiveness of Destination Math, (d) the role of the teacher, and (e) teacher perceptions. Then the written transcripts were used to identify and extract similarities and differences among the teachers' responses to the seventeen interview questions. Qualitative findings are presented in Chapter V, Presentation And Analysis Of Qualitative Data

Summary of Chapter III

To determine whether or not the algebra software "worked", three groups of first-year middle school algebra students were exposed to differing amounts of *Destination Math.* Algebra course grades and standardized statewide test scores were measured for each student, along with demographic information. This quantitative methodology allowed for statistical comparisons to be made between clearly defined groups, so that the effect of the "treatment" could be assessed using well-accepted quantitative measures of student performance and quantitative thresholds for determining statistically significant differences.

The qualitative portion of the present study, to interview teachers who use the software, was necessary because the efficacy of the software to confer benefit has little meaning if teachers are not willing to use this tool. That is, for *Destination Math* to be considered useful, it must be demonstrated that student performance improves and that teachers "like" to use this tool. The qualitative interview methodology employed in the present study was specifically designed to acquire vital insight from teachers who actually use the software in their classrooms.

Results for the quantitative analyses are presented in Chapter IV. To supplement quantitative findings, and to determine whether *Destination Math* is perceived to be beneficial by teachers, the results of the qualitative portion of this dissertation are presented in Chapter V.

CHAPTER IV

QUANTITATIVE RESULTS

This chapter addresses research question one, the quantitative research question, "Does greater use of *Destination Math* positively correlate with higher student semester course grades in first-year algebra and with higher standardized test scores after controlling for select demographics and teacher differences?" The primary purpose of the present study was to examine the efficacy of the technology-based program, *Destination Math,* as an intervention tool to increase the success rate for students in first-year algebra. Efficacy was determined by measuring the extent to which student end-of-course grades and standardized test scores were a function of demographics, ability, teacher differences and the use of *Destination Math.*

Does treatment work? During the years 2002, 2003, and 2004 (Y02, Y03, and Y04) respectively, participants received differing amounts of the *Destination Math,* with the Y04 group receiving more *Destination Math* than Y02 or Y03. Therefore, the increase in level of treatment given students in Y04 should result in students earning higher course grades than Y02 or Y03 groups.

This chapter begins with participant descriptives, including gender, grade level, parent education, participation in the GATE program, disability, ethnicity, subsidized lunch, and home language. Teacher differences and participant performance on a statewide standardized test follow. The findings from the primary hypothesis are provided for both first semester and second semester algebra course grades. Findings from the secondary hypothesis relate to student achievement on a statewide mathematics test. The exploratory analyses utilize multiple regression to investigate whether demographics can account for the variance in algebra grade outcomes, and explores whether teacher differences can account for the major findings. This chapter ends with a summary of major findings.

Participant Demographic Descriptives

Gender of Participants

Of the 1452 participants, 771 (53.1%) were female and 681 (46.9%) were male. This pattern was similar across Y02, Y03, and Y04 groups. The Y02 group included 280 (52.3 %) girls and 255 (47.7 %) boys, the Y03 group included 241 (52.9%) girls and 215 (47.1%) boys, and the Y04 group included 250 (54.2%) girls and 211 (45.8%) boys. Chi-square revealed no statistical significance in the distribution of participant gender across groups, (Chi-square ($df = 2$) = 0.4, $p = .83$). The gender of participants by group is displayed in Appendix D.

Grade Level of Participants

Of the 1452 participants, 876 (60.3%) were in grade 7 and 576 (39.7%) were in grade 8 at the time they took algebra. This pattern was similar across Y02, Y03, and Y04 groups. The Y02 group included 322 (60.2%) students in grade 7 and 213 (36.9%) students in grade 8. The Y03 group included 265 (58.1%) students in grade 7 and 191 (41.9%) students in grade 8. The Y04 group included 288 (62.6%) students in grade 7 and 172 (37.4%) students in grade 8. Chi-square revealed no statistical significance in the distribution of participant grade level across groups, (Chi-square (df = 2) = 1.94, p = .38). The grade level of participants by group is displayed in Appendix E.

Level of Parent Education

Of the 1449 participants who chose to provide parent education information, 323 (22.3%) parents had high school as their highest level of education, 515 (35.5%) parents had some college experience, 381 (26.2%) parents had college degrees, and 230 (15.8%) parents had an education beyond a first college degree. This pattern of parent education was similar across the Y02, Y03, and Y04 groups. In the Y02 group, 119 (22.2%) parents had a high school education, 195 (36.4%) had some college, 137 (25.6%) had college degrees, and 84 (15.7%) exceeded a college degree. In the Y03 group, 102 (22.4%) parents had a high school education, 16 (36.2%) had some college, 115 (25.2%) had college degrees, and 74 (16.2%) exceeded a college degree. In the Y04 group, 102 (22.3%) parents had a high school education, 155 (33.8%) had some college, 129 (28.2%) had a college degree, and 72 (15.7%) exceeded a college degree. Chi-square revealed no statistical significance in the distribution of participant level of parent education across groups, (Chi-Square (df = 6) = 1.51, p = .96). The level of parent education of participants by group is displayed in Appendix F.

Gifted and Talented Education (GATE)

Of the 1452 participants, 79 (5.4%) were identified as GATE and were in the program, 1372 (94%) were not identified as GATE and were not in the program, and 9 (0.6%) were identified as GATE but were not in the program. This pattern was similar across Y02, Y03, and Y04 groups. In the Y02 group, 27 (5.0%) were identified as GATE and in the program, 512 (94.6%) were not identified as GATE and not in the program, and 2 (0.4%) were identified as GATE but not in the program. In the Y03 group, 23 (5.0%) were identified as GATE and in the program, 433 (94.5%) were not identified as GATE and not in the program, and 2 (0.4%) were identified as GATE but not in the program. In the Y04 group, 29 (6.3%) were identified as GATE and in the program, 427 (92.6%) were not identified as GATE and not in the program, and 5 (1.1%) were identified as GATE but not in the program. Chi-square revealed no statistical significance in the distribution of participant GATE program status across groups, (Chi-square (df = 4) = 3.4, p =.50). The GATE status of participants by group is displayed in Appendix G.

Disability

Of the 1452 participants, 1428 (98.4%) had no disability, 13 (0.90%) had a specific learning disability, 11 (0.8%) were deaf or hard of hearing, 6 (0.4%) had a language disability, and 1 (0.1%) was autistic. This pattern was well spread across the YO2, Y03, and Y04 groups in all categories. In the Y02 group, 4 (0.8%) had a specific learning disability, 4 (0.8%) were deaf or hard of hearing, and 4 (0.8%) had a language disability. In the Y03 group, 4 (0.8%) had a specific learning disability, 4 (0.8%) were deaf or hard of hearing, and 2 (0.1%) had a language disability. In the Y04 group, 5 (0.3%) had a specific learning disability, 3 (0.2%) were deaf or hard of hearing, 1 (0.1%) had a language disability, and 1 (0.1%) was autistic. Chi-square revealed no statistical significance in the distribution of participants with disabilities across groups, (Chi-square (df = 8) = 5.06, p = .75). The disability of participants by group is displayed in Appendix H.

Placement

Of the 1452 participants, 1420 (97.8%) required no special placement, 13 (0.9%) were in regular education classes with RSP, 8 (0.6 %) were DHH in regular education classes, and 11 (0.8%) were in DHH and not in regular education classes. This pattern was similar across Y02, Y03, and Y04 groups. The placement of participants by group is displayed in Appendix I.

In the Y02 group, 1442 (99.3%) received no special placement, 4 (0.3%) were in regular education classes with RSP, 3 (0.3 %) were DHH in regular education classes, and 4 (0.3%) were in DHH and not in regular education classes. In the Y03 group, 144 (99.3%) received no special placement, 4 (0.3%) were in regular education classes with RSP, 3 (0.3 %) were DHH in regular education classes, and 4 (0.3%) were in DHH and not in regular education classes. In the Y04 group, 1443 (99.3%) received no special placement, 5 (0.3%) were in regular education classes with RSP, 2 (0.1%) were DHH in regular education classes, and 5 (0.3%) were in DHH and not in regular education classes. Chi-square revealed no statistical significance in the distribution of participant placement across groups, (Chi-square (df = 4) = 0.54, p= .97).

Subsidized Lunch

Of the 1452 participants, 1075 (74.0%) did not receive subsidized lunch and 377 (26.0%) received subsidized lunch. This pattern was similar across Y02, Y03, and Y04 groups. The lunch status of participants by group is displayed in Appendix J.

In the Y02 group, 401 (75.0%) did not receive subsidized lunch, 134 (25.0%) received subsidized lunch. In the Y03 group, 334 (73.2%) did not receive subsidized lunch, 122 (26.8%) received subsidized lunch. In the Y04 group, 340 (73.8%) did not receive subsidized lunch, 121 (26.2%) received subsidized lunch. Chi-square revealed no statistical significance in the distribution of participant subsidized lunch status across groups, (Chi-Square (df = 2) = 0.40, p = .82).

Home Language

Of the 1452 participants, 1071 (73.9%) spoke English at home, 206 (14.2%) spoke Spanish, 126 (2.8%) spoke Cantonese, Mandarin, Japanese, or Tagalog, 19 spoke Arabic or Farsi, and 30 another non-English language. This pattern was similar across Y02, Y03, and Y04 groups. In the Y02 group, 406 (75.9%) spoke English at home, 70 (13.1%) spoke Spanish, 44 (8.2%) spoke Cantonese, Mandarin, Japanese or Tagalog, 6 (1.1%) spoke Arabic or Farsi, and 4 (0.8%) spoke another non-English language. In the Y03 group, 333 (73.0%) spoke English at home, 64 (14.0%) spoke Spanish, 44 (9.7%) spoke Cantonese, Mandarin, Japanese or Tagalog, 6 (1.3%) spoke Arabic or Farsi, and 4 participants (0.9%) another non-English language. In the Y04 group, 332 (72.8%) spoke English at home, 72 (15.6%) spoke Spanish, 38 (8.2%) spoke Cantonese, Mandarin, Japanese, or Tagalog, 7 (1.5%) spoke Arabic or Farsi, and 6 (1.3%) spoke another non-English language. Chi-square revealed no statistical significance in the distribution of participant language spoken at home across groups, (Chi-square (df = 6) = 3.7, p. = .72). The language spoken in the homes of participants by group is displayed in Appendix K.

Ethnicity

Of the 1444 participants who chose to report ethnicity, 244 (16.9%) were Asian, Pacific Islander, or Filipino, 610 (42.2%) were Hispanic, 69 (4.8%) were

Black, 510 (35.3%) were White, and 13 (0.9%) gave 'other' as their ethnicity. This pattern was similar across Y02, Y03, and Y04 groups. In the Y02 group, 85 (15.9%) were Asian, Pacific Islander or Filipino, 224 (41.9%) were Hispanic, 27 (5.1%) were Black, 195 (36.5%) were White, and 2 (0.4%) were other. In the Y03 group, 83 (18.2%) were Asian, Pacific Islander or Filipino, 194 (42.6%) were Hispanic, 21 (4.6%) were Black, 155 (34.1%) White, and 3 (0.7%) were other. In the Y04 group, 76 (16.6%) were Asian, Pacific Islander or Filipino, 193 (42.1%) were Hispanic, 21 (4.6%) were Black, 160 (34.9%) were White, and 9 (2.0%) were other. Chi-square revealed no statistical significance in the distribution of participant ethnicity across groups, (Chi-square ($df = 14$) = 10.7, $p = .70$). The ethnicity of participants by group is displayed in Appendix L.

Lep/Fep Program LAC

Of the 1452 participants, 1188 (81.8%) participants were English speakers, 264 (18.2%). were distributed within the Lep/Fep (limited emerging English speakers) Program Overall, 21 (1.5%) in structured English immersion, 79 (5.4%) in English language mainstream, and 164 (11%) in another instructional setting. This pattern was similar across Y02, Y03, and Y04 groups. In the Y02 group, 9 (1.7%) were in structured English immersion, 22 (4.1%) were in English language mainstream, and 53 (9.9%) were in another instructional setting. In the Y03 group, 9 (2.0%) were in structured English immersion, 21 (4.6%) were in English language mainstream, and 50 (11.0%) were in another instructional setting. In the Y04 group, 3 (0.7%) were in structured English immersion, 36 (7.8%) were in English language mainstream, and 61 (13.2%) were placed in another instructional setting. When comparing the relative frequencies of structured English immersion, English language mainstream, and another instructional setting across groups, there was no statistically significant disproportionality, (Chi-Square (df = 4) = 7.0, p = .14). The frequency of participant eligibility for Lep/Fep Program LAC across groups is displayed in Appendix M.

Teachers

Of the 1452 participants, 397 (27.3%) had Teacher M, 551 (37.9%) had Teacher N, and 504 (34.7%) had Teacher S (see Appendix M). The pattern of participant assignment to teacher was similar across the Y02, Y03, and Y04 groups. In the Y02 group, 229 (42.8%) had Teacher M, 150 (28.0%) had Teacher N, and 156 (29.2%) had Teacher S. In the Y03 group, 79 (17.3%) had Teacher M, 242 (53.1%) had Teacher N, and 135 (29.6%) had Teacher S. In the Y04 group, 89 (19.3%) had Teacher M, 159 (34.5%) had Teacher N, and 213 (46.2%) had Teacher S. Chi-Square revealed a significant difference in the distribution of teachers across groups, (Chi-Square (df = 4) = 143.0, p < .001) suggesting that teacher differences are a very important variable that needs to be accounted for in the investigation of the effect of *Destination Math* on middle school algebra grades. The distribution of participants by assignment to teacher is displayed in Appendix N. Participant exposure to *Destination Math* is displayed in Appendix O.

CAT1SS

The CAT1SS, a standardized test of reading ability, was used as a surrogate for general intelligence. Groups scored similarly on the CAT1SS. The Y02 group averaged 680.5 (SD = 37.2), The Y03 group averaged 681.5 (SD = 39.9), and the Y04 group averaged 668.1 (SD = 37.3). This difference was not significant by ANOVA, F (2,1449) = 0.1, p = .90. This suggests that groups were similar in intelligence as inferred from reading ability.

Groups scored similarly on the CAT1SS even when parent education was statistically removed from the comparison of interest by ANCOVA, F (2,1448) = 0.30 p = .71. Groups scored similarly on the CAT1SS even when gender, age and reduced lunch status were statistically removed from the comparison of interest by ANCOVA, F (2,1445) = 0.1, p = .93. This finding suggests that groups were similar in CAT1SS scores. CAT1SS score descriptives by group are displayed in Appendix P.

Summary of Participant Demographics

Participants were 1452 middle-school algebra students. Participant gender was well distributed between female (53%) and male (47%) students. Most participants were white (35%), Hispanic (42%), or Asian (16%). Most (80%) were native English speakers. Most spoke English (80%) or Spanish (15%) at home. Roughly 5 percent of students were in the GATE program. Most participants had a parent with a college degree or some college. Few participants (2%) were disabled or required special placement.

Gender, race, language, GATE, parent education, subsidized lunch, and disabilities were represented in similar proportions across the Y02, Y03, and Y04 groups. There were no statistically significant differences between Y02, Y03, and Y04 groups on any demographic variable. This is important, because the present study sought to determine the effects of *Destination Math* between groups who were "seldom exposed" (Y02, n = 541), "occasionally exposed" (Y03, n = 458), and "often exposed" (Y04, n = 461) to *Destination Math* in their classrooms. Because demographic variables were similar between groups, these data were considered adequate to addressing the hypothesis-generated results that follow.

When the data were split according to grade level, the demographics over the 7th grade and 8th grade students remained consistent with those found for the entire group across Y02, Y03, and Y04. There were no statistically significant differences between Y02, Y03, and Y04 groups on any demographic variable when using the split data. This is particularly important because it enhances the present study that sought to determine the effects of *Destination Math* between groups who were "seldom exposed" (Y02, n = 541), "occasionally exposed" (Y03, n = 458), and "often exposed" (Y04, n = 461) to *Destination Math* in their classrooms. The demographic variables were similar between the groups of students who were taking algebra in the 7th grade and those who were taking algebra in the 8th grade. When the CAT1S*S* scores were used as a measure of general intelligence, the scores were distributed similarly across all three groups. Because groups were similar in demography, these data were considered adequate to address the hypothesis-generated results that follow.

Results from Primary, Secondary, and Exploratory Research Questions

This section covers the results from three quantitative questions. The primary quantitative question relates exposure to *Destination Math* to achievement measured in algebra course grades. The secondary quantitative question investigates the relationship between exposure to *Destination Math* and scores on the CAT4SS, a statewide standardized that encompasses general mathematics topics. The exploratory analysis section addresses the relationship between demographic variables and algebra course grades, and explores whether teacher differences could account for the primary findings of the present study.

Results from Research Question One

The primary qualitative research question of the present study asked whether higher exposure to *Destination Math* would result in higher student semester course grades in first-year algebra, after controlling for demographics and teacher differences.

The primary hypothesis of the present study predicted that the group that received the greatest exposure to *Destination Math* (Y04) would perform better in algebra course grades. This question was addressed for both first semester algebra and for second semester algebra in parallel analyses. For each semester, a description of participant grades by group is presented. Next, a statistical comparison of groups to address the research question using ANOVA, followed by additional ANCOVA analyses to determine whether any statistically significant differences remained after demographic and teacher effects were statistically removed from the comparison of interest. For each semester, a summary is provided. Lastly, a summary of overall findings for Research Question One is presented.

First Semester Algebra Grades

In the first semester of algebra, 1452 participants averaged 5.8 (SD = 3.1) on the 12-point grading scale (0 = F, 12 = A+), equivalent to a grade of "C" (see Table

1). Groups YO2 (SD = 3.1) and Y03 (SD = 2.8) both averaged 5.4, equivalent to a grade of C. Group Y04 averaged 6.5 (SD = 3.1), equivalent to a grade of B-. ANOVA revealed a statistically significant difference between groups, $F(2,1427) = 17.9$, $p < .001$.

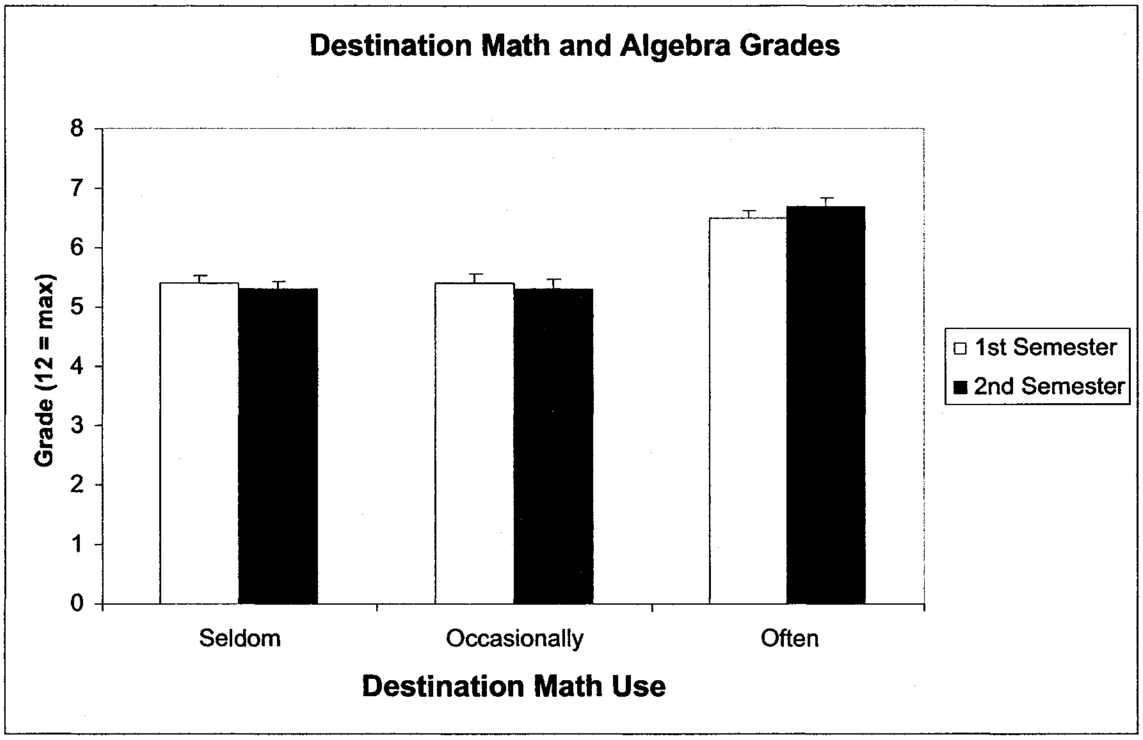
To localize statistical differences between groups, pairwise multiple comparisons test (with Bonferroni correction) revealed that Y04, the group that received the most *Destination Math*, scored significantly higher than Y03 ($p < .001$) and significantly higher than Y02 ($p < .001$), while Y02 and Y03 were not significantly different ($p = .99$). This finding is consistent with the hypothesis that the group that received the most *Destination Math* would score higher in algebra course grades (See Figure 1).

Table 1
First Semester Grade Descriptives by Group

Group	Mean	N	SD	Minimum	Maximum	SEM
Y02	5.4	525	3.1	0	12	0.1
Y03	5.4	449	2.8	0	12	0.1
Y04	6.5	456	3.1	0	11	0.1
Total	5.8	1430	3.1	0	12	0.1

Note: SD = standard deviation. SEM = standard error of the mean.

Figure 1
Destination Math and Algebra Course Grades



Note: bars express mean values. Error bars indicate standard error of the mean.

Destination Math, first semester algebra grades, and parent education. Groups were significantly different in first-semester algebra grades, even when parent education was statistically removed from the comparison of interest by ANCOVA, F (2,1423) = 18.8, $p < .001$. Localizing pairwise comparisons revealed that Y04 grades were significantly higher than Y03 grades ($p < .0004$) and Y02 grades ($p < .001$).

Participant demographics, Destination Math, and first semester algebra grades. Groups were significantly different in first-semester algebra grades, even when the effects of gender, grade (7^{th} or 8^{th}), GATE status, parent education, subsidized lunch status, and a surrogate measure of general intelligence (CAT1SS) were statistically removed from the comparison of interest by ANCOVA, F (2,1416)

= 16.9, $p < .001$. Localizing pairwise comparisons revealed that Y04 grades were significantly higher than Y03 grades ($p < .001$) and Y02 grades ($p < .001$).

Summary of first semester algebra grades. These findings supported the hypothesis that groups that received the greatest exposure to *Destination Math* would receive higher first semester grades in their algebra course. This finding was robust, above any effects of parent education, age, GATE status, subsidized lunch status, gender, and general intelligence demographics. Whether this finding of higher grades for the first semester of algebra with more *Destination Math* exposure was replicated in the second semester is addressed next.

Second Semester Algebra Grades

In the second semester of algebra, 1399 participants averaged 5.7 (SD = 3.2) on the 12-point grading scale (0 = F, 12 = A+), equivalent to a grade of "C" (see Table 2). Group Y04 averaged 6.7 (SD = 2.8), a grade of B-. Groups Y02 (SD = 3.3) and Y03 (SD = 3.3) both averaged 5.3, a grade of C. ANOVA revealed a statistically significant difference between groups, $F(2,1396) = 29.7$, p =. 001. This finding suggests significant differences between groups in second semester algebra grades.

To localize the differences between groups, pairwise multiple comparisons tests (with Bonferroni correction) revealed that Y04 scored significantly higher than Y03 ($p < .0003$) and significantly higher than Y02 ($p < .001$), while Y02 and Y03 were not significantly different ($p = .001$). This finding is consistent with the hypothesis that the group that received a greater exposure to *Destination Math* would receive higher first semester grades in the algebra. (See Figure 1).

Table 2
Second Semester Grade Descriptives by Group

Group	Mean	N	SD	Minimum	Maximum	SEM
Y02	5.3	517	3.3	0	12	0.1
Y03	5.3	441	3.3	0	12	0.2
Y04	6.7	441	2.8	0	11	0.1
Total	5.7	1399	3.2	0	12	0.1

Note: SD = standard deviation. SEM = standard error of the mean.

Destination Math, second semester algebra grades and parent education. Groups were significantly different in second-semester algebra grades, even when parent education was statistically removed from the comparison of interest by ANCOVA, $F(2,1392) = 31.4$ $p < .001$. Localizing pairwise comparisons revealed that Y04 grades were significantly higher than Y03 grades ($p < .001$) and Y02 grades ($p < .001$).

Participant demographics, Destination Math, and second semester algebra grades. Groups were significantly different in second-semester algebra grades, even when the effects of Gender, Grade (7^{th} or 8^{th}), GATE status, Parent Education, subsidized Lunch status, and two surrogate measures of general intelligence (CAT1SS and CAT2SS) were statistically removed from the comparison of interest by ANCOVA, $F(2,1385) = 30.3$, $p < .001$. Localizing pairwise comparisons revealed that Y04 grades were significantly higher than Y03 grades ($p < .001$) and Y02 grades ($p < .001$).

Summary of Destination Math and second semester algebra grades. The group that received the most *Destination Math* (Y04) earned significantly higher second semester algebra grades than the groups receiving lesser treatment. This finding was robust, above any effects of parent education, age, GATE status, subsidized lunch status, gender, and general intelligence demographics. This finding suggests that the group receiving the most *Destination Math* earned higher grades in second semester algebra. This finding for second semester algebra mirrors and replicates the first semester outcome.

Teacher Effects

It is possible that the significant, positive treatment effects seen in algebra course grades in the present study were due to differences between teachers ($n = 3$) or by teacher by treatment interactions. It is important to note that teachers were not evenly distributed across the groups Y02, Y03, and Y04.

A 2 by 2 (teacher by treatment) factorial ANOVA was conducted using 1st semester and 2nd semester course grades as dependent variables in parallel analyses.

1st semester grades. Factorial ANOVA revealed a significant main effect of teacher, $F(2,1421) = 22.6$, $p < .001$, and a significant teacher x treatment interaction $F(4,1421) = 6.1$, $p < .001$. However, including teacher as a factor did not change the significant effect of *Destination Math* treatment, $F(2,1421) = 22.1$, $p < .001$. Bonferroni-corrected pairwise comparisons confirmed that Y04, the group that received the most *Destination Math* treatment, earned significantly higher grades than Y02 ($p < .001$) and Y03 ($p < .001$) groups receiving less *Destination Math* treatment (see Appendix O).

Similarly, the effect of *Destination Math* was statistically significant when the 2 by 2 (teacher by treatment) ANOVA was expanded to include gender, parent education, subsidized lunch, GATE program status, CAT1SS and CAT2SS test scores as surrogates for IQ, and whether the student was in 7^{th} or 8^{th} grade when taking the algebra course as covariates.

The main effect of *Destination Math* remained statistically significant $F(2,1410) = 19.2$, $p < .001$. Bonferroni-corrected pairwise comparisons confirmed that Y04, the group that received the most *Destination Math* treatment, earned significantly higher grades than Y02 ($p < .001$) and Y03 ($p < .001$) groups receiving lesser *Destination Math* treatment.

2nd semester grades. Factorial ANOVA revealed a significant main effect of teacher, $F(2,1390) = 18.5$, $p < .001$, and a significant teacher x treatment interaction $F(4,1390) = 6.1$, $p < .001$. However, including teacher as a factor did not change the significant effect of *Destination Math* treatment, $F(2,1390) = 32.5$, $p < .001$. Bonferroni-corrected pairwise comparisons confirmed that Y04, the group that received the most *Destination Math* treatment, earned significantly higher grades than Y02 ($p < .001$) and Y03 ($p < .001$) groups receiving less *Destination Math* treatment.

Similarly, the effect of *Destination Math* was statistically significant when the 2 by 2 (teacher by treatment) ANOVA was expanded to include gender, parent education, subsidized lunch, GATE program status, CAT1SS and CAT2SS test scores as surrogates for IQ, and whether the student was in 7^{th} or 8^{th} grade when taking the algebra course as covariates. The main effect of *Destination Math* remained statistically significant, $F(2,1379) = 30.5$, $p < .001$. Bonferroni-corrected pairwise comparisons confirmed that Y04, the group that received the most *Destination Math* treatment, earned significantly higher grades than Y02 ($p < .001$) and Y03 ($p < .001$) groups receiving less *Destination Math* treatment.

These findings suggest that teachers varied in their grading, but when the effect of teacher differences in grading were accounted for, and demographics included as covariates, there was still a statistically significant effect of *Destination Math*, such that the group that received the most treatment demonstrated the higher grade achievement. These findings support the primary hypothesis of the present study.

Summary of teacher effects and Destination Math on outcomes. The group that received the highest amount of *Destination Math* earned the highest grades even when the effect of teachers and the effects of teacher x treatment interaction were included in the analyses. Further, this pattern remained statistically significant even when the effects of gender, parent education, subsidized lunch, GATE program status, CAT1SS and CAT2SS test scores as surrogates for IQ, and whether the student was in 7^{th} or 8th grade when taking the algebra course were included in the analyses along with teacher differences. Furthermore, the pattern remained for 1^{st} semester and for 2^{nd} semester algebra course grades. These findings suggest that the positive effects on algebra course grade earned in the Y04 group cannot be attributable to teacher differences or teacher by treatment interactions.

Summary of Research Question One

For both the first semester of algebra and for the second semester of algebra, compared to other groups, the group that received the highest amount of *Destination*

Math earned the highest algebra classroom grades. In both cases, this finding was robust, above any effects of demographics or effects due to differences between teachers. These data support the primary hypothesis of the present study, that compared to groups that received less, the group receiving the most *Destination Math* would achieve significantly higher algebra course grades.

Results from Secondary Quantitative Research Question

The secondary hypothesis of the present study asked whether state-wide mathematics test performance was higher in the group that received the most *Destination Math* compared to groups that received less treatment. This question was analyzed parallel to Research Question One and the presentation is parallel, but briefer. Descriptives are followed by ANOVA to determine whether there may be an effect of treatment, followed by ANCOVA findings to validate that any effects are not attributable to parent education and other demographic variables. This secondary investigation ends with a summary of findings of the effect of *Destination Math* on CAT4SS scores.

CAT4SS

Groups scored similarly on the CAT4SS, a standardized test of mathematics achievement. The Y02 group averaged 696.1 (SD = 41.9), the Y03 group averaged 696.8 (SD =43.5), and the Y04 group averaged 695.1 (SD = 43.4) (see Table 3). This difference was not significant by ANOVA, $F(2,1449) = 0.2$, $p = .83$. This finding did not support the hypothesis that groups would score higher on the CAT4SS with increasing exposure to *Destination Math*.

Table 3
CAT4SS Score Descriptives by Group

Group	Mean	N	SD	Minimum	Maximum	SEM
Y02	696.1	535	41.9	487	850	1.8
Y03	696.8	456	43.5	487	850	2
Y04	695.1	461	43.4	487	850	2
Total	696	1452	42.8	487	850	1.1

Note: SD = standard deviation. SEM = standard error of the mean.

Group CAT4SS and parent education

Groups scored similarly on the CAT4SS even when parent education was statistically removed from the comparison of interest by ANCOVA, $F\ (2,1445) = 0.2$, $p = .78$. This finding does not support the secondary hypothesis.

Group CAT4SS and gender, age, and reduced lunch status

Groups scored similarly on the CAT4SS even when gender, age and reduced lunch status were statistically removed from the comparison of interest by ANCOVA, $F\ (2,1446) < 0.1$, $p = .99$. This finding does not support the secondary hypothesis.

Summary of CAT4SS

Present findings were not consistent with hypothesis that an increase in exposure to *Destination Math* would be associated with higher CAT4SS scores.

Exploratory Analysis: Multiple Regression

The present study primarily sought to determine the efficacy of *Destination Math* on the grades and test scores of middle-school algebra students. However, the present data are also convenient towards exploring what other variables might predict student performance, both on a standardized mathematics test and in the grades received in their algebra course. The purpose of the exploratory analysis was to determine whether any demographic variables might be associated with higher algebra course grades, or associated with higher scores on a state-wide standardized mathematics test.

Multiple regression was conducted for four dependent variables: CAT4SS, the average algebra grade, the first semester algebra grade, and the second semester algebra grade. For each dependent variable, two regression procedures were conducted, either including or excluding CAT1SS and CAT2SS test scores. For each regression, the model of best fit is provided, along with the statistical significance, variance accounted-for (R^2), and the multiple regression equation.

Multiple regression predictor variables included gender, parent education, subsidized lunch, exposure to *Destination Math*, GATE program status, and whether the student was in 7th or 8th grade when taking the algebra course. Findings from the dependent variable of algebra course grades is presented first, followed by presentation of findings using CAT4SS test scores as the dependent variable.

Prediction of CAT4SS

Using the first semester course grade as the dependent variable in multiple regression, a five-factor model was generated:

Equation 1

$$Y = 581.1 + .24 \text{ (parent ed)} + .24 \text{ (GATE)} + .12 \text{ (grade)} + -.01 \text{ (gender)}$$

This relationship was statistically significant, F (4,1443 = 58.1, $p < .0001$. This relationship accounted for 13.9% of the variance (R^2) in yearly course grades. This finding suggests that parent education, gender, and GATE program status may be predictive of performance on (CAT4SS), a standardized test of mathematics achievement. The beta weights in equation 1 suggest that parent education may be the strongest predictor of CAT1SS performance.

Prediction of average algebra grade, including CAT1SS and CAT2SS scores.

Using the first semester course grade as the dependent variable in multiple regression, and including CAT1SS (reading) and CAT2SS (language) scores as predictor variables in the analysis, a five-factor model was generated:

Equation 2

Y = -23.26 + .37 (cat2ss)+ .17 (parent ed) + .13 (gender) + .10 (*Destination Math*) + .08 (*CAT1SS*)

This relationship was statistically significant, $F(5,1424) = 117.7$, $p < .0001$. This relationship accounted for 29.2% of the variance (R^2) in first semester course grades. This finding suggests that CAT1SS and CAT2SS (standardized English tests of reading and language) may be predictive of algebra course grades, in addition to parent education, gender, and exposure to *Destination Math.* The beta weights suggest that CAT2SS and parent education may be the strongest predictors of algebra course grades.

Prediction of Second Semester Algebra Course Grade

Using the second semester course grade as the dependent variable in multiple regression, a four-factor model was generated:

Equation 3

$$Y = 1.14 + .25\ (\text{parent ed}) + .20\ (\text{gender}) + .15\ (\textit{Destination Math}) + .12\ (\text{GATE})$$

This relationship was statistically significant, $F\ (4,1394) = 57.7$, $p < .001$. This relationship accounted for 14.2% of the variance (R^2) in yearly course grades. This finding suggests that parent education, gender, exposure to *Destination Math*, and GATE program status may be predictive of classroom performance in algebra. The beta weights suggest that parent education and gender may be the strongest predictors of grades. Even after controlling for parent education, *Destination Math* remained a significant predictor of grades.

Prediction of Second Semester Grade, Including CAT1SS and CAT2SS Scores. Using the second semester course grade as the dependent variable in multiple regression, and including CAT1SS (reading) and CAT2SS (language) scores as predictor variables in the analysis, a five-factor model was generated:

Equation 4

$$Y = -23.72 + .34\ (\text{cat2ss}) + .16\ (\text{parent ed}) + .15\ (\textit{Destination Math}) + .14\ (\text{gender}) + .08\ (\textit{CAT1SS})$$

This relationship was statistically significant, $F\ (5,1393) = 104.6$, $p < .0001$. This relationship accounted for 27.3% of the variance (R^2) in first semester course grades. This finding suggests that CAT1SS and CAT2SS (standardized English tests of reading and language) may be predictive of algebra course grades, in addition to parent education, gender, and exposure to *Destination Math.* The beta weights in equation 4 suggest that CAT2SS and parent education may be the strongest predictors of algebra course grades. Even after controlling for parent education, *Destination Math* remained a significant predictor of grades.

Prediction of First Semester Algebra Course Grade

Using the first semester course grade as the dependent variable in multiple regression, a five-factor model was generated:

Equation 5

$$Y = 1.07 + .26\ (\text{parent ed}) + .20\ (\text{gender}) + .13\ (\text{GATE}) + .13\ (\textit{Destination Math}) + -.06\ (\text{lunch}).$$

This relationship was statistically significant, $F\ (5,1420) = 51.8$, $p < .0001$. This relationship accounted for 15.4% of the variance (R^2) in first semester course grades. This finding suggests that parent education, gender, exposure to *Destination Math*, and GATE program status may be predictive of first semester grades achieved by middle school students in first-year algebra. The beta weights suggest that parent education and gender may be the strongest predictors of grades. Even after controlling for parent education *Destination Math* remained a significant predictor of grades.

Prediction of Algebra Course Grades, Excluding Destination Math as a Predictor

When exposure to *Destination Math* was removed as a covariate leaving gender, parent education, subsidized lunch, GATE program status, and grade during which the student took algebra as covariates and using the first semester course grade as the dependent variable in multiple regression, a four-factor model was generated:

Equation 6

$$Y = 2.42 + .26\ (\text{parent ed}) + .21\ (\text{gender}) + .13\ (\text{GATE}) + -.06\ (\text{lunch}).$$

This relationship was statistically significant, $F(4,1421) = 57.2$, $p < .0001$. This relationship accounted for 13.9% of the variance (R^2) in first semester course grades. This finding suggests that parent education, gender, GATE program status, and subsidized lunch status may be predictive of first semester grades achieved by middle school students in first-year algebra.

Similarly when exposure to *Destination Math* was removed as a covariate and using the second semester course grade as the dependent variable in multiple regression, a three-factor model was generated:

Equation 7

$$Y = 2.01 + .26\,(\text{parent ed}) + .20\,(\text{gender}) + .12\,(\text{GATE}).$$

This relationship was statistically significant, $F(3,1391) = 63.3$ $p < .0001$. This relationship accounted for 12.0% of the variance (R^2) in second semester course grades. This finding suggests that parent education, gender, and GATE program status may be predictive of second semester grades achieved by middle school students in first-year algebra.

Summary of Exploratory Multiple Regression Analyses

Multiple regression was conducted for three dependent variables: CAT4SS, the first semester algebra grade, and the second semester algebra grade. For each dependent variable, two regression procedures were conducted, either including or excluding CAT1SS and CAT2SS test scores. For each regression, the model of best fit was provided, along with the statistical significance, variance accounted-for, and the multiple regression equation.

Multiple regression predictor variables included gender, parent education, subsidized lunch, exposure to *Destination Math*, GATE program status, and whether the student was in 7th or 8th grade when taking the algebra course.

Multiple regression revealed that parent education, gender and GATE program status may be predictive of higher performance on the standardized test CAT4SS by middle school students.

Multiple regression also revealed that parent education, gender, exposure to *Destination Math*, and GATE program status may be predictive of improved first and second semester grades for middle school students in algebra.

Similar results were revealed when several variables including parent education, GATE program status, subsidized lunch status, whether the student was in 7th or 8th grade when taking algebra, and exposure to *Destination Math* were used as covariates. The result remained constant. Increased exposure to *Destination Math* increased the grades of middle school students in first and second semester algebra.

Quantitative Results Chapter Summary

Participants were 1452 middle-school algebra students. Participant gender was well distributed between female and male participants. Most participants were white, Hispanic, or Asian. Most were native English speakers, and the majority spoke English or Spanish at home. Roughly 5 percent of students were in the GATE program. Most participants had a parent with a college degree or some college. Few participants (2%) were disabled or required special placement. Importantly, these demographic variables were similarly distributed across the three groups in the present study.

The most important finding was that students who received the greatest exposure to *Destination Math* achieved higher first and second semester algebra grades. This result was robust, and remained statistically significant even when teacher effects, parent education, GATE program status, subsidized lunch status, and grade in which the student took algebra were used as covariates. The primary hypothesis of the present study was supported by this empirical evidence.

However, the students who received the greatest exposure to *Destination Math* did not achieve higher scores on the CAT4SS, the standardized test of achievement in mathematics. The secondary hypothesis of the present study was not supported. Exposure to the algebra-specific *Destination Math* was not associated with higher scores on a statewide general mathematics tests.

Multiple regression revealed that parent education, gender and GATE program status middle school students may be predictive of higher performance on the standardized test CAT4SS. Further, parent education, gender, GATE program status, and exposure to *Destination Math* in middle school students may be predictive of improved first and second semester grades in algebra.

CHAPTER V

PRESENTATION AND ANALYSIS OF QUALITATIVE DATA

The present study used mixed methodology to determine the efficacy of computer software on student achievement in a comprehensive middle school first-year algebra program. Chapter IV presented an analysis of the data from research question one, the quantitative research question, "Does greater use of *Destination Math* positively correlate with higher student semester course grades in first-year algebra and with higher standardized test scores after controlling for select demographics and teacher differences?"

The present chapter presents an analysis of the data from research question two, the qualitative research question, that focused on teacher perceptions of *Destination Math* including: (a) Do teachers like the program and find it useful? (b) What specifically do they like about it? (c) What do they consider its advantages? (d) Do teachers believe *Destination Math* will affect student achievement? (e) How do teachers describe the response of students to *Destination Math*? (f) How well do teachers feel they were trained to use the program? (g) What suggestions do teachers have to improve teacher training and the use of *Destination Math*?

Question two was intended to supplement and support the quantitative outcomes of research question one described in Chapter IV. Research question two examined: (a) the effect of teachers' attitude toward the overall purpose and potential of *Destination Math* as an intervention program, (b) the role of the teacher using *Destination Math* including the individual teacher's integration of *Destination Math* into daily practice, and (c) teachers' reception of the training and support received throughout the implementation process.

This chapter begins with a description of the participants and an overview of the qualitative methodology. The guided interview consisted of seventeen questions (see Appendix C) that were based on five broad topics: a) teacher qualifications, b) technical training and support, c) effectiveness of *Destination Math*, the computer-assisted software, d) the role of the teacher, and e) teacher perceptions. The participants' responses to each topic are presented in separate sections. Each section begins with an introduction which is followed by the participant responses to the interview questions that relate specifically to that topic. Every section is summarized, and the chapter concludes with a summary of qualitative findings. The complete transcript of each teacher's interview is displayed in Appendices Q through V. The interview questions are presented in Appendix C. Any reference to a specific interview question is indicated with a parenthesis that includes Appendix C followed by the question number.

Participants

The present qualitative results chapter focuses on six mathematics teachers at the same middle school that provided the quantitative results reviewed in the previous chapter. Three of the teachers taught the participating students in first-year algebra during the study. The other three teachers taught these students in prior years. All teachers used the designated software, *Destination Math*, and all participated in the interview process. The teachers used the same District-adopted first-year algebra textbook, pacing guide, assessments, and interactive software program throughout the study. The 1,462 students were in grades 7 or 8 at Sierra Vista Middle School over the three-year period from 2002 through 2004. Interviews were conducted to measure the efficacy of using *Destination Math* with the middle school first-year algebra students from the teacher's point of view.

Overview of the Qualitative Methodology

The guided interview was the primary qualitative data collection method. It allowed for open-ended responses in an effort to gain insight into respondents' perspectives and concerns. The interview was used to learn things that could not be directly observed, including teacher feelings (Kvale, 1996; Patton, 1990). The initial interview protocol was piloted with two veteran mathematics teachers who were not in the pool of possible respondents in this study. Results of that pilot led to the design of the actual interview protocol used in the study. Prior to the day of the interview the researcher talked in person with each respondent to introduce the study, to determine the willingness of the respondent to participate, and to schedule a convenient time for the interview. Follow-up confirmation was conducted both by telephone and by letter.

Interviews were held during the course of the normal school day in a familiar, comfortable setting at the teachers' own school site. A substitute teacher was available to cover each teacher's class during the interview. Teachers were not required to come early or to stay late. Participants incurred no monetary expenses. Interviews were tape-recorded to ensure a verbatim record of teachers' responses. With one exception, the teachers agreed to be recorded. Careful handwritten notes were taken during the non-recorded interview. Interviews were relaxed, participants were enthusiastic, and no unwarranted tension was evident. A verbatim transcript was sent to each respondent for review and possible editing. Included with that correspondence was a letter thanking the respondent for her/his participation and an envelope in which the transcript could be easily returned through inter-district mail.

Teacher Qualifications

The credentials, experience and competence of the teachers in the classrooms in which the interactive software, *Destination Math* was being used were of great interest in the present study. No matter the quality or quantity of textbooks, support materials, and technology, the decision and competence to use the materials remains the prerogative of the teacher.

Participants were asked for information about their subject matter credentials, years of experience, and years teaching first-year algebra (Appendix C, Q1a, Q2a, Q3a). Participants had either a multiple subject credential or a supplemental mathematics credential. Participants had a minimum of six years and a maximum of 20 years of teaching experience, and all taught first-year algebra in middle school between three and twelve years.

Summary of Teacher Qualifications

The participants in the present study had appropriate credentials, subject-matter competence, teaching experience and training to teach first-year algebra using the interactive software, *Destination Math.*

Training and Support

The extent to which teachers are trained to use computers to support learning plays a role in determining whether technology has a positive impact on student achievement. The success, or failure, of technology requires teachers to view technology as a valuable resource and for teachers to determine where and when it can have the highest payoff, and then to match the design of the application with the intended purpose and learning goals (Moursand, 2001).

A school may have the best software ever made and access to the web from every computer, but experts say schools will not see much difference in student learning unless its teachers know how to use the digital content in their classrooms (Moursand, 2001). It is likely that even the teachers who are enthusiastic about using technology run into difficulties balancing the time spent teaching academic content with the time necessary for their students to learn the necessary technical skills for such technology enrichment (Moursand, 2001).

Participants were introduced to *Destination Math* from one to three years prior to the data of the interview. Participants were trained in *Destination Math* during district in-services, or were mentored by other teachers. Additionally, four of six teachers were trained directly by representatives from Riverdeep (Appendix C, Q1, Q2).

Participants were asked what they would do if in charge of the implementation of *Destination Math* in the District (Appendix C, Q11). One teacher said, "I am the techno-peasant of the math people . . . so the thought of implementing it is just soooooo scary. . . I would really try to align it with the textbook. . . It is so convenient for us to use it now." Another said, "I would do pretty much like what has been done here; make sure that the teachers know how to use it; make sure that it was accessible in their classrooms; and make sure they know how to help the students access it at school and at home. I think it's been implemented very well here." Participants emphasized the need for teachers to achieve a level of comfort compatible with knowledge of the program and sufficient training to implement it. They felt it was important that all technology and equipment be in place at the beginning of a school year. Another participant said, "Naturally, I'd make sure that there is a lab for all the students to go to and enough computers for everyone to be able to work on their own." Participants agreed that the program had been implemented very well at their school. They concluded that, "It is hard to imagine what we could do to make it more accessible."

Summary of Training and Support

Participants all agreed that the District provided sufficient training, materials including projectors, and on-going support throughout the implementation process. Teachers claimed, "We have the training, the equipment, and the technicians." "Technical support from the District TSS is as close as the telephone." When given the opportunity, no teacher offered a recommendation for how she/he would have improved upon the implementation strategies provided by the researcher and/or the District.

Effectiveness of *Destination Math*

Computer-assisted technology, as it supports learning, includes the definition of a digital environment, how research supports computer-assisted technology, and teacher attitudes toward computer-assisted technology. A digital environment promotes experiential learning that integrates learning with the real world. The predominant source of content would then shift from the teacher and textbook to a variety of other sources. With computer software, individualization and student choice would acquire new dimensions (Relan & Gillani, 1997).

Moursand (2001) states that the combination of mind and the computer system provides both information to be learned and feedback to be acquired during the learning process. This is consistent with such learning theory that supports placement of the learner in a rich, real world, problem-solving environment. Computers are a valuable component of such a learning environment (Moursand, 2001). The use of multiple representations, graphs, tables, algebra, natural language, Venn diagrams, bar graphs, and other teaching aides linked within a software program, bring variety to the classroom and allow students to initiate their investigation with the representation of their choice (Borba, 1994).

Destination Math is a visually oriented, computer-based mathematics curriculum compatible with California Mathematics Standards. It is a carefully sequenced, comprehensive mathematics curriculum that demonstrates mathematical issues that arise from real-life situations. The *Destination Math* Mastering Skills and concepts courses are correlated to the California State Content Standards and offer full on-line teacher support with printable student worksheets. The program enables teachers to supplement classroom instruction in a computer lab environment to facilitate differentiated instruction for individual students' dynamic levels of proficiency (Riverdeep, 1999/2000). In the lab, each student can work independently at a computer, to reinforce concepts previously taught in class, to learn and to enhance basic math skills. Even the most capable students can find enrichment on a familiar topic or pursue a new one. The interactive format of *Destination Math* imitates the popular video game format that attracts and holds young people's attention.

To investigate the effectiveness of the *Destination Math* software at Sierra Vista Middle School, participants were asked to discuss the implications *Destination Math* had for the first-year algebra curriculum (Appendix C, Q5). One teacher said, "It is exactly aligned with the algebra book that we use. . . It's almost in the exact same order on the computer program as it is in the book." Other teachers also emphasized the significance of *Destination Math* being aligned with the Glencoe textbook and the California standards. Teachers are able to use the index provided to easily locate a particular lesson for presentation or reinforcement and to provide students with the appropriate *Destination Math* worksheet. Participants agree that *Destination Math* makes the curriculum come alive. One teacher commented, "I love how it takes abstract ideas and shows the kids the applications in a more concrete way. It uses animation in a medium much like a video game to attract and hold student attention." Another said, "*Destination Math* is tightly aligned with our curriculum, which makes it really nice for either presenting lessons or reinforcing them. It is a simple task for teachers to assign the *Destination Math* worksheets that correspond to the Glencoe lesson being presented. It is really, really simple."

Teachers agreed that their practice had changed as they learned to use an additional vehicle for delivering instruction (Appendix C, Q7). One teacher said, "It gives me more options than the standard lecture, practice, work this out." Participants also found that the engaging format of *Destination Math* easily replaced their monotonous and routine practices. "It is more entertaining." With *Destination Math* teachers were able to differentiate instruction. The more visual learners found that the video game format saved the day, and learners whose abstract reasoning skills were not highly developed found that the actions of Digit, *Destination Math*'s animated character, makes the abstract more concrete through real life examples.

Participants recognized *Destination Math* as an additional tool for presenting lessons in a more colorful, interesting manner. They agreed that *Destination Math* gives mathematics a connection with reality that provides additional reinforcement. For one participant, *"Destination Math* saves the day." For another, "It gives me the ability to make graphing in the coordinate plane less tedious and far more enlightening for students" (Appendix C, Q7).

Participants were asked to discuss, based on their knowledge and experience with *Destination Math,* the changes they see that have improved learning in the classroom (Appendix C, Q10). They found that using *Destination Math* with today's students is valuable because today's students recognize the similarity between *Destination Math* and their own video games. Participants said that *Destination Math* makes algebra come alive and makes the lessons far more interesting than most teachers can make them. They found that students are more excited and more eager to pay attention when the lesson includes *Destination Math.* One teacher said, "Today students need something flashy to keep them engaged." Participants found that the intervention program which gives students credit for using *Destination Math* in the lab after school motivates students to make up failed tests and to potentially improve their grade. One participant said, "I think that *Destination Math* is really valuable with today's students because they are very video game driven, i.e., it's a different way of presenting that certainly does have value."

To determine how the use of *Destination Math* might impact the success of students in first-year algebra, participants were asked to discuss, based on their knowledge and experience with *Destination Math,* how they saw that *Destination Math* impacted the success of students in first-year algebra (Appendix D, Q13). Participants all responded that *Destination Math* would have a positive affect on student success. They stated that *Destination Math* would help students who are struggling to really understand concepts. They also stated that *Destination Math* would help others to deepen their understanding. Participants appeared eager to relate that *Destination Math* was going to have a positive effect on students' understanding and scores and their overall concept of algebra. They felt that *Destination Math* had already helped many students, especially those in the after school intervention program. One participant confided having heard a student say, "Hey, I can ask *Destination Math* to repeat it ten times to me, and it doesn't tell me, 'Why aren't you getting it? or study your notes'." That participant recognized a self-esteem issue handled well by *Destination Math.*

Summary of Teacher Opinions of the Effectiveness of Destination Math

There was consensus among participants that the use of *Destination Math* played a role in increasing the success rate of the students in first-year algebra. One teacher commented, "For the visual learner *Destination Math* saves the day." Another, "*Destination Math* has allowed me to replace monotonous and routine practices from my past teaching with colorful and meaningful presentations which are so varied that they capture and hold students' attention." One teacher reports significant grade improvement for those students who are serious and want to focus. Quoting a student, another teacher reported that the use of *Destination Math* can preserve a student's self-esteem. The student volunteered, "Hey, I can ask *Destination Math* to repeat it ten times to me, and it doesn't tell me, 'Why aren't you getting it? or What is wrong with you? Study your notes.' like a teacher could say, "Teachers agree that mathematics comes alive for students through the use of *Destination Math*. They further agree that the teacher's attitude is a very important ingredient in the use of, and therefore in the effect, that *Destination Math* can, and will, have on student success in first-year algebra.

The Role of the Teacher

How mathematics teachers move from principles to practice to create and sustain meaningful change isn't easily determined, and it appears that the teacher as change agent acts as the catalyst in creating the bridge between policy and implementation. Respected educators differ in their emphasis on the emerging role of the teacher.

Fullan states, "The goal is to engage the majority of teachers in creating collaborative work cultures by deepening the focus on inquiry, assessment, teacher interaction and sharing and continuous problem solving" (Fullan, 1995). Darling-Hammond maintains that the teacher needs to study mathematics by working at the intersection of good curriculum materials and students responses to those materials (Darling-Hammond, 1994; Lampert 1998). Kanold warns, "Failure to use technology, at least in demonstration, may be evidence of malpractice" (Kanold, NCSM, 2003). He further maintains that the "power" of the professional learning community will lie in the ability of the leadership base to create a culture that broadens the "teacher as leader" idea (Kanold, personal communication, April 9, 2003).

The traditional role of the teacher often changes when software is made available. Participants in this study were asked about their perception of the role of the teacher who uses *Destination Math* in the classroom and in the lab (Appendix C, Q3). Participants saw the teacher having unique and separate roles in the classroom and in the lab. In the classroom the teacher set the pace of the presentation while demonstrating the lesson projected on the screen from the computer. In the lab the students paced themselves and were more self-directed with less direct involvement with the teacher. Participants saw the teacher more as facilitator and less as lecturer both in the classroom and in the lab. They saw the teacher as a guide to provide an orientation regarding the mechanics of using the software and also as a supervisor to help enforce a healthy protocol. Whether in the classroom or in the lab one teacher said the role of the teacher was to be "someone who thinks that this is vitally important and is great and is serious about it . . .that is contagious to the students."

Participants were asked a question regarding the way in which a particular learning site may influence the role of the teacher who uses *Destination Math* (Appendix C, Q4). They had the option to use *Destination Math* in the classroom or in the lab or both. Participants said the role of the teacher in the classroom was to emphasize important parts of the lesson and to focus student attention. They appreciate that the new LCD projectors enabled teachers to project the images from the software program on the screen to emphasize important parts of the lesson and to focus student attention. All participants found that using *Destination Math* in the classroom had an additional benefit because the software brought the lessons to life. *Destination Math* provided a change of pace from the teacher lecture routine. Participants also agreed that student liked that change of pace.

Participants enjoyed the self-directed learning style of using *Destination Math* in the lab (Appendix C, Q5). One said, "As with any teaching tool, you get out of it as much as you put into it. A teacher who thinks using *Destination Math* is vitally important and is serious about using it presents something very contagious to students. Students realize the importance and seriousness of using *Destination Math* with a teacher who is serious and treats *Destination Math* as important."

Participants were asked to describe their use of *Destination Math* in a typical day and/or week (Appendix C, Q6). They described three different ways in which they used *Destination Math*: first, in the classroom working with students as a group, then in the computer lab where each student worked at her/his own computer usually at her/his own speed, and finally in the computer lab during the after school intervention.

Participants used *Destination Math* in the classroom during regular class time to introduce new concepts. One found *Destination Math* extraordinarily helpful for showing multiple representations to the large group. That participant said, "I find *Destination Math* extraordinarily helpful in many ways, especially for presenting multiple representations to the class as a whole." "I sometimes use it to introduce a lesson that I find kind of boring to teach because *Destination Math* will spruce it up." Others chose to use *Destination Math* to present a typical lesson. They found the *Destination Math* manner of presenting vocabulary and practical examples very effective. In fact they said that students thought it was fun. Participants used *Destination Math* in the lab during regular class time as reinforcement. Students went through the tutorials when they needed additional help and then used the *Your Turn* black line masters. "They think it is a treat." Participants said they also go to the lab for another kind of help. "I am not so vain as to think I'm the only person/vehicle who can teach my students. Digit, the animated character in *Destination Math*, can teach them as well."

Participants used *Destination Math* in the intervention program after school in the lab. Students went to the lab to use *Destination Math* for 're-teaching and reinforcement' before being 'retested'. Then students could retake their tests for credit.

To determine whether teachers' interaction with students while using *Destination Math* was different from their interaction while using traditional methods, participants were asked to summarize the involvement they had with students while using or following the use of *Destination Math* (Appendix C, Q9).

Participants found a higher degree of interaction with students in the classroom while using *Destination Math* than while using traditional teaching methods. They reported that the interaction developed naturally from the engaging lessons and the teacher's opportunity to direct questions to students during the presentation. Participants found that students liked the program and had fun learning.

Participants found a lesser degree of interaction with students in the lab. However, they found a higher degree of monitoring student time on task while in the lab. In fact, a participant reported having heard a student say, "Oops! I actually learned this when I was having fun." Several teachers appreciated their increased capability to reference a previous lesson with a comment such as, "Remember the lesson on Tuesday when the car increased it speed?"

Summary of the Role of the Teacher

Teachers identified and described the role of the teacher in various ways (Appendix C, Q3). Several teachers viewed the teacher as a facilitator who clarifies concepts and helps students make meaningful connections between the lesson in the text and the application of mathematics so graphically presented in *Destination Math.* Others saw the teacher as communicator and model of computer etiquette. Another recognizes the role of teacher as organizer of an orientation characterized by clear and simple directions that allow students to confidently and competently use the software and its accompanying printed materials. One teacher emphasized a critical need for teachers to become comfortable with the program and know how to use the technology before they are expected to use it with students. Another teacher suggested that teachers need to make a personal commitment to use *Destination Math* in spite of competition for their time in the classroom from other programs including district benchmark assessments and state standardized testing.

Teachers in the study self-selected to use *Destination Math*; the district did not mandate its use. Consequently, there was some variation in how teachers use *Destination Math*. Most teachers use *Destination Math* in both the classroom and in the computer lab. One, however, uses the program solely in the classroom. In the lab several teachers use the printed materials provided with the software to guide students' work, while a few teachers do not use those materials. Some teachers used *Destination Math* to preview new concepts, some to introduce new concepts, and still others use the program to review and reinforce concepts they have previously presented in the classroom. Most teachers choose a particular strategy from among those mentioned depending on the concept to be studied, and whether their students need the concept to be re-taught, reinforced, or enriched. Teachers in this study recognized the entertainment value of the software compared with the limitations of their own talents for simultaneously entertaining students and keeping them on task.

All teachers acknowledged the power of *Destination Math* to attract and hold student attention over an extended period of time. One teacher enjoyed the animated interaction during which students even interrupt from excitement rather than from a lack of respect. Teachers and students agreed that the visual examples would most probably outlive the spoken word.

Teacher Perceptions

The transformation of the traditional algebra curriculum into a comprehensive curriculum of algebra for everyone in the 21^{st} century is a work in progress. There remains an ongoing struggle to redefine the specific mathematics content first-year algebra students should study in the 21^{st} century (Thorpe, 1989). "The type of mathematics instruction that involves students actively and intellectually requires much from the teacher" (NCTM, 1985). The use of software appears to enhance both content mastery and problem-solving ability to a significant degree (Liu et al., 1992). In an era of mathematics education reform, one must be mindful that new wine is not successfully poured into old wine skins. Teachers' knowledge, attitudes, and perceptions, as well as the learning environment, need to be adjusted to accommodate the new focus on mathematics content. Students' learning of mathematics is enhanced in a learning environment that is built as a community of people collaborating to make sense of mathematical ideas (NCTM, 1989).

Participants were asked whether the use of *Destination Math* had changed their perception(s) of the potential for student success in first-year algebra (Appendix C, Q8). If so, why and how? Participants agreed that the use of *Destination Math* had changed their perception of the potential for student success in first-year algebra. Participants found that *Destination Math* increases student motivation and interest. The increased motivation and interest may translate into success in algebra. Participants have observed increased attendance in the lab after school to use *Destination Math*. They believe that *Destination Math* brings along some students who would typically not be successful. One participant said, "When students are motivated, I've seen great improvements with kids using *Destination Math.*" Another said, "In fact quite a few kids understand the concepts better after using *Destination Math.* Those who go to the lab on their own are taking advantage of a great opportunity."

To help determine whether the implementation of *Destination Math* at Sierra Vista had been successful, the participants were asked to identify some factors that contribute to a successful implementation of an intervention program (Appendix C, Q12). They suggested that teachers have to believe that such a program really can work, that it can actually benefit students, and that it is worth the time. One teacher said, "It is important that teachers feel comfortable using the program and that appropriate resources be available in case something goes wrong." They also believe that parental support and positive teacher attitude are significant for the successful implementation of any intervention. Teachers believed that, "Sufficient training and ongoing support are necessary so that teachers are confident in their ability to deliver the program."

To give the participants the opportunity to make comments on other aspects of the program not covered in the guided interview the participants were asked whether they had anything else they would like to add (Appendix C, Q14). Most participants had no additional comments. However, one participant said, "I'm glad we have a district that supports us and does its very best to provide us with everything that we need to better educate our students. I feel very supported and like the program very much."

Summary of Teacher Perceptions

Common threads included teacher perceptions that: (a) strategies employed to implement *Destination Math* in the district were successful. (b) training provided teachers was effective and continuing, (c) teacher comfort is essential and their use of the program is directly proportional to their level of comfort in using it, (d) teacher enthusiasm for the program is essential in an atmosphere of self-selection rather than prescribed use, (e) use of *Destination Math* has positive implications for the success of all students in first-year algebra, (f) when using *Destination Math* teachers act more as facilitators than lecturers, (g) levels of interaction between teacher and students are raised in quantity and in quality during lessons with *Destination Math,* (h) *Destination Math* provides students a learning environment that directly resembles their familiar video game setting, (i) the vast majority of students respond positively to the use of *Destination Math,* (j) *Destination Math* provides the multiple representations necessary for all students to achieve success in this relatively new high school graduation requirement, (k) algebra 'comes alive' and students become familiar with the applications of algebra in everyday life, (l) *Destination Math* is aligned with state standards and the adopted text so that it is possible for teachers to integrate its use easily into their daily practice, and (m) *Destination Math* is so closely aligned to the District's mathematics curriculum and to California content standards that teachers recognize its use as simultaneous preparation for district benchmark assessments and state standardized testing.

Summary of Findings from Qualitative Analyses

The findings from this qualitative investigation demonstrate that, during the three-year study, the six participating teachers at the target middle school liked using the interactive software, *Destination Math*, in the classroom and in the lab. This finding supports the empirical gains described in Chapter IV. Teachers recognized the power of *Destination Math* to catch and hold student attention more readily than a page in the textbook. Teachers generally increased their use of the software in each successive year of the study. Teachers were given the freedom to choose to use the software. While the use of *Destination Math* was self-selected by the teachers and not imposed by the administration, the participating teachers came to consensus on their use of the software. Teachers believed that *Destination Math* was an underused resource. They felt that students did not take full advantage of the after-school opportunities to use *Destination Math.* Teacher attitude and training may impact the use of interactive software interventions such as *Destination Math.* There was consensus among these middle school teachers that the use of *Destination Math* may play an important role in increasing the success rate of the students in first-year algebra.

The data from the qualitative investigation showed that teachers: (a) like the program, (b) find it catches and holds student attention, (c) find among its advantages that it holds student attention and provides multiple representations, (d) believe *Destination Math* will affect student achievement, (e) describe student response to *Destination Math* as positive, (f) say they were well trained to use the software program, (g) were positive about the training they had received. Teachers recognized the need for ongoing training to learn to fully use the instructional software program.

CHAPTER VI

DISCUSSION

The primary purpose of the present study was to examine the efficacy of a technology-based program, *Destination Math*, as an intervention tool to increase success in first-year algebra for middle school students. The secondary purpose was to assess teacher attitudes toward the use of *Destination Math* as it impacts student achievement in first-year algebra.

Algebra is a Civil Right

Robert Moses, an advocate for equity in the 1960s, became an advocate for a different kind of equity in the 1980s. When speaking about his book, *Radical Equations* (2001), Moses stressed that the most pressing civil rights issue in this technical era is economic access.

Moses declares equity the new civil right and defines equity in mathematics reform as the obligation to provide the opportunity to learn algebra for all students regardless of background, race, or ability (Moses, 1995). Moses and Cobb further argue that "algebra . . . once solely in place as the gatekeeper for higher math, is now the gatekeeper for citizenship, and people who don't have it are like the people who couldn't read and write in the industrial age . . . . [I]t has become not a barrier to college entrance, but a barrier to citizenship. That is the importance of algebra that has emerged with the new higher technology" (Moses and Cobb, 2001, p. 14). Susan Frey, in a 2002 article, writes that for this to become a reality, all of society, students, parents, teachers, and administrators, must believe and expect that all children can and must learn algebra. In other words, "A multitude of players need to achieve a singleness of purpose" (p. 12).

In an era in which "knowledge" is replacing the industrial worker, illiteracy in mathematics must be considered as unacceptable as illiteracy in reading and writing in the past. The core idea in public schools should be that education is an opportunity structure for every student. Public education should mean quality public education for all students. Given that math instruction/learning is the civil rights issue of the new millennium (Moses, 1999), and critical for economic success, the findings of the present study may potentially benefit society by fostering a more successful, better prepared citizenry.

The decision of the California State Department of Education to include first-year algebra among the graduation requirements in California's public high schools was preceded by the development of the California State Content Standards, and strongly influenced by the requirement of a new California High School Exit Exam (CAHSEE). Algebra as a graduation requirement presents challenges to mathematics educators in school districts throughout the State. Every school district in the California must give every student an equitable experience and equal opportunity to achieve success. Further, algebra courses must be compatible with the Equity Principle as put forth by the National Council of Teachers of Mathematics (NCTM), including high expectations, access and opportunity, adequate resources and support, so that outcomes are equitable for every student. Towards achieving these goals, computers are increasingly common in California algebra classrooms, but the efficacy of computer-based algebra instruction remains unclear.

This chapter begins with an introduction, a review of the major findings, and the strengths and limitations of the present study. The major findings are presented in their theoretical context as well as in the context of empirical research. The discussion includes technology in education, the No Child Left Behind (NCLB) Act, computer software in the classroom, and the role of algebra teachers. A summary of the general discussion is followed by implications of the present findings, limitations, and suggestions for future research. The chapter ends with the conclusions.

Review of Major Findings

The findings of the present study were consistent with the primary hypothesis of this investigation: middle school students who receive the highest level of exposure to *Destination Math* achieved higher grades in first-year algebra than students who receive a lower level of exposure to *Destination Math.* The present study found no support for the secondary hypothesis that the highest exposure to *Destination Math* would be associated with the highest average standardized test scores in a state-wide general mathematics examination, possibly because the computer-based treatment was directed at algebra rather than at general mathematics. The present study found that 7^{th} graders and 8^{th} graders were similar in algebra grades. The present study found parent education was positively correlated with algebra grades, but the positive effect of *Destination Math* exposure was statistically significant above effects of parent education or teacher differences. Teachers were enthusiastic about the positive value of using computer software to teach algebra. These findings suggest that computer software, such as *Destination Math*, may be useful for middle school algebra instruction.

Strengths of Present Study

The present study used mixed methods to determine the efficacy of a designated computer software program on student achievement in a middle school comprehensive first-year algebra program. The study was conducted using student data routinely gathered and readily available on ARIES, a student information software program. Because neither the students nor the teachers knew in advance that such data would be of interest for the present study, this database study was ecologically valid (Bronfenbrenner, 1977). The study sample was large, including 1452 middle school students, and it accounted for the effect of teacher over time and for the effect of teacher interaction over time. All 1452 students were exposed to *Destination Math* for a full school year. The amount of exposure was determined by the year in which the student studied first-year algebra. This study included a local evaluation of student achievement in the form of course grades in addition to standardized test scores.

Further, the study used two semesters of course grades to ensure that any possible effect could not be due to the particulars of fall or spring. The data were split across grade levels, to account for possible differences between 7th and 8th graders in algebra. Covariance was used to determine whether the effects of treatment were evident above the effects of demographics and inter-teacher differences. Multiple regression was used to investigate potential predictors of success on outcome measures.

Present Findings in the Context of Research

The findings of the study were consistent with the hypothesis that middle school students who receive the highest level of exposure to *Destination Math* achieve higher grades in algebra than those students who receive a lower level of exposure to *Destination Math.*

The findings of significantly better algebra course grades with the highest exposure to *Destination Math* were consistent with the findings of Rivet (2000), who found significant improvement using *Destination Math* with 6^{th} grade students studying fractions, and with the findings of Thrasher (2000) who found gains using *Destination Math* with low-achieving 7^{th} and 8^{th} grade mathematics students. This study was also consistent with the Palomares Middle School (2000) study of low achieving students that found one-third of the students competent to return to their regular class after using *Destination Math* for eight months.

The finding of no significant relationship between exposure to *Destination Math* and improved standardized test scores was not consistent with the findings of several studies, including the Chipman Junior High School of Bakersfield, CA. which used *Destination Math* for 10 weeks with at-risk students receiving the greatest intensity, and increased their school's statewide standardized (SAT-9) test scores (Riverdeep, 2005). The Pender County, North Carolina study (2001) found the scores of students who used *Destination Math* increased at a greater rate than the scores of students who did not use *Destination Math* prior to taking the state standardized test (Riverdeep, 2005). The Arlington Woods Middle School in Indianapolis, Indiana (2000) study found a statistically significant increase in the scores of their lowest achieving students on the state mathematics test after using *Destination Math* (Riverdeep, 2005).

The failure to detect a significant difference on a standardized test in the present study may have been because the standardized test was a general mathematics exam, while the *Destination Math* modules utilized were exclusively focused on algebra instruction only.

Theoretical Context of the Present Findings

Skinner's Teaching Machines

The introduction of the teaching machine by B.F. Skinner in 1954 foreshadowed the 21st century use of technology in the classroom (Skinner, 1954). While Skinner's critics claimed his teaching machine would eventually replace the teacher, there are those who level similar criticism today on the use technology in education. NCTM addresses that criticism from their position that technology is an essential tool for teaching and learning mathematics effectively, one that extends the mathematics that can be taught and enhances students' learning (NCTM, 2003). The primary goal of the Enhancing Education through Technology Act of 2001, was, "to improve student academic achievement through the use of technology in elementary schools and secondary schools..." (http://www.ed.gov/legislation/ESEA02/pg34.html). Technology is playing an increasingly important role in the teaching and learning of mathematics at all levels according to the Technology-Supported Mathematics Learning Environments Sixty-seventh Yearbook (NCTM, 2005).

General Discussion

Technology in Mathematics Education

Technology is essential when teaching or learning mathematics (Kanold, 2003). Technology influences the mathematics taught and enhances student learning. Technology offers options for students with special needs. Some students may benefit from the more constrained and engaging task situations possible with computers. Students with physical challenges can become much more engaged in mathematics using special technologies. The teacher must make prudent decisions about when and how to use technology and should ensure that the technology is enhancing student mathematical thinking (NCTM, 2003). Tim Kanold, author, teacher, school superintendent, suggested that teachers who fail to use technology today, at least in demonstration, may be guilty of malpractice (Kanold, 2003). Because technology is becoming so pervasive, we need empirical evidence to determine which software "works" for which goals. For example, if we desire improvements in standardized tests, we need training that is content valid, and appropriately represents the standardized test material. The present study provides empirical evidence that technology in the classroom "works", in that technology can help middle school algebra learners.

NCLB / computer math instruction benefits the low achievers

The No Child Left Behind (NCLB) Act (2002) promises that all children will be proficient in mathematics by the year 2014. NCLB focuses on the low achieving student and on bringing that student to a minimum level of proficiency. Thrasher (2000) found gains using *Destination Math* with low-achieving 7^{th} and 8^{th} grade mathematics students in Colorado. The Palomares Middle School (2000) study of low achieving students in California found that one-third of the students were competent to return to their regular classes after using *Destination Math* for eight months. In the present study, the smaller standard deviation found when students received the greatest exposure to *Destination Math* implies that the lower achieving students achieved the greatest gains. These studies all suggest that *Destination Math* may provide benefit for low-achieving students, in accordance with NCLB. However, whether computer-assisted technology can maximize the achievement of the top level students remains unclear, and this uncertainty presents an empirical question for future scholars.

Computer Software and Algebra Teachers

The present study included interviews with middle school teachers who used the *Destination Math* software with the students whose test scores, grades and demographics comprised the quantitative part of the study. The qualitative research question was "What are teacher attitudes toward the use of *Destination Math* that impact student achievement in first-year algebra as inferred from interviews with teachers?"

Teachers described a positive learning environment and positive gains in achievement when using *Destination Math*, especially with their low achieving students. They recognized the power of *Destination Math* to attract and hold student attention over an extended period of time even for the lower achieving students. One teacher reported animated interaction during which students even interrupt from excitement rather than from a lack of respect. Teachers believe that *Destination Math* provides another opportunity for low achieving students to meet the new high school graduation requirement. Teachers acknowledged that *Destination Math* provides students an opportunity for reinforcement in the classroom, in the lab, even at home. Such additional support can be the difference between success and failure for the lower achieving student, as witnessed in the Palomares Middle School (2000) study (Riverdeep, 2005).

One teacher commented, "Oh, I think as I look back to the kind of student I was, kind of shy to ask the teacher for help; embarrassed to ask smarter friends for help. I could have benefited from *Destination Math* because it is so individual; it goes at your own pace; I wouldn't have to feel stupid because somebody else found out I repeated something. Students who may not seek help from the teacher publicly may find the necessary help from the software privately. One teacher strongly held, "Now I think every student does have a chance to pass algebra. Whether in the class room or in the lab after school during intervention, students can go at their own pace, even viewing lessons multiple times when necessary." Still another teacher said, "the brighter students tuned *Destination Math* out; they don't tolerate the repetition, yet their classmates need the reinforcement."

Summary of General Discussion

From Skinner's (1954) teaching machines to the present day classroom, technology has become increasingly essential in teaching and learning mathematics. Technology influences the mathematics that is taught and enhances students' learning. Empirical studies, including the present study, demonstrate that technology can increase the achievement of middle school algebra students as evidenced by their course grades. An empirical question for future researchers may be how technology can maximize achievement for our top-achieving students.

Implications of the Present Findings

Findings from the present study have implications for the classroom and beyond the classroom. Significant for the classroom is an existence proof that teachers can effectively collaborate in quasi-experimental studies of algebra interventions across multiple grade levels. Further, the present investigation demonstrates that studies can account for teacher effects without disrupting the classroom. Cooperation and collegiality among teachers can foster empirical research. Software can improve the pass rate in algebra; therefore, more students should complete graduation requirements. In this study, student grades increased, but standardized test scores did not. Therefore, multiple measures of student achievement remain necessary. The achievement of 7^{th} and 8^{th} graders was similar, which implies that these students of differing ages may learn algebra similarly. In the future, classroom teachers will have access to the technology to track student time on task when using computer-assisted technology for intervention. The management system of computer-assisted instruction will also provide feedback on student errors to teachers electronically.

Implications Beyond the Classroom

Implications beyond the classroom extend to the district level, the developers of the software, and to society. The findings of the present study should encourage district level educators to become more comfortable with software to accompany textbooks or to replace textbooks. District educators may choose to foster the use of appropriate software in their classrooms. The findings may encourage the district educators to promote research such as this present study, to make instructional decisions based on empirical evidence, to promote the use of computer software in other disciplines to determine efficacy, and to ensure that no child gets left behind in mathematics, including areas of the mathematics curriculum in which *Destination Math* has modules designed specifically as reinforcement of individual content standards. Further, the findings of the present study, in conjunction with the findings of other scholars, may eventually lead to a classroom free from paper textbook, which fosters environmental ecology.

Implications for the Developer

The present study demonstrated that *Destination Math* can improve classroom algebra grades, but not necessarily improve scores on standardized test, possibly due to content differences. The developers of *Destination Math* software are encouraged to foster content validity between *Destination Math* and the mathematics content on the California Standards Test and on other statewide standardized tests, such as the

CAHSEE, to determine whether *Destination Math* can also increase student performance in those areas.

Implications for Society

For society, the increasing use of technology in a digital environment may reduce the weight of student backpacks in an eco-friendly manner, and may ultimately be better for student learning. As technology becomes increasingly more portable, students will gain access to textbooks and homework support online. Student learning will be encouraged in a variety of locations. Consequently, students' work and study will not be limited by the absence of their textbook.

Technology may also help to level the playing field for all learners. Access to curricular materials including online textbooks is becoming more available from school and public libraries for those students who may not have access to the necessary books in their classrooms or in their homes.

Limitations

Limitations of the Sample

Limitations of the present study include limitations of the sample, the measures, and the design. Although the sample was relatively large, the sample included a single school in a single district. Therefore, it is not clear whether a cohort effect existed, in which the findings may have been specific to the present sample. Further, participants may have been affected by time and place. This emphasizes the need for replication using a different population before drawing strong conclusions. The present study was limited by the sample.

Limitations of Measures

The present study included no behavioral measure to quantify use of software by the teacher or by the students in the classroom or in the lab. The study relied on teacher self-report estimations regarding usage. The present study included no validated measure of IQ. Further, the present study relied on self-report of parent education level with no external validation. The study needed a better metric for quantifying seldom, occasional, and frequent use of treatment. There was no single State standardized algebra test score available for all participants. The present study was limited by the measures.

Limitations of Design

The study was limited by the cross sectional design, and was therefore not able to show changes within students over time, as would be possible with longitudinal designs. The present study included treatment followed by a one-time test, and included no baseline scores, no pre-test/post-test, and no blocking for high and low achievers. The present study was limited by not including a control group.

Suggestions for Future Research

Suggestions for future research include focus on sample, measure, and design. Future researchers are encouraged to extend the sample to include additional schools within and outside a single district, and to consider blocking data for high and low achievers. They are encouraged to use a validated measure of IQ, to use a behavioral measure to quantify use of software by teacher, to develop a non-self report technique to determine teacher usage including timers on computers, and to use a common content standard test score for all participants. Future researchers are encouraged to use longitudinal designs, to acquire baseline scores, to use pre- and post-test results, so that changes within students can be assessed. Future researchers are encouraged to use control groups, and to include multiple computer-assisted programs, so that the efficacy of various computer-assisted learning software can be assessed. By including these design considerations, future researchers may be able to identify optimal strategies for middle school algebra instruction.

Conclusion

The findings of the present study were consistent with the primary hypothesis of this investigation: middle school students who receive the highest level of exposure to *Destination Math* achieved higher grades in first-year algebra than students who received a lower level of exposure to *Destination Math.* There was consensus in the interview data indicating that the teachers liked using the software. Teachers recognized the ability of the computer assisted program to "catch and hold" student attention beyond textbook instruction with a challenging age group. The findings of the present study suggest that middle school algebra students may benefit from computer-based software programs, such as *Destination Math.*

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Appendix A

Participant Informed Consent Form

Consent to Participate in a Research Study

University of San Diego

Informed Consent Form

Patricia Taepke, a Doctoral student in the Leadership Studies Program in the School of education at the University of San Diego, is conducting a study entitled, "*Destination Math*: A Dynamic Intervention Tool and Its Impact on the success of Students in First-Year Algebra."

The following is a consent form for those subjects who wish to participate in a study of *Destination Math* in the Covina-Valley Unified School District, 2002-2003.

Below are the conditions by which subjects in the study will work:

1. Subjects will be asked to share their perceptions of:
*teaching first-year algebra to all students;
*an intervention program for students in first-year algebra;
*of the role of the teacher in the intervention program;
*the intervention's effect on their practice; and
*the need for dynamic staff development in the implementation of an intervention program.

2. Subjects in this study will be referred to by pseudonyms. However, as quotations or descriptions from individuals may be used in the written document, complete confidentiality cannot be guaranteed.

3. Quotations or descriptions may be used in the written document. Therefore subjects will be able to review, and if need be alter, interview transcripts before the material is used in written documents resulting from the study.

4. Interviews will be recorded and the recordings will be transcribed. Tapes will be destroyed after completion of the transcriptions.

5. All subjects will remain anonymous and data collected will be kept in a locked file away form the research site for a period of five years. Computer files containing data will be password protected.

6. Interviews will be conducted at the subjects' school site at their convenience.

7. Participation in the study is completely voluntary. Subjects can withdraw from the study at any time. Data collected prior to withdrawal will not be used unless the subject agrees to its use.

8. When subjects have any questions or concerns at any time n the study, they are encouraged to contact Patricia Taepke (ptaepke@cvusd.k12.ca.us or 909-626-0069 or Professor Mary Scherr, Ph.D. (scherr@sandiego.edu).

9. The data collected will be used in Patricia Taepke's dissertation and any publications that may evolve from that study. Although results might be made public, all individual data will remain anonymous and confidential.

10. There is no agreement, written or verbal, beyond that which is expressed on this consent form.

Signature of Subject:
_____________________________Date:_________

Printed Name:
____

Address:
____

____

Contact Info:
Phone______________________Fax:_________
E-mail____________________________________

Note: Two copies of this form will be provided, one for the researcher and one for the subject.

12/12/02

Appendix B

Letter of Invitation to Teachers

Dear Teacher of First-Year Algebra,

In the past algebra courses were traditionally reserved for college bound students of above average ability. Commencing with the Class of 2004, California teachers of first-year algebra present all students an opportunity to learn algebra, regardless of their ability or special needs. This is an issue of equity. All students are required to successfully complete the first-year algebra course and to pass the California High School Exit Exam (CAHSEE) before graduating from a California Public High School. The NCTM strategies provide a common blueprint for the design of comprehensive programs in which all students have an opportunity for success.

In addition to an appropriate textbook, a comprehensive course of study for first-year algebra demands intensive classroom instruction, appropriate use of technology, and an effective intervention program that provides every student the support necessary for her or his success.

Patricia Taepke, a Doctoral student in the Leadership Studies Program in the School of education at the University of San Diego, is conducting a study entitled, "*Destination Math*: A Dynamic Intervention Tool and Its Impact on the success of Students in First-Year Algebra."

This study will

*examine the effectiveness of the technology-based program, *Destination Math,* as an intervention tool to increase the success rate of students in first-year algebra;

*consider the implications for providing ongoing staff development specifically designed to support the infusion of *Destination Math* in a comprehensive first-year algebra program;

*explore teachers' understanding of the potential of *Destination Math* as a tool for instruction, reinforcement and intervention; and

*explore the ways in which individual teachers integrate *Destination Math* into their daily practice.

You are asked to participate in this study and are assured that

*responses during the interviews will in no way affect your employment status, and
*the researcher remains a fellow teacher, with absolutely no supervisory or administrative authority with respect to any other teacher.

You will participate in approximately two interviews in which you will be asked to share your mathematics background and you experience with, and expectations of, *Destination Math*. Interviews will be tape recorded and transcribed, and you will have the option to review and edit al transcripts. After the tapes are transcribed they will be destroyed; computers used to record participant data will be password protected. Transcripts will be kept in a locked file cabinet in the researcher's possession.

This study will be conducted during the fall and spring semesters of the 2002-2003 academic year. There will be no expense to the participants other that the time invested in interviews and in the optional review of the transcripts.

Interviews will be conducted and audio taped n a place and at a time convenient to the subjects, most likely in a quiet, comfortable meeting room at the subject's school site. Interviews will be conducted subsequent to the receipt of permission from the Committee on the Protection of Human Subjects, with the permission of the subject, the subject's site administrator, and the researcher's site administrator. Permission to conduct the study in two schools in the Covina-Valley Unified School District was secured from Dr. Gayle Odell, Assistant Superintendent of the Covina-Valley Unified School District. Permission to use demographic information, semester test scores, and semester course grades in the first-year algebra classes was secured from Dr. Stella Port, Director of Research and Program Evaluation in the Covina-Valley Unified School District.

Several steps will be undertaken to eliminate any risk to the participants during the course of this study:

Risks

1. participants will not be used absent the appropriate and necessary signed consent form;

2. the identity of the research site(s) will remain confidential;

3. pseudonyms will be used for all subjects'

4. participants will be involved in appropriate revision of the text necessary to assure confidentiality'

5. tapes will be destroyed after completion of transcriptions;

6. transcripts will be stored in a locked location away from the research site(s).

Benefits

Participants will:

1. share in short and long term feedback which specifically studies the effectiveness of the intervention tool they are expected to infuse into their practice;

2. have an opportunity to participate in staff development specifically designed to support the infusion of *Destination Math* in their practice;

3. learn how their colleagues integrate *Destination Math* into their practice;

4. clarify their understanding f the potential of *Destination Math* as tool for instruction, reinforcement and intervention;

5. enjoy additional district support for the implementation of *Destination Math* through informal interaction and collaboration with fellow teachers and formal staff development.

Below are the conditions by which participants in the study will work:

1. Participants will be asked to share their perceptions of:
*teaching first-year algebra to all students;
*an intervention program for students in first-year algebra;
*of the role of the teacher in the intervention program;
*the intervention's effect on their practice; and
*the need for dynamic staff development in the implementation of an intervention program.

2. Participants in this study will be referred to by pseudonyms. However, as quotations or descriptions from individuals may be used in the written document, complete confidentiality cannot be guaranteed.

3. Quotations or descriptions may be used in the written document. Therefore subjects will be able to review, and if need be alter, interview transcripts before the material is used in written documents resulting from the study.

4. Interviews will be recorded and the recordings will be transcribed. Tapes will be destroyed after completion of the transcriptions.

5. Interviews will be conducted at the subjects' school site at their convenience.

6. Participation in the study is completely voluntary. Participants can withdraw from the study at any time. Data collected prior to withdrawal will not be used unless the subject agrees to its use.

7. When participants have any questions or concerns at any time in the study, they are encouraged to contact Patricia Taepke (ptaepke@cvusd.k12.ca.us or 909-626-0069.

8. The data collected will be used in Patricia Taepke's dissertation and any publications that may evolve from that study.

Sincerely,

Patricia Taepke

Appendix C

Interview Questions

Appendix C

Interview Questions

Background questions

1a. What is (are) your credential(s) and how long has it (they) been held?
2a. What subject(s) does (do) your credential(s) permit you to teach?
3a. How long have you taught first-year algebra?

<u>Guided questions</u>

1. When were you first introduced to *Destination Math* as an intervention tool for first-year algebra students?

2. Describe the training you have received to use *Destination Math.*

3. Describe your perception of the role of the teacher who uses *Destination Math* as an intervention tool in the classroom and in the lab.

4. In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher?

5. Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.

6. Describe your use of *Destination Math* in a typical day and /or week.

7. Has the use of *Destination Math* altered your daily practice? If so, why and how?

8. Has the use of *Destination Math* changed your perception(s) of the potential for student success in first-year algebra? If so, why and how?

9. Summarize the involvement you have had with our students while using or following the use of *Destination Math.*

10. Based on your knowledge and experience with *Destination Math* what positive changes do you see that that improve learning in your classroom?

11. If you were in charge of the implementation of *Destination Math* in the District, what would you do?

12. What are some underlying factors that contribute to a successful implementation of an intervention program?

13. Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?

14. Would you like to share anything else?

Appendix D

Gender of Participants by Group

Appendix D

Gender of Participants by Group

Group		Male	Female	Total
Y02	Count	255	280	535
	%	47.7%	52.3%	100.0%
Y03	Count	215	241	456
	%	47.1%	52.9%	100.0%
Y04	Count	211	250	461
		45.8%	54.2%	100.0%
Total	Count	681	771	1452
	%	46.9%	53.1%	100.0%

Appendix E

Grade Level of Participants by Group

Appendix E

Grade Level of Participants by Group

Group		7^{th} grade	8^{th} grade	Total
Y02	Count	322	213	535
	%	60.20%	39.80%	
Y03	Count	265	191	456
	%	58.10%	41.90%	
Y04	Count	288	172	460
	%	62.60%	37.40%	
Total	Count	875	576	1451
	%	60.30%	39.70%	

Appendix F

Parent Education of Participants by Group

Appendix F

Parent Education of Participants by Group

Group		high school	some college	college grad	grad school	unknown
Y02	Count	119	195	137	84	
	%	22.20%	13.40%	9.40%	5.80%	
Y03	Count	102	165	115	74	
	%	22.40%	11.40%	7.90%	5.10%	
Y04	Count	102	155	129	72	3
	%	22.10%	10.70%	8.90%	5.00%	0.20%
Total	Count	323	515	381	230	3
	%	22.20%	35.50%	26.20%	15.80%	0.20%

Appendix G

Gate Status of Participants by Group

Appendix G

Gate Status of Participants by Group

Group		not gate	gate	gate qualified	Total
Y02	Count	506	27	2	535
	%	94.6%	5.0%	0.4%	
Y03	Count	431	23	2	456
	%	94.5%	5.0%	0.4%	
Y04	Count	427	29	5	461
	%	92.6%	6.3%	1.1%	
Total	Count	1364	79	9	1452
	%	93.9%	5.4%	0.6%	

Appendix H

Disability Status of Participants by Group

Appendix H

Disability Status of Participants by Group

Group		DHH	language	learning	autism	other	Total
Y02	Count	4	3	4		1	12
	%	33.3%	25.0%	33.3%		8.3%	
Y03	Count	4	2	4			10
	%	40.0%	20.0%	40.0%			
Y04	Count	3	1	5	1		10
	%	30.0%	10.0%	50.0%	10.0%		
Total	Count	11	6	13	1	1	32
	%	34.4%	18.8%	40.6%	3.1%	3.1%	

Appendix I

Placement of Participants by Group

Appendix I

Placement of Participants by Group

Group		none	RSP	Other	total
Y02	Count	3	4	4	11
	%	27.3%	36.4%	36.4%	
Y03	Count	3	4	4	11
	%	27.3%	36.4%	36.4%	
Y04	Count	2	5	3	10
	%	20.0%	50.0%	30.0%	
Total	Count	8	13	11	32
	%	25.0%	40.6%	34.4%	

Appendix J

Subsidized Lunch Status of Participants by Group

Appendix J

Subsidized Lunch Status of Participants by Group

Group		no subsidy	subsidy	Total
Y02	Count	401	134	535
	%	75.0%	25.0%	
Y03	Count	334	122	456
	%	73.2%	26.8%	
Y04	Count	340	121	461
	%	73.8%	26.2%	
Total	Count	1075	377	1452
	%	74.0%	26.0%	

Appendix K

Home Language of Participants by Group

Appendix K

Home Language of Participants by Group

		English	Spanish	Cantonese	Mandarin	Japanese	Tagalog	Arabic	Farsi	Other
Y02	Count	406	70	14	23	1	6	5	1	4
	%	75.9%	13.1%	2.6%	4.3%	0.2%	1.1%	0.9%	0.2%	0.7%
Y03	Count	333	64	14	23	1	6	5	1	4
	%	73.0%	14.0%	3.1%	5.0%	0.2%	1.3%	1.1%	0.2%	0.9%
Y04	Count	332	72	13	18		7	6	1	6
	%	72.0%	15.6%	2.8%	3.9%		1.5%	1.3%	0.2%	1.3%
Total	Count	1071	206	41	64	2	19	16	3	14
	%	73.8%	14.2%	2.8%	4.4%	0.1%	1.3%	1.1%	0.2%	1.0%

Appendix L

Ethnicity of Participants by Group

Appendix L

Ethnicity of Participants by Group

Group		blank	Asian	Pac-Islander	Filipino	Hispanic	Black	White	Other	Total
Y02	Count	1	66	2	17	224	27	195	3	535
	%	0.2%	12.3%	0.4%	3.2%	41.9%	5.0%	36.4%	0.6%	
Y03	Count	1	66	2	15	193	21	155	3	456
	%	0.2%	14.5%	0.4%	3.3%	42.3%	4.6%	34.0%	0.7%	
Y04	Count	2	52	3	21	193	21	160	9	461
	%	0.4%	11.3%	0.7%	4.6%	41.9%	4.6%	34.7%	2.0%	
Total	Count	4	184	7	53	610	69	510	15	1452
	%	0.3%	12.7%	0.5%	3.7%	42.0%	4.8%	35.1%	1.0%	

"blank refers to the frequencies and percentages for participants who had no race identified.

Appendix M

Lep/Fep Frequencies Across Groups

Appendix M

Lep/Fep Frequencies Across Groups

Group		immersion	mainstream	other	Total
Y02	Count	9	22	53	84
	%	10.7%	26.2%	63.1%	
Y03	Count	9	21	50	80
	%	11.3%	26.3%	62.5%	
Y04	Count	3	36	61	100
	%	3.0%	36.0%	61.0%	
Total	Count	21	79	164	264
	%	8.0%	29.9%	62.1%	

Note: Immersion = structured English immersion, Mainstream = English language mainstream, other = other instructional setting.

Appendix N

Teachers of Participants by Group

Appendix N

Teachers of Participants by Group

Group		Teacher M	Teacher N	Teacher S	Total
Y02	Count	229	150	156	535
	%	42.8%	28.0%	29.2%	
Y03	Count	79	242	135	456
	%	17.3%	53.1%	29.6%	
Y04	Count	89	159	213	461
	%	19.3%	34.5%	46.2%	
Total	Count	397	551	504	1452
	%	27.3%	37.9%	34.7%	

Appendix O

Participant Exposure to *Destination Math* by Group

Appendix O

Participant Exposure to *Destination Math* by Group

Group		seldom	occasional	often	Total
Y02	Count	535			535
Y03	Count		456		456
Y04	Count			461	461
Total	Count	535	456	461	1452
	%	36.8%	31.4%	31.7%	

Appendix P

CAT1SS Score Descriptives by Group

Appendix P

CAT1SS Score Descriptives by Group

Group	Mean	N	SD	Minimum	Maximum	SEM
Y02	680.6	535	37.2	570.0	820.0	1.6
Y03	681.5	456	39.0	570.0	820.0	1.8
Y04	681.1	461	37.3	498.0	820.0	1.7
Total	681.1	1452	37.8	498.0	820.0	1.0

Note: SD = standard deviation. SEM = standard error of the mean.

Appendix Q

Transcript of Interview with teacher "Charlotte"

Appendix Q

Transcript of Interview with teacher "Charlotte"

1. **What is (are) your credential(s) and how long has it (they) been held?**

   I have a multiple-subject credential. I've had it for about 12 years.

   Interviewer: Have you always taught in California?

   Charlotte: Yes, I have.

2. **What subject(s) does (do) your credential(s) permit you to teach?**

   All subjects, plus I have a supplemental in English and social studies. Plus, I have enough units in math to be able to teach math.

   Interviewer: Very multi-faceted.

3. **How long have you taught first-year algebra?**

   This is my first year.

   Interviewer: Had you taught any math in the middle school before this year?

   Charlotte: Yes, I taught sixth grade last year.

   Interviewer: And what course was that in the sixth grade?

   Charlotte: It was science and math.

   Interviewer: And what algebra are you teaching this year?

   Charlotte: Algebra 1B.

   Interviewer: And that is actually the second semester of the first-year algebra course?

   Charlotte: Yes, it is.

GUIDED QUESTIONS

1. **When were you first introduced to *Destination Math* as an intervention tool for first-year algebra students?**

I was introduced to it last year as a sixth-grade teach. We had an in-service on *Destination Math* and we were showed how it can be used in the lab and to take our students over to the lab and to use it there to work through lessons and concepts.

Interviewer: Was that the in-service with James Rivet?

Charlotte: Yes, it was.

2. **Describe any other training you have received to use *Destination Math.***

As far as Riverdeep?

Interviewer: Um-hmmm.

Charlotte: We had that training with James Rivet, we had, oh, let me think, I've been to several school in-services where the teachers have shown it to us and taught us how to use it, how to sign our kids in, and how to log on.

Interviewer: Kind of the nuts and bolts of . . .

Charlotte: Yes.

Interviewer: That's good.

Charlotte: And there have been at least two or three of those in the last two years

3. **Describe your perception of the role of the teacher who uses *Destination Math* as an intervention tool in the classroom and in the lab.**

I think the role of the teacher becomes less of the teacher, as the program does the teaching, and you become a facilitator. I love how you can posit and say "look at this," "notice that." I think you just facilitate the learning rather than teaching.

Interviewer: Rather than lecturing, right?

Charlotte: Right. Yes, you're still teaching, but you're using the program.

Interviewer: So many people think of teaching as lecturing, because that's what so many of us have been used to.

4. **In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher?**

Sorry, are you talking about a lab as opposed to a classroom; or just at our school site?

Interviewer: I think possibly both. At this particular site, and also within the District at a site.

Charlotte: I think it's great to have it as a lab where your whole classroom can go in and use it. But I think it's even better that it's in our classrooms with a projector because I love using it as a teaching tool and not just as a lab experience where everybody is individually looking and learning, where you can use it to show everybody at the same time. I like it in my classroom very much.

5. **Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.**

I love how it takes these abstract ideas and it shows the kids in a more concrete way, it shows them through animation, it shows them through a media that they're used to (almost like a video game). They're used to seeing things like that and I think it really attracts them and their attention.

Interviewer: Finally we have a way of students' learning the way they like to play.

6. **Describe your use of *Destination Math* in a typical day and/or week.**

In a typical week, I use it in two different ways, and it just depends on how I feel, I suppose. Some weeks, I'll use *Destination Math* as an introduction to a new concept and we'll go through the program, the concept working through it that way. Sometimes I'll do the lessons and we'll be working and I'll see the kids are not quite grasping the lesson or the concept. I've exhausted the way I know to show them. So then I'll put Riverdeep and we'll go through it then and I hear "Oh." Sometimes when I've shown it as a preview, then I'm showing the kids after, a follow-up, it's really interesting to hear, the kids will say: "Yeah, but, on Riverdeep they did it this way. What were they doing when they did that?" And, I like that because they're very aware of different things, more than when I do it myself.

Interviewer: When you use it in the classroom, do you actually operate the computer or do you have a student advancing it? How do you do it?

Charlotte: I used to, when I first started, I did it. But my computer is in the far corner and I wasn't as pleased with the results as when I put a student there. Then I can roam and look, and I like that much better.

Interviewer: I also found that to be true. It was very difficult to stand and pause and start and so on and not be distracted from engaging the student. Students like to be in charge.

Charlotte: Definitely.

Interviewer: So, you would use it in the classroom. But what else might you do in the course of a day or a week, besides the classroom?

Charlotte: I could take the kids to the lab and have them all either redo a lesson that we've done on their own so they could work through the problems on their own as a review. Or through the worksheets that come with each lesson. Also, they can do a follow-up. Sometimes we do the follow-up lesson as an at-home assignment, a homework assignment.

Interviewer: The printed sheet?

Charlotte: Yes. They get to practice what they've learned.

Interviewer: When you're in the lab, there are two different kinds of exercises that you can through with students, one being all students on the same lesson, each at his or her own rate, but nevertheless on the same lesson. And there's another possibility of the pre-test/post-test, where students just zoom out on their own. Have you used both of those? Or do you tend to use one more than the other?

Charlotte: I have not.

Interviewer: So you've used all on the same lesson, which is fine, to reinforce your daily lesson.

Charlotte: I have sent . . . at our school we have kind of an intervention where, if a child fails a chapter test, they go take the tutorials in the lab on their own time and then they can take a test and I can use that grade instead of the failed grade. Actually, if they pass the test, we give them a "C," because we don't let anybody with a "C" retake the test so to make it fair they can earn up to a "C."

Interviewer: I see. So the students do that on their own time. Now that would be considered when during the day?

Charlotte: After school; and I think there is one morning a week that the lab is also open.

Interviewer: And, so after school, morning; can they do this at lunchtime?

Charlotte: I don't think they have anybody in the lab at lunch.

Interviewer: So this is teacher supervised?

Charlotte: Yes.

Interviewer: And the tutorials are back, the workouts actually from the *Destination Math* lesson?

Charlotte: Yes.

7. **Has the use of *Destination Math* altered your daily practice? If so, why and how?**

I don't know that it has altered my daily practice. Just that it gives me more options than the standard lecture, practice, work this out. It has given me more options in what I can do to present a lesson.

Interviewer: I think as you've described answers to previous questions, you've really have altered your practice more than you think.

Charlotte: I think you're right.

Interviewer: Because I think the mere fact that you would be using it to help introduce a lesson is certainly something different than you've ever done before.

Charlotte: That's true.

Interviewer: I think you've made more changes than you are even aware of.

8. **Has the use of *Destination Math* changed your perception(s) of the potential for student success in first-year algebra? If so, why and how?**

I think, yes. I have a few, in fact quite a few kids struggling and working hard and it feels like a foreign language to them and I think *Destination Math* is making it more comprehensible to the children. I think that even the opportunity to go to a lab and to work on their own—and what's really interesting, too, is that they can go home and pull *Destination* up on the internet and work, if they so desire. It has to be a really motivated student to do that, but the options are there. It is definitely a help to those who will use it.

Interviewer: So, students who would have thought in the past may not have been successful in algebra, do you feel they now have more of an opportunity to be successful?

Charlotte: I do. They do have more opportunity. Like I said, they have to be motivated to use, but it's there for them.

Interviewer: Because we do have in California, with the addition of algebra I as a graduation requirement, that all students need to pass algebra I to graduate—very different than what we had before. So we have in our class students of a great variety of abilities. And so you think this is something to address?

Charlotte: Yes.

Interviewer: When you have students in the lab, do you feel that very capable students have an opportunity to, through *Destination Math*, to explore other topics also.

Charlotte: I think the opportunity is there. I have not done that yet. But, yes, the opportunity is definitely there for them to go fly with whatever they're interested in.

Interviewer: One of the things in the spring, with the Golden State Exams, we often find that in the regular classes we don't have an opportunity to present all the topics covered. Do you think this might be a time when you could point out those topics to more capable students, for them to pursue?

Charlotte: I think that would be a great use of *Destination Math.*

Interviewer: Bringing it more from the intervention to some enrichment.

9. **Summarize the involvement you have had with your students while using or following the use of *Destination Math*, how you would interact with students after that experience?**

Like in my classroom, when I've used it, I notice that we can talk about what we saw, what we did, I can bring it up in the teaching ("Remember when the car went from here to here, and that was showing you the hypotenuse, or whatever?"). It brings a visual into their minds and I like it a lot.

Interviewer: There's a lot of reinforcement there. And another commonality of experience with you and the student.

10. **Based on your knowledge and experience with *Destination Math*, what positive changes do you see that improve learning in your classroom? Have you seen that actually improve learning in your classroom?**

I believe it does improve the learning. As I said before, I think it makes algebra a little more concrete, it takes them at their interest level, it's definitely more interesting than I am, more entertaining.

Interviewer: We hate to admit that, don't we?

Charlotte: It's more entertaining, it's . . . I find the kids are very focused when it's on. Besides the worksheets, we keep a piece of paper and we'll pause it, you try it now, work it out. We get a consensus, the answer, because it's all for one. If anybody else has that answer, and half of us have it, let's try that one. If half of us are wrong, let's back and do that again and see what we did wrong.

Interviewer: So you have the student's worksheet and then you have the guide sheet, plus you have student worksheet where they try things. I see. So students are actively engaged in paper and pencil, as well.

11. **If you were in charge of the implementation of *Destination Math* in the District, what would you do?**

Cry. Gosh, I don't know. I would do pretty much like what has been done here. Make sure that the teachers knew how to use it, make sure that it was accessible in their classrooms, make sure they know how to help the students access it at school and at home. I think it's been implemented very well here.

Interviewer: In terms of the implementation at the present time in the District, you're comfortable with what's being asked of you and the steps that have been taken to make it possible for teachers to use *Destination Math*?

Charlotte: Yes.

Interviewer: Is there something that you can think of that teachers in the classroom or in the lab need as support from the District that we don't have at this time? Anything, if we were able to ask the District for additional support in any way, anything that could think of?

Charlotte: I think we're very well supported now. I really can't think of anything offhand. I like having, even a day like to today, when a sub is provided to plan lessons incorporating the Riverdeep and other technologies into lessons, to actually have a day to plan that. That's awesome. That would be a great thing for all teachers to be able to have a day just to plan.

Interviewer: To have that built into the teaching schedule.

12. **What are some underlying factors that contribute to a successful implementation of an intervention program?**

    I think the teachers have to believe that it really can work, that it would actually benefit students. We're under a lot of time constraints as far as benchmarks and testing and cover this much material in this amount of time. I know it's been difficult for myself, because I feel the pressure. I need to keep moving and if I stop and review with this, then what am I missing? I think you have to believe that it's worth the time you spend on it. I think that one of the underlying, very important factors—that you believe that it works, and that's worth the time it takes. Because time is precious.

    Interviewer: Interesting.

13. **Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?**

    I think it will have a positive affect on them. It will help those who are struggling to be able to really understand the concepts there. It think it will help those who get it to really deepen their understanding. I think overall it's going to have a positive effect on their understanding and their scores and their overall concept of algebra.

14. **Would you like to share anything else?**

    No, I can't think of anything else.

Interviewer: I really want to thank you so much for participating in this study and consenting to give this interview today. I know it has taken time, and I just wanted to reinforce that I believe that your comments and your opinions are most valuable. It is because of teachers like you who take the time to work with students and to try new things that we begin to find those programs that work best for students. So I really want to thank you again for doing this.

Charlotte: Sure.

Appendix R

Transcript of Interview with "Corinne"

Appendix R

Transcript of Interview with "Corinne"

1. **What is (are) your credential(s) and how long has it (they) been held?**
   I have a multiple-subject credential, K through 6 actually, and I've had that credential for seven years.

2. **What subject(s) does (do) your credential(s) permit you to teach?**

   That's a different question, because I was going to say I don't actually have a supplement in math, but I have enough units in math that I can teach math and other elementary subjects.

3. **How long have you (taught first-year algebra) been teaching math?**

   Well, since I started here at Sierra Vista six years ago, I was teaching sixth grade for four years, math and science. And then, that was sixth-grade math out of the Glencoe book; the last two years I switched over to algebra 1A with math 7, and then this year I moved to algebra 1B and I have pre-algebra.

   Interviewer: I see. So you have a full day of algebra, six periods.

   Corinne: Well, I have four of pre-algebra, two of algebra 1B.

   Interviewer: And, so, it's a real algebra curriculum.

GUIDED QUESTIONS

1. **When were you first introduced to *Destination Math* as an intervention tool for first-year algebra students?**

   Last year . . . I suppose first introduced a couple years ago . . . but, last year we started having the people from *Destination Math* come to our school and teachers here that were already using it were getting excited about it so they were trying to show us.

   Interviewer: So the training, then, that you've had has been both provided by the company . . .

2. **Describe the training you have received to use *Destination Math.***

   . . . and by the District, too. And by Glenco; I think, also, Glenco sent a representative here to show how it corresponded with *Destination Math.*

Interviewer: And have you also had your own teachers at this site doing in-services to help other teachers with the nuts and bolts?

Corinne: Yes, our Principal, Bob Sharvis (spelling?), has allowed for a substitute in a room for Cases (a person? spelling?), in general, she's sort of our expert here, on-site, and she's gone into our room and done the demonstrations. And then we've received the, what are they called? I call them overhead . . .

Interviewer: . . . the projectors?

Corinne: Yes. The ones hanging from the ceiling, the ceiling projectors, I guess. And she's shown us how to use that actually in our classroom, so we don't have to necessarily take the kids to the computer lab, although that's beneficial for them as well. But, sometimes if there are just a few students who aren't understanding the way we're teaching it, it's just another way that it can be taught. So it's real useful to be able to have that on the screen and we can do it as a whole class.

Interviewer: And without making plans a week ahead to get a projector.

Corinne: To find, right, to find it to be booked, or the computer lab. That, too. Because sometimes you schedule . . . that's some of the problems I've encountered . . . maybe I'll schedule this week for one day next week, but maybe that's not where we are. So then I have to backtrack.

3. **Describe your perception of the role of the teacher who uses *Destination Math* as an intervention tool in the classroom and in the lab.**

Well, I think the role of the teacher is instrumental at first, certainly to introduce the student to what might be very new to them. Because I'm teaching eighth grade this year, most of these students have already been exposed to it, so they already know how to log on and things like that. When you say first-year algebra teachers, see, that would have actually applied to me better last year because I was teaching the first-year algebra class. And so, for that I thought it was very important because most students hadn't logged on, most students weren't familiar with *Destination Math* and, so, . . . and just the whole computer thing. Some students are very used to the traditional way of teaching where they work with paper and pencil. And it's a little more difficult for them. And, yet, others, where the paper and pencil was very difficult for them, they seem to have grasped the computer much better. Because it's sort of like a video game and the kids are exposed to that and they already like that.

Did I answer that question?

Interviewer: You sure did. If we would just expand that a little bit: How does the teacher function when the class is in the lab? What is the teacher's function during that time?

Corinne: Well, it can be as a disciplinarian, because often times the kids will try to just skip through it, you know, those kids. And so, I think that just more or less just walking around and monitoring their progress . . . maybe if there's something that . . . I always present a black-line master to them. I like that better than having them just go through the tutorial and doing the worksheet. I like a black-line master. So, if I have an answer key of the black-line master, I can actually walk around and see how they're progressing on their black-line master. If I see that they're getting something wrong, I can tell them to go back to this. And, then, if I can see that there are several people that are getting things wrong, that same question or something, I can go back and review that.

Interviewer: That's good.

4. **In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher? Now that really is a two-prong question: Here at this school site there's the use in the lab and in the classroom; and then there's the use at this site versus at another school. So how would you think that the site location influences the role of the teacher?**

I think I'm not understanding the question.

Interviewer: OK, would it make a difference if you were at one of the other schools versus at this school in your use of *Destination Math*? Maybe you don't know that, but do you think there would be?

Corinne: Well, it might be based on the type of population that we're talking about. But, I'm not sure if . . . I'm thinking, like a lower socioeconomic area. Is that . . . that could be a factor.

Interviewer: I don't have a predetermined answer. That could be very . . . well, for instance, if this school site, I understand there are students who can log on to this at their home computers.

Corinne: Correct. We have a lot of students who can.

Interviewer: Would that be different at another school site in the District?

Corinne: Probably so, if children were a lower socioeconomic level and couldn't afford computers at home. Although I suppose everyone has access to a public library, but I think that the motivation would not be there. In fact, when I first introduced Glenco, I don't take the kids . . . I mean, I'm sorry, Glenco and *Destination Math* both, we do them both. When I introduce . . . first of all, to them, expose them, I do it in my classroom and I write down where the web site is and maybe a week will go by and I'll notice that very few of my 196 students have even checked out that web site. So I think that they're not necessarily motivated to do that. You know, here they're a captive audience.

Interviewer: Is the role of the teacher different when using it in the classroom versus when using it in the lab?

Corinne: Yes, I think so, because I think that when they're using it in the lab it's simply a tutorial that they're being taught by the little alien guy . . .

Interviewer: Digit.

Corinne: Digit! I was thinking "Ditto." And I think when I'm teaching, I'm using the light board to show them examples, I'm using the overhead to show them notes, and I'm trying to incorporate that to reinforce. So, it's more me reinforcing and slipping it in where I think it needs to be inserted. They're just getting the whole general thing in the lab. And there's no emphasis on what's important for them in the lab, I think.

Interviewer: So the teacher, then, has a role in focusing . . .

Corinne: In emphasizing . . .

Interviewer: In emphasizing and focusing.

Corinne: Sure.

5. **Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.**

Interviewer did not ask this question.

6. **Describe your use of *Destination Math* in a typical day and/or week.**

Let's not go with the typical day, because I don't always use it daily. But in a typical week I might go to the lab one time a week and I would use the black-line master and have them do something. I would . . . I sometimes use it to introduce a new lesson that I think it's kind of boring to teach, because that'll spruce it up a bit. I will most often use it as reinforcement for something that

I think that they're having a difficult time with. So, if I'm collecting a homework assignment and there are just still so many students that I think are having difficulty grasping stuff, then I'll go to the lab to help them learn it maybe another way. I'm not so vain that I think I'm the only person that can teach them. You know, Digit can teach them as well.

Interviewer: A multiple representation.

Corinne: Right. Sure.

7. **Has the use of *Destination Math* altered your daily practice? If so, why and how?**

Yes, I think it has because it's yet another mode of teaching. It's not . . . it's . . .

Interviewer: . . . an option?

Corinne: Right. It's not as though I always just do book problems and then only do worksheets, but sometimes it seems like it just is so monotonous and routine in math that it allows for another option. Sure. And so that has changed.

Interviewer: When you have your students in the lab, do you also have them with the blank piece of paper to work out other problems, as well as the black-line master.

Corinne: I haven't always suggested that but, boy, that is the way to go because they end of up making a mess in doing their own calculations all over it. That's a good idea. No, I have not always done that, but that's a good idea.

Interviewer: It's a possibility, hmmm?

Corinne: Right.

8. **Has the use of *Destination Math* changed your perception(s) of the potential for student success in first-year algebra? If so, why and how?**

Yes, certainly, because I thought that, originally, when I was teaching algebra 1A last year, I thought that maybe they were too young for the majority of them to be grasping this . . . the majority of seventh-grade students. But I think, when presented with another option that they can be successful at, they can grasp this and . . . . For me, so often homework was such a viable, important source of their grade, and I don't think I was emphasizing enough the class work that was going into it. And, so, if we're working on this in lab, that can be a class-work grade that isn't just those students who end up loosing their homework on a daily basis and quiz and test poorly, so I could incorporate yet another grade for me. So I felt that that was better and could make more people successful.

<u>Interviewer</u>: Interesting.

9. **Summarize the involvement you have had with your students while using or following the use of *Destination Math*. What about the interaction that you have with students?**

Well, clearly when I'm doing it in the classroom, there's much more interaction because the kids will interrupt—and I allow that; I have a pretty high noise level. I'm OK with that as long as we're on-task. And so I feel that that can be guided better when it's in the classroom. When it's there, I'm just really walking around monitoring and assuming that there's no wrong problems on their black-line master that I need to correct, I'm really, more or less, just walking around and, if they have a question, I'm able to answer it. So, I think that my . . .

<u>Interviewer</u>: So you're facilitating in that regard?

Corinne: Right. I loose track of the question . . .

<u>Interviewer</u>: This was the involvement you have with your students.

Corinne: I think more involvement, more interaction when it's in my classroom than I do at the lab.

10. **Based on your knowledge and experience with *Destination Math*, what positive changes do you see that improve learning in your classroom?**

Yes, I do. Do I have to expand on that?

<u>Interviewer</u>: No.

It's simply "yes." I find it to be very good.

11. **If you were in charge of the implementation of *Destination Math* in the District, what would you do?**

Well, I am the techno-peasant of the math people that you're dealing with right now, so the thought of implementing it is just so-oo-oo scary. I guess . . . you mean if I was in charge of bringing it to a new school, what would I do?

<u>Interviewer</u>: Yes.

Corinne: I would really try to align it, first of all, with the textbook and find out . . . because that was what was frightening to me. It was overwhelming for me to try to know where we are in the lesson and try to find what course, and what was too simple, and . . . and we have Glencoe and so Glencoe sent a representative out here and we have sort of aligned it. So it's so convenient for us, now, to be able to . . .

Interviewer: And I know James Rivet also sent that, so we do have that alignment.

Corinne: Who is he? Is he from *Destination Math*?

Interviewer: He's the educational consultant from Riverdeep.

Corinne: OK. So he's who did it.

Interviewer: That's right.

Corinne: And I found that to be so incredibly helpful.

Interviewer: So that could be on the top of the list of what's introduced.

Corinne: That would be my top of the list, yes. And then maybe just walk through it, first of all, not taking them into the lab, because they need to know lab etiquette. We have an overhead of the screen, a sign-in sheet of the screen that the kids will see. So we handed them that and we had them bring their ID cards and we had them fill that out so that when they saw the screen, we talked through it. Now that we have the computer thing, the projection, in our classroom, it's much easier to do that because they'll be familiar with what they'll see before they go there.

I would say those are the two most important things: the textbook alignment and how to sign on and all the etiquette that's involved with the lab so there's not, not just stealing mouse balls and things like that.

12. What are some underlying factors that contribute to a successful implementation of an intervention program?

I'm sure there are. Unrelated to Riverdeep, I just think parent support is huge. That would be most on my list. The kids that I have that are failing are failing because they don't turn in work. It's not because they're not bright, and they're not capable. But, that's probably unrelated to what you want.

Interviewer: No. I think it's probably related in some way. What about teacher attitude?

Corinne: Oh, sure. If you're excited about something, then they're excited, of course. In fact, my kids, I always go: "Oh, you're gonna love this today." And they say: "Ach, you think everything is exciting." But, yes, if it's something you enjoy doing and you think it's fun . . . if it's something you tell them right off the bat it's going to be hard and you're going to hate this, well they are going to hate it.

Interviewer: Is there anything that you see as additional support that is needed from the District at this time with our *Destination Math* implementation?

Corinne: No, I don't think so. I think we have everything that we need to be able to use it successfully, both in the classroom and in the computer lab. Although it would really be nice if we had new IMACs or IBMs to run it. They're a little slow; we have kind of dinosaurs in our computer lab.

Interviewer: Especially with 35 students at a time.

Corinne: Right. And, also, we don't have enough.

Interviewer: Oh. How many do you . . . do you have 35 stations?

Corinne: You know, I'm not sure, but I don't think so. I think there are about 28, and sometimes some are not operational. Then you have to pair up and then you have to have the splitters. You know. It would be nice if we had a nice . . . like next door Mr. Phifer has IMACs and it's a nice computer lab. Ours is a little prehistoric.

Interviewer: Now, when you say "next door," who . . .

Corinne: Next door here. Mr. Phifer has a computer lab, has computers.

Interviewer: That's for whom? For which students?

Corinne: For elective students that have computers as an elective.

Interviewer: There's a separate lab that students use for other courses, and then there's a lab in which students learn how to use the computer.

Corinne: Right.

Interviewer: And I have a feeling that you got the computers that were old.

Corinne: The old ones. We got the dinosaurs.

Interviewer: I didn't understand that before.

13. Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?

Yes, I do. And, especially, if they have access to it at home and really try to, you know, try to research it and try to be excited about it themselves. And, maybe show their parents at home and have that kind of support.

Interviewer: In addition to the intervention, do you see capable students while in the lab being able to use this as an enrichment.

Corinne: Yes, more so than a learning experience because it would just . . . yes.

Interviewer: For instance, with the Golden State Exam that happens in the spring, often teachers don't get to some of those topics with all of the students. Might this be a place where those topics could be pointed out to students to go ahead? . . .

Corinne: It would be a great idea.

Interviewer: . . . and to pursue that?

14. Would you like to share anything else?

I can't think of anything.

Interviewer: Well, Corinne, I really want to thank you for your participation today. I know that you have used this program. Your comments and perceptions of this whole program are very important, and I want to thank you.

Appendix S

Transcript of Interview with Teacher "Donna"

Appendix S

Transcript of Interview with Teacher "Donna"

1. **What is (are) your credential(s) and how long has it (they) been held?**

   I have a clear credential that I've had for four years and I had an emergency credential for one year before that. I also have a Masters in school counseling, as well as a credential in school counseling.

2. **What subject(s) does (do) your credential(s) permit you to teach?**

   I have a multiple-subject credential.

3. **How long have you been teaching math?** (Interviewer changed question.)

   This is my fifth year teaching sixth-grade math.

   Interviewer: What course of study are you using?

   Donna: The Glencoe Book two or three, whatever it is.

   Interviewer: I see. That first or second course book?

   Donna: Yeah.

   Interviewer: Is there any pre-algebra that you're teaching to any sixth-grade students?

   Donna: It does have a little bit of pre-algebra in it, some solving equations throughout the book. Most of the lessons have some solving of equations. Then I do some pre-algebra stuff at the end of the year after testing to get them ready.

   Interviewer: I see. So your experience with *Destination Math*, then, is with sixth-grade students, as well as with the algebra.

   Donna: Yes, I do the seventh-period intervention program and have algebra 1A and 1B students in it.

   Interviewer: I see.

GUIDED QUESTIONS

1. **When were you first introduced to *Destination Math* as an intervention tool (for first-year algebra students)?**

We started using it for second semester last school year, so we started the math in March, once we got all the students referred and everything worked out. At the end of February, the beginning of March, we started that. So, since last March.

2. **Describe the training you have received to use *Destination Math.***

When we first started it, we had, I think we had somebody from *Destination Math* come and show us how to use it. Actually, I think when we first started it in the lab, we just learned how to use it. Then, a few months later, at the end of the school year, we had an in-service with all the math teachers teaching us how to use it. But I don't think they came before we actually started the intervention.

Interviewer: I see, so . . .

Donna: Somebody from Riverdeep came.

Interviewer: Right. So you were here when James Rivet came out from Riverdeep then.

Donna: Yes.

Interviewer: Now, have other teachers here at your own site provided some staff development or in-service for teachers?

Donna: Um-hmmm, yes. We had an all-day thing last year for all of the math teachers, using Riverdeep with James Rivet. And then we've had one or two other days when it was, like, an hour after school or something just to review with people how to use it.

Interviewer: Has anyone done model lessons for you using it?

Donna: Not for me. I've done model lessons for the other teachers, but I haven't had put-in from . . . just from what James showed us when he came out and things like that.

3. **Describe your perception of the role of the teacher who uses *Destination Math* as an intervention tool in the classroom and in the lab.**

I feel that the teacher, when using that program—well, depending on how you use it—if you use it in your classroom where you're running the computer, you're more guiding the students through the lesson and interacting with them and with the computer all at the same time. If you are in the lab, it's more of, OK, you're doing this lesson today and it's more self-directed for the students and less teacher involvement in it. So, I think it would depend on how you were doing it, doing the lesson.

Interviewer: When you use it in the classroom, are you actually operating the computer or do you have students doing that?

Donna: I usually operate the computer just because, if they're working on a problem, I want to wait until they finish it and I don't want the kid who's operating it to go on before everyone's ready.

4. **In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher? Now, this is really two questions: It's at this school site versus at another school site; and at this site in the lab or in the classroom. So we can look at that both ways.**

OK, I'm sorry can you . . .

Interviewer: **So in what ways do you think that the site location in which Destination Math is used influences the role of the teacher?**

Donna: Meaning, if you use it in your classroom, it's going to influence you differently than . . . . OK.

Well, as I was saying before, I think if you use it in your classroom, it changes the way that you teach it. If you're in the lab, it's more "go do it"; if it's in your room, the way you teach it is a lot more talking through it. While the computer pauses, you might interject your own things and that kind of thing. Is that what you mean?

Interviewer: That's fine. Sure. And also, on the other hand, how would using it in this school versus using it in another school in the District—would you think that the particularly school that you're at would influence the role of the teacher?

Donna: I don't know if I could really say, compared to another school. I'm not sure . . . .

Interviewer: And sometimes unless you have some first-hand information, you probably can't.

Donna: And I've never worked at a different school, so I don't know.

5. **Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.**

Like if it matches up and that kind of thing? Well, they gave us a chart showing how each lesson in the book matches a lesson in *Destination Math* and it's . . .

<u>Interviewer</u>: . . . the alignment.

Donna: Yes. It's exactly aligned with the algebra book that we use. So, it's really nice. And it's almost in the exact same order on the computer program as it is in the book, so that really is helpful for the teachers and the students in finding in what they are trying to teach with that lesson.

6. **Describe your use of *Destination Math* in a typical day and/or week.**

I usually use *Destination Math* about once a week, depending on what I'm getting to in the book. And, usually, when we start a new concept, we'll use it a lot more than when we get toward the end of something. And I might use it for one day for review at the end or something. But I usually take the kids to the computer lab and give them the worksheet that goes with the lesson and they run through the lesson themselves and then we'll go over it the next day. I usually do it, I teach the lesson one day and then the next day we'll go to the lab so that they can be reinforced with it in the lab. I have done a couple times where I'll use it as a pre-teaching tool and then teach it in my class the next day. I also have used it as a review. Like at the end of a chapter, I've had them do a practice test on the *Destination Math* test thing before we took the chapter test, you know, paper and pencil. So, quite a few different ways. And, in my classroom as well, depending on if the lab is booked or not, then I might just do the lesson out loud with them all.

7. **Has the use of *Destination Math* altered your daily practice? If so, why and how?**

I think it definitely has because it has given me more tools as how to show them different ways to do each concept. Because the way I might explain it might be a little bit different than the way that *Destination Math* explains it and maybe some kids will get it the way that the computer explains it. So, I think it definitely provides for multiple representation. It helps in that way as a teaching tool, just giving the kids more options to learn it and more reinforcement on one concept.

<u>Interviewer</u>: Provides that multiple representation.

8. Has the use of *Destination Math* changed your perception(s) of the potential for student success (in first-year algebra)? (If so, why and how?)

I think, you know, that it helps them to succeed because they are getting the extra reinforcement and we also have the lab open after school so that they can come in, if they need to, and redo a lesson. Or, if they're not getting it in class, they can do it in the lab or make things up, or come in for extra tutoring and kind of a thing. So, I think that helps them to succeed also.

Interviewer: Do you see more students succeeding as a result of having that *Destination Math*?

Donna: I would say "yes." It's hard to tell whether it is definitely from *Destination Math* or not, because I'm not using it exclusively. So, it's kind of hard to tell whether it's definitely from that. But they really like and it catches their attention, so I think . . .

Interviewer: Which is half the battle.

Interviewer: One of the implications, possibly, for the curriculum is in its presentation of the concepts. Do you find that that catches the students' attention?

Donna: Yes, definitely. Lots of color and visual things in the room are alien and they love that. So, I think it definitely catches their attention and helps them.

Interviewer: Its similarity to the video game.

Donna: Exactly.

Interviewer: Finally they learn the way they play.

9. Summarize the involvement you have had with our students while using or following the use of *Destination Math.*

If I'm teaching it in my classroom, I am a little more involved with them, talking them through things and kind of reiterating something that's said on the screen and helping them to figure out how to work out the problems. In the lab, I don't interact with them as much. It's more, if they have a question or some technical problem with the computers, that I'm interacting with them. Afterward, we go over it the next day and we talk about the concept that they learned and go over some things on the worksheet that they did along with the lesson for that day and kind of reinforce what they learned.

Interviewer: Are students more animated when they're using *Destination Math* in their involvement with you as a teacher?

Donna: Um-hmmm. Yes, I think so. They . . . it just really involves them mentally. They seem to be more involved in the lesson when they have that visual aid to look at.

10. Based on your knowledge and experience with *Destination Math*, what positive changes do you see that improve learning in your classroom?

I think so, yes. Just, you know, the kids really want to go to the lab and do the lessons. They really like them and they want to come after school and do extra practice on it and that kind of thing. So I think it's helped turn them on to math a little bit more, too.

Interviewer: How does what they do after school affect their grade in the class?

Donna: We have two different things that we use for after-school tutoring forum. If they're getting an "F" in their math class, they can come after school and do lessons on the computer lab and, hopefully, that increases their knowledge of the subject so that they start getting more in their class. The other thing that we do is, if they have failed a chapter test in their class, they can come and do all the lessons on the computer lab and retake the test, so that can improve their grade in their class because they're able to redo the test.

Interviewer: So, there's some motivation for coming to lab?

Donna: Yes.

Interviewer: Theoretically then, would you say that no student should really be more than one chapter behind as you go along.

Donna: Theoretically, yes. There are some things technically that are kind of difficult, like we don't usually start using the lab until at least the middle of October. We don't usually open it up until after back-to-school night, or even after parent conferences. So, it's like the middle of October. So, you may have gone through two—and the sixth-grade book may be even more like three chapters. And then, also, in the sixth-grade book, Chapter 1 and 2 in the sixth-grade book, barely anything is covered on *Destination Math*, but the rest of the chapters are covered very well. So that makes it a little difficult for them to make up a chapter if they can't study all of the things on it.

Interviewer: The way it's appropriate.

11. If you were in charge of the implementation of *Destination Math* in the District, what would you do?

I think, you know, more training for people who haven't used it before. The projector screens, or the LCD projectors that we got this year have been very helpful and for all math teachers, K through 12, to have those in their classrooms would be great.

Interviewer: Do you have them for all math teachers here?

Donna: Yes, all math teachers have one. Because they want us to be using the lab, they want it to be used everyday. If someone is in the lab everyday, then you can't use it. So you have to have the LCD projector to do it in your class, at least. So, that's been very helpful. Besides using *Destination Math*, I've been able to use PowerPoint also, or show them something on the internet on the projector also. So, it's really been helpful in more than one area, not just for my math class but my other subjects that I teach also.

Interviewer: Also, having the projector in the classroom, and not having to make arrangements to borrow it, would allow for some spontaneous use by teaches.

Donna: Yes. And that has happened a number of times with me also. So, like my overhead projector broke one day, so I couldn't put the notes on the overhead, so I just went over to my computer and typed them on Word and they copied them down as I was typing them. So, that has definitely been helpful having the projector in there. So, I think K-5 teachers would benefit from that also. Even if they couldn't get one for all the teachers, at least have some on-site for them to use. Train them how to use it and to use the programs that go with it, to use PowerPoint and all those things, because I think a lot of teachers don't know how to do it and are afraid of technology and just don't use it at all. But I think if somebody were to show them how to use and actually model something in their class like we did here this year, I think that would really help them to see: "Oh, the kids really like it and they're really interested in what's going on on the screen because they've got something to look it." You don't have to rewrite things; you've got problems on the screen already, you don't have to write them on the board. So you can be walking around the room instead of standing at the board, so I think it would be good to help all of the teachers, not just the algebra teachers, because the program goes down through lower math levels, also, and I think it would be helpful for . . .

Interviewer: It would be helpful now for preschool. . .

Donna: Yes.

Interviewer: . . . which is amazing.

Donna: And I know that the high schools are using it a lot more, and the junior highs are getting more into it this year. So, it's trickling down . . .

12. What are some underlying factors that contribute to a successful implementation of an intervention program?

Well, I think immediacy is a big thing, because, most of the time, when, as I was saying before, our intervention program doesn't start until the middle of October, six weeks of math or English is missed. And so the kids aren't getting help on that and have already missed six weeks. Or, if they get referred in the middle of the year, it still takes a couple weeks for the paperwork to get done and the parents to sign the letter. So I think immediacy is huge because, after two weeks go by, you could be on a whole new chapter.

Interviewer: Yes.

Donna: . . . and then they're lost.

Interviewer: So you would like to see this intervention program starting almost at once.

Donna: I think it would be much more helpful if we could start it a lot earlier.

Interviewer: Do you see any reason why you couldn't?

Donna: I don't think there's any reason we couldn't. Last year we had to, by hand, type in all the numbers of the students and that's why it took so long. And then this year, they uploaded all the numbers from the computer but they still didn't do it until October. And there's no reason that that couldn't be done earlier.

Interviewer: In other words, you would need enough (like from areas) to put all the students into the computer.

Donna: The other thing is, two weeks into school sometimes it's hard to tell who's really failing and who's just getting back into school mode. But, at least the lab could be open for kids even if they're not referred to be there as a mandatory thing. It could be open for kids to go who are struggling with the subject that they're on right now so that they don't miss a whole chapter or two by the time the lab is open.

13. Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?

I think it has helped some students. I think a lot of the kids that are in the intervention program after school—it's been really hard for us with the intervention program because we have so many different math classes coming in that it's hard to target certain things. For the overall school-wide success, I think it's helped to increase success school-wide just because it's reinforcing concepts and kids can go back and review things or go back and relearn things that they've already done and it keeps their interest and that kind of thing.

Interviewer: When your students come for intervention, then you have students from three or four different classes or courses in that same time. Is that what you're finding difficulty with?

Donna: Yes. That's been really difficult. We had sixth-grade math, seventh-grade math, pre-algebra, algebra 1A, algebra 1B. So we really had five different classes and there are 11 different teachers, so not everyone's in the same spot. So that's been kind of hard. So we took all the sixth graders out and they're doing just like paper-and-pencil tutoring with the teacher so that we can focus more on the algebra students. So, hopefully, that helps. We just recently did that in the last couple weeks. So, hopefully, that will start to help with that.

Interviewer: Is the intervention program set up so a student can come in and directly go into what that student needs, or does the student need to be directed by the teacher?

Donna: Well. Some of the kids come in knowing what they need to do because their teacher has told them or written it down for them or gone in and made an assignment for them in their class. But most of the kids come in not knowing what they're supposed to do and, so, we have to figure out where they are in the book, and what they've missed, and where they need to go. And then it's like individually telling each of them how to get there. So, we've kind of made a whole new program that we just started this week and we've got all the worksheets for algebra 1A and algebra 1B copied (like 20 copies of each one) and they just go into the little file folders and get out the worksheet for that day and they can follow what course module unit lesson to go to. That helps because they're able to find it themselves, rather than us having to tell them what to do.

Interviewer: Right.

Donna: So, that's helped a lot, too. And we've only been doing that a couple days now, but I can already see that it's making it a lot easier on us, that they know what they're supposed to do each day.

Interviewer: Having a little more structure for what the students would do to know where the student is would be helpful to you. With that kind of thing we could possibly get some help for you. I know that some things are happening at the high school so that when students walk in they know just where to go. So maybe we could get some of that information to you.

Donna: We do have the charts, the alignment with the book and Destination Math so that we know if they're in this chapter in the book this is where they go. But some of the kids—they're that lax that they don't know what they're studying. But, it's getting better. And the other thing is that teachers here not giving them the assignments to do or not telling them what they're supposed to be working on. So that's been kind of a struggle.

Interviewer: There has to be communication between teachers and the people in the lab

Donna: Some of the teachers do tell us.

Interviewer: Would even teachers letting you know on a Monday what sections they're covering that week, so that you would know if a student from Teacher 18 needs the sections.

Donna: And we've tried that. I've e-mailed them over and over asking for what their students should be working on and only a couple reply. That's been a struggle, but hopefully what we've started this week will work a lot better because the reason they're in there is because they're failing their math class so they've obviously missed what was going on at the beginning of the year anyway. So they're starting . . .

Interviewer: Sounds like.

Donna: . . . chapter 1 if they're in algebra 1A and they're going through each of the lessons. So even if they're in chapter 3 now, they're going back and relearning what they missed.

Interviewer: Which is very important.

Donna: Hopefully that can help them to catch up.

14. Would you like to share anything else?

No, I think that was very thorough.

Interviewer: I want to thank you, again, for participating today. Your comments are important.

Appendix T

Transcript of Interview with Teacher "Jennifer"

Appendix T

Transcript of Interview with Teacher "Jennifer"

1. **What is (are) your credential(s) and how long has it (they) been held?**

   I have a multiple-subject credential and I've had it now for three or four years. I've been teaching about six, this is my sixth year, on a preliminary credential.

2. **What subject(s) does (do) your credential(s) permit you to teach?**

   All of them, K through 8, any subject.

3. **How long have you taught first-year algebra?**

   This is my third year.

   Interviewer: Do you teach any other math courses also?

   Jennifer: I teach Math 7.

   Interviewer: Math 7 and first-year algebra.

   Jennifer: Yes.

GUIDED QUESTIONS

1. **When were you first introduced to *Destination Math* as an intervention tool for first-year algebra students?**

   It would be about a couple years ago.

2. **Describe the training you have received to use *Destination Math*.**

   Several in-services where representatives from the company have come in and shown us how to apply the program to our curriculum.

   Interviewer: Have there been other times when just teachers here at the school site have gotten together to go through the nuts and bolts of how you actually use it?

   Jennifer: Yes, that has happened as well—teachers who are more in charge of computer software have put together also in-services to further help us as well.

3. **Describe your perception of the role of the teacher who uses *Destination Math* as an intervention tool in the classroom and in the lab.**

   OK, I believe the role of the teacher with this program is to find the corresponding lesson in the *Destination Math* program to correlate with the lessons out of our math books. We could run off copies of the coordinating worksheets that go with the lesson from the *Destination Math* as well.

   <u>Interviewer</u>: How does the teacher actually perform while using *Destination Math*?

   Jennifer: Well, . . .

   <u>Interviewer</u>: Is it any different than how the teacher might act if the teacher weren't using *Destination Math*?

   Jennifer: Well, *Destination Math* sort of takes care of teaching the lessons for you, where the role of the teacher is more to emphasize what they are presenting and maybe clarify anything that may seem unclear to the students.

   <u>Interviewer</u>: Emphasizing clarification?

   Jennifer: Right.

4. **In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher? By site location, we could mean two different things: we could mean at this school site, whether you use it in the classroom or in the lab; and we could also mean in the District as a whole, this school versus the other schools.**

   I don't think I understand.

   <u>Interviewer</u>: To rephrase it: Do you think it would make a difference as to what school in the District, middle or high school, that you were assigned, as to what the role of the teacher would be in *Destination Math*? And, then, in your present school site, what is the role of the teacher in the classroom versus in the lab, when using it?

   Jennifer: You want to compare middle school to high school use?

   <u>Interviewer</u>: Not necessarily compare, but to talk about how it might differ from one school to another; and also how it differs even in the school depending on whether you're in the lab or classroom.

   Jennifer: OK. Well, here at this school we have the option now of using it in the classroom or going to a lab. I think having the opportunity of going to a lab is better in the sense in that each child can sit at a computer and work independently. Whereas, using it in the classroom, I can just use it to, say, present lessons, which also has its benefits because it really brings the lessons to life and it makes it more interesting than just having the kids hear my voice all period. I hate to admit that, but anytime there's a change, they like that. So I think that both of these . . . the difference is . . .I think also District-wide certain . . . like at this school I know a lot of students have computers at home where they're able to actually access the program from home as well. Where if I chose to, I could assign homework assignments for them to do at home, I'm not too sure that other schools in the District have students with those opportunities.

Interviewer: That's right. That's, I guess, another important consideration for us to have in mind.

5. **Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.**

Well, I think it closely relates. They've created a program that is tightly aligned with our curriculum, which makes it really nice for either presenting lessons or reinforcing them and, umm . . .

Interviewer: When you say that teachers go to sign the worksheets, it's not a difficult process to sign.

Jennifer: No, it's a very simple process because now we have a packet that shows us exactly which lesson corresponds to which lesson in the *Destination Math.* It makes it really, really simple.

Interviewer: You have the assignments.

Jennifer: Yes. It's clearly stated.

6. **Describe your use of *Destination Math* in a typical day and/or week.**

There are some days when I choose to use it to present my lessons. It has a really nice way of presenting vocabulary and showing realistic, fun examples for the kids to understand the concepts. And then there are other times when I'll take them into the lab as a reinforcement to go through the tutorials if I feel they need additional help or . . . . It's also a fun day for them because they love going, you know, they love working on the computers. So, sometimes it's a treat.

Interviewer: When you're using it in your classroom, do you actually operate the computer or do you have students doing that part of it?

Jennifer: I generally do it myself because that way it's easier for me to control when I want to move on, or if I want to go back and cover something. So I just find that it's easier for me to do it.

<u>*Interviewer*</u>: What grade level student are you typically working with with *Destination Math*?

Jennifer: This year, seventh grade.

<u>*Interviewer*</u>: Seventh grade.

Jennifer: Last year it was eighth grade.

7. **Has the use of *Destination Math* altered your daily practice? If so, why and how?**

I could say it has on the days that I choose to use it. It's another tool, like I had mentioned earlier, for me to present my lessons in a more colorful, interesting way. And, again, it's another resource to reinforce any concepts that, you know, I need to teach the kids.

<u>*Interviewer*</u>: A way to go back and not say it the same way.

Jennifer: Exactly, yes. Sometimes a second day, I'll teach them the first day and then the second day, again, I'll show it. And so it kind of reinforces what I had taught the previous day and gives it some reality, which is nice.

8. **Has the use of *Destination Math* changed your perception(s) of the potential for student success in first-year algebra? If so, why and how?**

I think so, because algebra can be so abstract that, I think, having this tool to bring it to a more realistic level for them is . . . it has to help them. I think it's making the concepts a little clearer and easier for them to grasp. Yeah, I think it's definitely making a difference.

<u>*Interviewer*</u>: In this age when all students are now required to pass algebra, we do have a different audience.

Jennifer: Right. Right.

9. **Summarize the involvement you have had with our students while using or following the use of *Destination Math*.**

What do you mean?

Interviewer: What kind of interaction would you have with your students after you use *Destination Math* either to present the lesson or in the lab?

Jennifer: Do you mean, like how do they feel about it?

Interviewer: Um-hmmm.

Jennifer: Oh, they love it. They think it's neat, they find it exciting, it's fun. I mean, just about every other day they're asking me if we're going to use the projector or go to the lab.

Interviewer: Do you find that there's more active participation, more interaction with more students as a result of this approach?

Jennifer: Yes, I believe there is more. I think it captivates their attention a lot longer, because there's always so much going on and it's colorful and fun and it does ask questions. So, I'll stop and have them work it out on paper, then we can go over it together. So, I think they really like it.

Interviewer: So, when you're using it in the classroom, students have a piece of paper that they can work problems on?

Jennifer: Right, they have a blank sheet of . . .

Interviewer: . . . it holds their attention . . .

Jennifer: They have a blank sheet of paper where they can work out problems as well as the corresponding worksheets that have them answer questions as we go through the lesson.

Interviewer: I see.

10. Based on your knowledge and experience with *Destination Math*, what positive changes do you see that improve learning in your classroom?

Can you repeat that?

Interviewer: Sure. Based on your knowledge and experience with *Destination Math*, do you see positive changes that actually improve learning in your classroom?

Jennifer: Yes, definitely I do. I see the kids more excited about the lessons, I see them more eager to pay attention and understand what's happening. I think it's a very positive thing.

11. If you were in charge of the implementation of *Destination Math* in the District, what would you do?

Hmmm. Well, I would make sure that everybody does have the overhead projectors that connect it to the computer so that we do have the option of using them to present lessons.

Interviewer: Is that something that you have here at this site now?

Jennifer: Yes, we have that here and we lived without, and now with, and it does make a big difference. Naturally, I'd make sure that there is a lab for all the students to go to and enough computers for everyone to be able to work on their own. I think it's an activity that's best done independently. And, that would be it, those are the main things that you really need.

12. What are some underlying factors that contribute to a successful implementation of an intervention program?

I think it's important that the teachers feel comfortable using the program. Otherwise, that would definitely keep them from trying. It's nice to have resources available in case, you know, something goes wrong or we're not sure what to do. I think they're important things that will encourage the teachers to keep trying and using it.

Interviewer: Do you have sufficient technical support at this site if you run into trouble?

Jennifer: I believe we do. Absolutely.

13. Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?

Well, I see it giving them an extra resource for supporting them in their learning. Even the days that it's not used in the classroom, they can still go after school and work on the program and work on the lessons that we're doing. They could also do it at home if they have access. So, it's really available anytime they need it. Definitely at the school, and again at home.

Interviewer: So you see that as a positive impact?

Jennifer: That's definitely very positive.

Interviewer: I understand that you have an intervention program that allows students to improve a test grade. Can you tell me about that?

Jennifer: Yes. If they fail a test given in class, we have the option of sending them to the computer lab where they can take the test provided by the *Destination Math.* Then we can use that as a second grade. And it does help because it takes them through a tutorial, they're sort of prepared and re-prepares them for the test again. And, so, that's been working out really nice, too.

Interviewer: Theoretically, then, if students take advantage of that, you should never have a student who is more than one chapter behind?

Jennifer: Right. Exactly. And they should all technically be able to somewhat pass or come close because the tests are a big part of a grade and they are able to retake them and get the additional help that they need. Their grades are definitely going to improve as a result.

Interviewer: And by allowing them to improve the grades, certainly gives motivation to go into the intervention.

Jennifer: Right. Exactly.

14. Would you like to share anything else?

Well, I'm glad that we have a District that supports us and does its very best to provide us with everything that we need to better educate our students. I feel very supported and like the program very much.

Interviewer: I really want to thank you again for taking time to come today, because I know that you are anxiously awaiting the birth of your child and it is very special that you would come to do this.

Appendix U

Transcript of Interview with Teacher "Kerry"

Appendix U

Transcript of Interview with Teacher "Kerry"

1. **What is (are) your credential(s) and how long has it (they) been held?**

   My credentials . . . I have a clear credential K through 8 elementary with a supplementary in mathematics and I've been teaching junior high, sixth through eighth grade, for 13 years.

2. **What subject(s) does (do) your credential(s) permit you to teach?**

   Kindergarten through eighth grade.

   Interviewer: All supplemental in math?

   Kerry: Yes, plus all subjects.

3. **How long have you taught first-year algebra?**

   Probably 11 years out of the 13.

GUIDED QUESTIONS

1. **When were you first introduced to *Destination Math* as an intervention tool for first-year algebra students?**

   I believe it's three years ago when I was introduced to the District and I was invited to one of the very first meetings.

2. **Describe the training you have received to use *Destination Math*.**

   We've had several, I don't know the exact number, three to four groups, planning sessions, in-services. I've also had some individual instruction from mentor-teachers, as well as self-exploration on the program itself.

   Interviewer: Did you receive training from a representative of the Riverdeep company itself.

   Kerry: Yes.

3. **Describe your perception of the role of the teacher who uses *Destination Math* as an intervention tool in the classroom and in the lab.**
Role of the teacher how to use it?

Interviewer: Yes.

Kerry: I think it's important for the teacher to be comfortable of the program itself, know all of the aspects of it. Allow the students the instructional kind of view of it, the mechanisms such as how to work the assignment button that leads you directly to an assignment, as well as showing the student the different course levels, manipulate the modules and the unit buttons. I think that it's important for the students to track themselves as well, to help develop all the different recording buttons down at the bottom, such as the "play" and the "pause" and the different tools that are available, because there is a calculator available, along with a glossary dictionary. I think that it's important that the students feel really comfortable using the test part because, for a junior high student to transfer information from a scratch paper onto a keyboard to answer a question, is quite a transitional thing that they need to feel real comfortable with.

Interviewer: Interesting. Is there a difference in the role of the teacher who uses it in the lab and the role of the teacher who uses it in the classroom.

Kerry: Yes. I think in the classroom, even if you had one student or two students sitting at a computer screen doing the actual manipulation for you as you speak to the rest of the class, that is a total different experience than the child exploring it themselves individually. There is a whole different management environment when you have 32 little bodies trying to do all the same thing and keeping on track with a patience level. At this stage, the students know enough technology to jump ahead of you and it's important that they stay with the instruction. So, in the lab you really have to train them thoroughly to become independent later, not to become independent at the moment and explore. So, that takes a little bit. It is helpful with the overhead projectors because they can follow along and experience . . .

(Tape ended at this point; interviewer went to different part of tape and resumed interview)

Interviewer: We're talking about the perception of the role of the teacher using *Destination Math* in the lab and in the classroom; and what I'm wondering is, does the teacher's role take on a different meaning in the classroom versus in the lab where you were talking about your teaching the student how to access the program and the nuts and bolts of using it. How would the teacher use *Destination Math* while giving instruction in the classroom?

Kerry: I think that in the classroom itself it can be used as an introductory tool. I've used it as, you know, introduction to a lesson where the students haven't actually studied that concept yet and later the next day or several days teach from the book and they go: "Oh, that's what that was talking about." It all comes together. And I've also used it as a review tool, after we've processed the book and I feel the students are ready to move on, it gives a quick double check or an extra day review of the concept. I think it's important for them to see how it changes and manipulates with their own individual help. In the lab it can be a little more independent on the student's part. That's why in the classroom they're still relying on the teacher to guide them. But I don't know that there are benefits, one is better than the other, or . . .

Interviewer: Or both are beneficial?

Kerry: Yes. They are different ways of using it.

Interviewer: If you were using it in the classroom, would you be actually on the computer or would you have a student at the computer?

Kerry: When I first started out, I was on the computer to show them how everything moved and changed. But I gradually brought in other students who felt confident or wanted to try to work it as I gave verbal directions. And, then, right after that we gave everybody a chance because that seemed to spark interest where "let me try, let me try" happened.

Interviewer: If that allowed you to step away from the computer and to interact with students?

Kerry: Right.

Interviewer: When you use the *Destination Math* either in the lab or the classroom, do you have students with a blank piece of paper so they can work problems on paper as well as just responding on the computer? . . . that they have a chance to actually work through a solution if they think they need to?

Kerry: I try never to have the students working without the worksheets that go along with the Riverdeep, whether they're independent in the lab or as a collection group. They always have the worksheet that correlates because, if not, they tend to wander in their thinking or in their understanding. It kind of helps them lock in to listen to what they need to fill in. And then the back part I've assigned is the homework, the "your turn," that's their time. They take the practice and they go home and work on it.

Interviewer: Is there enough room on those sheets for students to work problems themselves, or do they need another sheet? Do you find it helpful for them to have an extra piece of paper to work on?

Kerry: Yes, they usually have scratch paper or something to work on.

Interviewer: To help organize.

Kerry: Right. Yes.

4. **In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher? Now, this is two part: By site location it could be here in your school. The site could be in the classroom and in the lab. Or, on the other hand, the site could be this school versus another school in the District. So, how would you think, or in what ways would you think that the site location would influence the role of the teacher? Or would it be the same in all sites?**

   Umm. I think that depends on the teacher and how much they put emphasis. Because someone who thinks that this is vitally important and, you know, is great and is serious about it . . . that's contagious to the students. Students find the importance and the usefulness of it as to a teacher who doesn't give it much time, there's not going to be much effort on the students' parts either. So I think it's like any tool—as much as you put into it, you also get from it, of course. And usage. If I don't have my students in there once every two weeks at least, my students tend to forget. Where was I? How do I log in again? So, it's a consistent type thing that needs to be practiced as well.

   Interviewer: Just like they forget the content, they forget the delivery.

5. **Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.**

   The implication of . . . ?

   Interviewer: *Destination Math* for the curriculum. Would there be any ways that you can think that *Destination Math* would have the implication of using the program on the curriculum itself.

   Kerry: I think it's great that it already corresponds with our algebra book. There are some holes in that where I've had to go back through and find a topic that's not in course one or course two of the algebra, but located certain subjects in course four, course five, even course three.

   Interviewer: Pre-algebra sometimes.

Kerry: It would help if there were some kind of index, if Riverdeep had some kind of index because not always is it called one thing in a textbook and referred to another thing in the program and that's a little hard to find.

Interviewer: We do now have that alignment that they gave us with our textbooks. If you don't have one of those, I'll see that you get it because that does help a little bit. But, you're right. An index would be a nice additional tool.

Kerry: I think it would be user-friendly for the teachers that are a little leery, not sure if they have time to hunt and peck and maybe I'm not looking right and I'm missing it. They need something exact that could take them right to that location.

6. Describe your use of *Destination Math* in a typical day and/or week.

Typical day or a week?

Interviewer: And/or a week.

Kerry: A new concept in the 1A or 1B takes place about once a week. We spend about four days or so on a particular lesson because it is supposed to be drawn out. So I would use it as introductory to that. But that's only a small portion, sometimes it's only 10 or 15 minutes long. But to actually write an assignment for the students to take them into the lab they would have the whole class period, after already knowing how to work all of this, to explore it, to answer the questions, to complete the worksheets. Depending on how long the lesson is, sometimes we have to go on a second day into the lab for them to finish it. Then I usually give them two or three days to process all that and then write a test for them to take.

Interviewer: And do they take this using *Destination Math* in the lab?

Kerry: Right. And we've also developed this year that the algebra . . . every chapter has a test so if a child fails their teacher's test they can go into *Destination Math*, tutor themselves two or three days, and on Thursday try to retake that test on the computer using the *Destination* test.

Interviewer: And do they get a grade boost with that?

Kerry: They do. We left it up to the individual style of the teacher. Some teachers take it at face value; some allow the student, like a coupon, to give them another chance to take their own personal test; and some of them average the classroom test and the *Destination* test. So, we let that to the individual styles right now.

Interviewer: But there is motivation for the student to go to intervention.

Kerry: Right. Right. There definitely is an improvement, to some degree, in the grade.

7. **Has the use of *Destination Math* altered your daily practice? If so, why and how?**

Changed my daily practice?

Interviewer: Picture yourself in your classroom two years ago without *Destination Math* versus now, with *Destination Math.*

Kerry: Oh, yes. I think probably in a lot of the graphing things, instead of drawing it out on a light board a million times, the coordinate plane, it's easy to flash the coordinate plane up there on the light board and just use the reflection of the picture with my markers. It's made my life easier that way. I definitely think it shows attention span of our children today, where they need something flashy to keep them engaged. I've noticed that just in 13 years of my experience. There are some students at the textbook and pushing a pencil, they just don't meet the need of that child to absorb and to learn. So, I've seen the benefits of that. Definitely.

8. **Has the use of *Destination Math* changed your perception(s) of the potential for student success in first-year algebra? If so, why and how?**

Yes, but to the limited extent that any kind of tool, a textbook tool or a lecture tool, if a child's not developmentally ready for the algebraic concept, or if the child is not prepared to apply themselves . . . You know, I try to explain to the students, look, this is just like anything else. If you don't focus and if you don't to take this in and absorb it for yourself, the sounds are going to run in one ear and out the other. It's not going to be osmosis and just trickle into your brain. You have to work it as well. Some of the students have found that, if they just click on the arrow button and can tell it to continue, it will look like they've completed the lesson, but have not. It's like the pages of a book, looking at the pictures. And they've also found that, with some of the question, they can attempt the question, make it go back to the beginning of that section, try the same question again with a different answer, and it will mark that they have 100% correct. And they can try it four times and it doesn't block them. And, so, I tell the students right up front: "Look, I know you can do this. And I know some of you are still going to do it. But that doesn't mean that you've learned the information. And so you can do that, but you're cheating yourself." And I think that's an important lesson at this age, too; that they learn, Yeah there's a way around it, but it's going to only short-end my education. That's another life-long learning thing.

Interviewer: In today's world, with algebra I being a graduation requirement, we have different students in algebra than we've had before. We have more students. We have students who have never been in algebra. Has your use of *Destination Math* changed your perception of the potential for these students being successful, students who were once not successful or who would never have attempted the course? Would the use of *Destination Math* be a vehicle for their success?

Kerry: Yes, it will definitely pick up some of the ones who could possibly be lost in the shuffle and help them along. There are some students who truly want to learn this, but have whatever kind of disability in their learning styles or techniques that *Destination Math* does bridge a gap to. And to say that it could never possibly help any of those students is crazy. And there are always going to be some exceptions that, no matter what we try, they have too many things to overcome.

9. Summarize the involvement you have had with our students while using or following the use of *Destination Math.* What kind of interaction does it promote, either during use or after use?

I think maybe one of the biggest things is that kids actually like it. And they like . . . ah, this is fun . . . and actually get it now. It's kind of a side benefit to them; oops! I accidentally learned this because I was having fun. That's one of the biggest things that stick out in my mind. I have to say that I have seen grades improve for those that are serious and want to focus on it.

10. Based on your knowledge and experience with *Destination Math*, what positive changes do you see that improve learning in your classroom?

Yes. I know you want me to expand on that . . .

Interviewer: No. I think you did in the previous question and certainly these questions allow that kind of thing to happen.

11. If you were in charge of the implementation of *Destination Math* in the District, what would you do?

It's come so far so quickly, it's hard to imagine what else we could do to make it more accessible to people or to make it easier. It's been great that we've had the training, we have the equipment, we have the technicians that when there's a problem or a glitch they immediately pay attention to it. I don't really know how improvement could take place. I do know that *Destination Math* is only one segment of Riverdeep. There's the algebra matrix and the probability and the geometry part that could be accessed, which we have. Maybe some more training in those areas, but for right now the *Destination Math,* I think we're pushing the top of everything that's available, as far as I know.

Interviewer: Do you feel that there's anything else that the District could do to make you like using it better, or providing anything that we don't already have.

Kerry: I can't think of anything.

12. What are some underlying factors that contribute to a successful implementation of an intervention program?

I think the worksheets help the students stay focussed and then they can work as quickly or as slowly as needed. With the intervention, you are getting kids from all different levels trying to fill in all different kinds of cracks and holes in their education. One student might be lacking, another one doesn't and they don't need to review that but to push on. With the after-school intervention part, you can implement individual plans for each child to meet the needs. We have found that you can't just let a student, "Well, just go on there and find something that kind of looks like what you've been doing in the class." Nor can you write 35 to 60-some different lessons for just after school. So, the Riverdeep we've targeted to the chapters of what sections, the kids are trained to pull the file folders, and the worksheets lead them along as they go. And they have to complete them in a sequenced order that we've already prearranged in a filing cabinet. That's really helped organize a lot and Major Anderson provided the software that has all that on there so anywhere I go I can crank out a worksheet. I don't have to have a copy machine. That's helps with the intervention. Seventh-grade basic math is struggling as far as the correlation and trying to get kids . . . it's so convenient that it's all lined up to the algebra. I think that's about it.

13. Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?

I think it gives them something other than a teacher. One of the kids said: "Hey, I can ask it to repeat it 10 times to me and it doesn't tell me 'Why aren't you getting it?'" What's wrong with you; study your notes, like a teacher could say. And I said that is one of the nice things; it can be as patient as you need it to be and I think self esteem-wise that's important for the student. To have it accessible at home—several of the moms have come back and said: "Wow! This is great. I can't have my kid there from 3 to 4 after school, but from 6:30 to 7:00 at home I can have them on this." And they see the benefit of that. So, I think it's going to contribute to the success of the student, the accessibility of it.

Interviewer: Is that something that is unique, do you think, to this school site where another school in the District you might not have that same accessibility at home.

Kerry: Yes, I think we're really fortunate with the clientele that we have. In an average classroom setting, 80-90% could go home and access the internet. You have a few here and there that don't have access to that, and I think that's economic circumstances. Other schools don't have that as their clientele. I think we're really privileged by that.

14. Would you like to share anything else?

Interviewer: I know that, a few years ago when you first introduced to *Destination Math*, you were excited about it. But it was before you actually started to use it. Could you describe your experience last summer?

Kerry: Last summer I was given a laptop to work on, to investigate at my own time block and I was able to put in many hours. But it wasn't until I did spend that time myself and listen to the programs and work out the questions and really investigate every possible avenue in the Riverdeep—I mean, I felt like Riverdeep was flowing in my blood, I could stand on my head and spit jellybeans—that I really grasped what was available to the students. Until then it was like, oh, yes, this is nice and this is cute and, yeah, that will take up some time in my class and give the kids a different pace kind of a thing. That's all true, too. It is a nice pace for the students to be out of the classroom and in a different environment. It's the thrill of using the computer where some have not. That all plays a part of the engaging part of it. But I didn't personally know how to implement some things until I pounded it out and spent the time. I wish all the teachers who are just even a little hesitant could have a block of time to just experience it for themselves, to really understand what it could do for them, the benefit.

Interviewer: I really want to thank you for taking time to do this interview. It has taken time and your comments are very valuable. I thank you again for taking time to share your experience.

Appendix V

Transcript of Interview with Teacher "Michael"

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Transcript of Interview with Teacher "Michael"

1. **What is (are) your credential(s) and how long has (have) it (they) been held?**

I have an emergency credential in math and physics. This is my fourth year.

2. **What subject(s) does (do) your credential(s) permit you to teach?**

Interviewer did not ask this question.

3. **How long have you taught first-year algebra?**

Two years.

GUIDED QUESTIONS

1. **When were you first introduced to *Destination Math* as an intervention tool for first-year algebra students?**
   Like three years ago.

2. **Describe the training you have received to use *Destination Math***

   Most of my training, I would honestly say, has been self-taught. But, the Riverdeep Company has sent out representatives a number of times to give us some training on different aspects of the program, whether it be operation, use or the issues of building tests and student management and stuff.

3. **Describe your perception of the role of the teacher who uses Destination Math as an intervention tool in the classroom and in the lab.**

Depending upon the way it's used, because it can be used many ways, certainly it can be used as a presentation where it would be a start-and-stop, during which the teacher would be constantly adding to and interjecting his own thoughts into it. It could be used as a classroom, show it straight through as a tutorial and then discuss it, before or after, I should say—maybe not even then. But, just before or after, have a discussion based on the tutorial and then, actually, as more of an intervention would be where you have a pre-made test that the students can take that would prescribe what they need to do. They would actually go through and do it alone, so the teacher's job there would be to make the test ahead of time and then monitor their progress, make sure that they are getting done what they need to have done.

Interviewer: OK

4. **In what ways do you think the site location in which *Destination Math* is used influences the role of the teacher? Now, by site location we could refer to two things: it could be lab and classroom; or it could be this school versus in some other school in the District.**

As I see it, most of the schools in the District have the same setup as we have overall, meaning that most of the math teachers have a projector in the classroom for use in the classroom and, then also, we have the lab environment where each student can work at his own station on the computer doing his own tutorial. Or, even for those teachers who don't have projectors in their classrooms for one reason or another, we have projectors in the lab where they can do whole-class instruction using *Destination Math.*

Interviewer: Uh-huh.

5. **Discuss the implication(s) of *Destination Math* for the curriculum in first-year algebra.**

I think it's definitely a curriculum tool and that it can be added into what we already have as curriculum tools (being textbooks, whatever—other support materials available). I think it is a good tool in that it sometimes shows things a little differently than, maybe, the teacher would do, and that gives them a good advantage. I think we all tend to adjust our teaching so that it matches the book, at least to some extent, and I think this we can't really adjust. So, if there is a different way that they do it, it's going to be different. I think sometimes that's good for kids. Sometimes I think some get confused, but for most of them, I think, that second perspective is a good thing.

Interviewer: It's a multiple representation idea. OK.

6. **Describe your use of *Destination Math* in a typical day and/or week.**

I have two classes of Concepts of Algebra, where the students are struggling with algebra, and so it's an add-on class, where it's in addition to a regular Algebra I class. In that class, I use *Destination Math* typically three days a week, so three days a week they're at the computers, going through tutorials and I try to pre-pick the tutorials so that the goal is I'm just ahead of their regular Algebra I class, so that they're getting kind of a pre-load of this information in a free-form environment where it's more entertaining and less computational. So, it kind of has more entertainment to help hold their interest and less computational to help raise the defective (effective?) filter, so that they're not as . . .

Interviewer: Um-hmmm.

Michael: You know, these tend to be the kids who don't want to do math.

Interviewer: Yes. OK.

7. **Has the use of *Destination Math* altered your daily practice? If so, why and how?**

Well, certainly, in the realm of that class, that class was almost written with *Destination Math* in mind, not necessarily as whole, but as a good portion of the class, so certainly it has adjusted my perception on how I teach **that** class. Umm. As far as the regular Algebra I class, I've used it in the classroom on occasion, maybe not as much as I might like but sometimes it's hard to fit all the things into a day.

Interviewer: Right.

Michael: Umm. I think it has in, if nothing else, my own intervention, now instead of saying OK three days a week I'm here you can come ask me questions and get help, I'm still available, you can still come and ask questions and get help, but while that's happening, you can also get onto *Destination Math* and use that to give you the help that you need. So the kids have two options during that same hour of my time.

Interviewer: Sure.

Michael: They can use me personally **and** the *Destination Math* in any mix/match of the two.

Interviewer: Sure.

8. **Has the use of *Destination Math* changed your perception(s) of the potential for student success in first-year algebra? If so, why and how?**

Absolutely. With the right motivation, I've seen great improvements with kids using *Destination Math.* Some kids, unfortunately, don't take it seriously. They don't understand that it can help them, or how, and that is part of our job, to help them see how and understand how it can help them and working on that I'm not always as successful as I'd like to be, but that's the way it goes. But, yeah, I certainly think it can help, especially, honestly I think it especially is good now that we're moving the algebra down to Middle School. I do believe the program was really written more at a middle-school level.

Interviewer: With Digit and . . .

Michael: With Digit. I mean, they're all fine and they're all cute, but some of these kids at 17 years old who really think they're adults are a little bit put off by "Hey, Dig, let's go to the ballpark."

Interviewer: Right.

9. **Summarize the involvement you have had with our students while using or following the use of *Destination Math*. In other words, do you interact with your students differently because of the use of *Destination Math*?**

Well, certainly, the interaction is different in that there are days that the kids know what they're to do: they come in, they go to work. And, so, they're working on *Destination Math* and my interaction is minimal one-on-one. I'm obviously monitoring them, seeing what they're doing, making sure they're on task, those types of things. But, I'm not standing at the board doing problems on the board. So it is definitely a different interaction on those days. And the discussions about it afterward, the idea of "Well, I don't understand, why did they say it different?" Then I can have that new opportunity to explain, "OK. Sometimes there are different ways to do the same thing, and that's one of the neat things about math, as long as you're true to math, it doesn't hardly matter the method, you'll still get to the right answer. And I think that's a good thing for them to hear and see.

10. **Based on your knowledge and experience with *Destination Math*, what positive changes do you see that improve learning in your classroom?**

To restate some of the things, I think that it opens up an opportunity where the entertainment level goes and the effective filter goes down by presenting the material in a way that isn't "take out a pencil and work through the problems." And I think that's really valuable with today's students because they're very video-game driven and I don't think that by any means it replaces the "Here's a pencil, let's work through the problem," but I think just that different way of presenting it does certainly have its value.

11. **If you were in charge of the implementation of *Destination Math* in the District, what would you do? You've been involved in it, so that's a kind of loaded question.**

I would do a lot of the things that have already been done.

Interviewer: Right . . . that you've done.

Michael: I'm not sure how to answer this one in that, as you say, it is kind of a loaded question. As you know, at this time there is a problem with the operation of the software and the tech support has been lacking, in my opinion.

Interviewer: And that's from the company, not from the District?

Michael: Right, from the company. And, I get the very definite feeling that they're idea is that don't really want to support the lower versions, they want us to move up to the next level of the program, the newer version. But that requires a large investment of capital because we have to buy new computers in order to be able to operate that. And I'd like to see us do that because, from what I've seen of the version, it has some really neat features. So, as a classroom teacher, as a person just making it go, I'd love to see us have the new version. As a realistic person, knowing that's a lot of money, I know that that's not necessarily going to happen right now, especially in our current budget . . . so, I'd suppose I really would say I would change is somehow try to get better support from the Riverdeep people.

Interviewer: Then maybe, somehow through this project we will have a collective voice in trying to do that. Hopefully, that can happen.

12. What are some underlying factors that contribute to a successful implementation of an intervention program?

Student buy-in. I can't stress that one enough. And I guess, secondly, parent buy-in. Third would be teacher buy-in. I think if any one of those is lacking, you're severely hampered.

Interviewer: It's the motivation.

Michael: We can do wonderful things, we can have all the information in the world there, but if they don't show up or they aren't willing to receive it, it comes down to the "you can lead a horse to water . . . ."

Interviewer: That's right.

Michael: If we can't get them to show up because the student isn't motivated, we can't even get them to the water; we don't have parent support, it's hard to get them to really motivate. Even if we get them there, they're not going to drink. So, our idea is now, we have lead them, not only do we have to lead them, we need to maybe put salt in their oats to make them want to drink.

Interviewer: You're alluding to that that we need to carry this one step further and maybe our program that we just talked about before we started the interview with the telephone contact home to these parents to have them get their students involved in the retake, re-start Algebra I might be a way to start. So.

Michael: Right.

Interviewer: This is a dynamic, not a static activity that we are involved in.

13. **Based on your knowledge and experience with *Destination Math*, how do you see *Destination Math* impacting the success of students in first-year algebra?**

I definitely think it will have an impact. I mean, in my opinion, absolutely no question. I think as we as teachers and administrators become more familiar with what it can do and how it can do it and become more comfortable with doing things, I think the impact will become greater. As I've talked to people at the middle schools, they seem to be having a really high success rate. I know we had a high success rate, I felt, last year. Honestly, part of it, I think, was I was dealing with younger students than I am this year. And it really is, unfortunately, targeted a little bit young for our "upper classmen." Which is unfortunately, but I mean that's the way it is. We need to work through it, they need to work through it. But, I think as we get more and more comfortable with using it and we find more, I wouldn't even say find more ways to use it. I think we've been introduced to enough ways to use it, but become more comfortable where we do what we know more often.

Interviewer: Right, as we experience it more.

Interviewer: One other question I wanted to ask you: When a teacher has a class in the lab, generally we have seen that most of the students are working on the same lesson, and that's a directed lesson that the teacher prescribes. There are other uses in the pre-text/post-test those students can be working at their own level. Another consideration: In the regular algebra classes, when we have such a variety of students abilities present, teachers often say they don't have an opportunity to work with the more capable students in preparation for the Golden State Exam. How do you see time in the lab, with *Destination Math*, as helping in that kind of preparation for the capable students?

Michael: It certainly has the potential for that. I'm not exactly sure how to implement or to use that potential. Being a classroom teacher, I know that the idea of trying to direct students in different ways at the same time becomes difficult. So you would certainly have to pre set up something; you'd have to go into the lab, you'd have to understand the assignment system, the pre- and post-test system and be able to direct the student. I think it would probably take a couple of times going to the lab just to get the students familiar with how to do it. And, then, before you actually wanted to implement this type of a plan, where they were working in different places and then, moving on with that, through the use of the assignments where, you know, the kids could pick their own assignment and then work at their own pace. Where, if they took the pre-test and got 100%, or whatever your predetermined level was, boom . . . they could move right on and go right over that part and move forward. It would also give us the ability to hand-pick some of those things (quadratic equations that maybe we don't get to until toward the end of the year) and say "OK. You got this equation of a line down. We're going to work on the equation of the line, you guys here, I want you to just go through this part, get what you can out of it. Understanding that we're kind of jumping them ahead and there's a gap that they're jumping over, but just the introduction . . .

Interviewer: So, familiarity.

Michael: Familiarity, the vocabulary, those things are certainly likely to help in those types of cases.

Interviewer: For instance, if we would have maybe a series of ten lessons, but we would have a folder with which lessons a student would go to in a sequential order, that a teacher could give to capable students and keep track of which sheet, which lesson the students are working on, so that during the second semester some of them could become more prepared for that exam. And, again, it says something else; we can talk about it another time. But it just seemed like that would be a natural way to go.

14. Would you like to share anything else?

I have pretty much stated everything. I do definitely say that I like the program. I think that there's a lot of good with it. The bad that is there, hopefully, can all be fixed reasonably. I think it is, unfortunately, a little geared toward younger students than some of the ones we have here. That doesn't mean that they can't use it, it just means it makes a little more of a challenge to get the student buy-in, because they don't want to be . . . you know, it kind of talks to them at a little younger level. So, if I were to be involved in the making *Destination Math II*, that would probably be one of my thoughts. Maybe we need almost two levels.

Interviewer: A maturing level.

Michael: We need the same material, but one time present it a little less cutesy than the other level. Where you can almost do the same material with the same thing, just dress up the characters, dress up the voices to a little more adult level and I think it would be perceived a little better by some of the older students.

Interviewer: And I think you hit it with the voices and the appearance.

Interviewer:
I want to thank you very, very much. You have done a tremendous job here at the site and in the District as a whole in working with this implementation. I value your comments very much. Thank you.