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The impact individualized instruction with learning technologies has on student achievement: New directions for at-risk students with college aspirations

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The impact individualized instruction with learning technologies has on student achievement: New directions for at-risk students with college aspirations

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APPROVAL OF THE DISSERTATION

We approve the dissertation of Jorge Peña.

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Abstract

The purpose of the study is to measure the benefits of a remedial low-track academic program that includes individualized instruction using learning technologies by comparing the 9^{th} grade Explore, 10^{th} grade Plan, and 11^{th} grade ACT standardized tests scores as a measure of academic achievement in English, mathematics, reading, and scientific reasoning. A second purpose is to determine if there is a difference in academic achievement between male and female students that have experienced the same curriculum in a co-institutional single-sex schooling environment. The standardized test scores of male and female students from the class of 2007, the treatment group, are compared to the students in the class of 2006, the control group. There are 51 male and female students in the class of 2007, and 47 male and female students in the class of 2006. Although the students are at-risk of dropping out of high school due to low levels of educational attainment, they have college aspirations, and students who have graduated ahead of them have enrolled in post-secondary educational institutions. The students are African American, Latino/a, and European American and attend a private, religious high school in an urban environment. The analyses of the results reveal significant differences in scientific reasoning achievement for male students from 9^{th} to 11^{th} grade. There are mixed findings in English, mathematics, and reading that can be attributed to the curricular flexibility afforded in a co-institutional educational model. Although there was some lack of standardization of instruction in implementing the curriculum between the two campuses, no significant differences were found between the male and female students in the class of 2007.

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I. INTRODUCTION

College access is one of the most serious issues facing the United States when it comes to the transition of life after high school. Researchers agree that a college education leads to better life outcomes, and that college access must be part of any approach to redressing social inequalities. There are high school students that lag academically in reading, mathematics, English skills, and scientific reasoning who are labeled *at-risk*.

Some of the *at-risk* students are high school dropouts, some of them graduate from high school, and some continue to some sort of higher education at a two- or four-year college. The ones that continue their education beyond high school are the ones that enter college unprepared for the academic work. Hence they enroll in remedial courses in college which is problematic because these courses are not applied to satisfy the requirements of a bachelor's degree which means they fall behind, thereby increasing the likelihood of dropping out of college. Colleges, universities, and state legislatures have reduced funding and support for courses students should have learned in high school. Therefore, it is undesirable for students to remain *at-risk* throughout high school and onto college.

A. Background of the study

At-risk students receive remedial education in low educational tracks

The term *at-risk* is ambiguous because of the evolution of its meaning and the different interpretations of how students become *at-risk* or are placed in *at-risk* schooling environments (O'Brien et al., 1997). This study defines *at*-risk students as those that are in danger of failing to complete their education (Slavin et al., 1989), or have learning problems and adjustment difficulties, and often fail or are in danger of failing academically even though they are capable of learning. However, the term *at-risk* has been used to place blame on students for academic problems and to excuse schools from being accountable for their education (Fine, 1995).

Fine's (1995) definition places the burden on the school to remedy what places the student *at-risk*. Schools can do this in a number of methods: changing the school and classroom culture to reflect one of academic scholarship, limit the classroom size to 20 students (Keefe and Jenkins, 2000), use individual instruction to meet the unique needs of this type of student (Dunn, 1992), or use learning technologies that promote students' knowledge construction (Jonassen et al., 1999). The challenge to school administrators is how to organize the educational program to group an academically diverse student body.

A popular administrative organizational approach to grouping high school students is a three-tiered tracking academic program: honors or advanced track, a college preparatory track, and a remedial education track. The quality of instruction in remedial low-level educational tracks students are exposed to in high school has helped little their overall long-term achievement (Oakes, 1985). Students receiving such instruction may stay at low levels throughout high school and as a result not be adequately prepared for college. This point is illustrated by the number of students who need remedial courses in higher education institutions. The number of students who took at least one year of remedial coursework in college increased to 35 percent between 1998 and 2003 (Cavanagh, 2003). Clearly there is a relationship between student preparation in high school and the need to take remedial education courses in higher education institutions.

There is research that points to the ineffectiveness of low-track classes on student achievement (Oakes, Gamoran, Page, 1992; Anderson, 1993; Good, 1982; Greenbaum, 1990) and that low-track classes disproportionately affect African American and Latino/a students (Oakes, 1990, 1983). Despite the research against tracking programs, they are widely used in high schools because tracking is an administrative organizational practice that is aimed at facilitating instruction and increase learning (Hallinan and Oakes, 1994).

Single-sex education and learning technologies provide new directions for achievement for students in low-educational tracks

Individual instruction is an instructional and pedagogical approach that can be used to improve the academic achievement of students in low educational tracks (Gibbons, 1971). The pedagogical framework of individual instruction requires the teacher to assume the dual role of subject-matter facilitator and teacher-adviser to a select group of students (Keefe and Jenkins, 2000). The individual needs of students are met in a planned effort to maximize teacher-student contacts in order to provide instruction that is tailored to individual learning requirements (Disick, 1995). Individual instruction is designed to allow each student to work at their own pace, through a program that meets the student's abilities (Lewis, 1971).

Individual instruction begins with assessing each student's strengths and areas of improvements. Curriculum materials are meant to stimulate student curiosity, offer repetition without reducing interests, and create a personal involvement with the act of learning for the student (Dunn and Dunn, 1972). Learning occurs in an individual instruction program when a teacher assess a student's prior knowledge, prescribes curriculum materials, and learning activities such as one-on-one tutoring, independent study, or using learning technologies. Individual instruction is also achieved using a constructivist approach (Dunn, 1992). Constructivism holds that individual students construct knowledge by giving meaning to their current experiences and background knowledge. Advocates of single-sex education point to the success of a constructivist educational academic program provides when students are free from gender-bias and gender-stereotyping (Pollard, 1999).

When gender and achievement are examined in a tracking environment, it seems that equal access to educational opportunities and resources can be accomplished through coeducational classes. However, gender stereotyping and gender bias can be major factors in coeducational classrooms. An interest in single-sex education has emerged in the last decade. Attention is given to the achievement of girls due to fewer opportunities for learning and problem solving than boys have in classroom settings. This may lead to girls becoming less motivated and engaged in classroom activities and in turn perform less well as a result (Pollard, 1999). Furthermore, single-sex schooling is used as a perceived remedy to improve the classroom behavior and participation of boys who engage in more antisocial behavior than girls (Pollard, 1999).

Efforts to implement single-sex education in public schools have been curtailed due to federal restrictions written in the Title IX of the Education Amendments of 1972. The restriction in Title IX is aimed at prohibiting sex discrimination on the basis of gender in educational institutions that receive federal funds. The legislation emphasizes access to the same education experiences in school for both sexes. However, the resurgence in interest in single-sex schooling comes from the provisions in the No Child

Left Behind Act that allotted $3million to promote experimentation with single-sex classes and school (Herr and Arms, 2004).

Due to historical constraints on single-sex education, the research on the topic has largely focused on private schools and international public school systems. Most quantitative studies yield favorable results supporting single-sex schooling. However, Streitmatter (1998) states that there is no empirical evidence that single-sex groups alone might in and of themselves be a causal factor for improved academic achievement.

Nevertheless, there are studies that control for variables in attempts to isolate the effects of single-sex education. Some of these studies found that male and female students in Catholic single-sex schools outperformed their peers in coeducational schools (Riordan, 1985 and 1990), while another study found that males and females in single-sex schools have higher reading achievement than students in coeducational schools (Marsh, 1989a).

At the dawn of the 21st century, the use of technology and technology related careers will continue to expand. There are concerns in the education community regarding low rates of female enrollments in computer science and information technologies fields, and their underrepresented status in high technology learning environments (Crombie et al., 2000). This trend may be reversed as learning technologies are integrated in the school curriculum. Learning technologies support learning by allowing students to construct knowledge, collaborate, discuss, debate, and build consensus in the classroom (Jonassen et al., 1999). Learning technologies as an instructional approach can take the form of students using software to reinforce a lesson and homework by solving math problems using a computer (House, 2002); or using software to improve the learning of multiplication facts (Irish, 2002) of students with learning disabilities.

Description of high school in the study

The high school in this study is an urban independent co-institutional Catholic college preparatory high school in Chicago. The high school is not coeducational, nor single-sex, but co-institutional, which means that male students and female students experience the same curriculum, but in separate campuses, in this case 1.5 miles apart. A co-institutional approach capitalizes on the benefits of single-sex schooling for instruction while having a school culture and identity with schoolmates of the opposite sex.

A tracked three-tiered curriculum is structured to meet the individual needs of the students at both campuses. The tracks are the Honors Program, the College Preparation Program, and the General Studies Program. The Honors Program is for students with higher than average academic abilities. It is designed to enable students to pursue college-level studies while still in high school. The College Preparatory Program has the largest enrollment. The program provides students with the traditional college preparatory program. It is designed to prepare the student for entrance into college and for academic success in college courses. In the month of October, the ninth grade students in each academic program take the Explore test, while the tenth grade students in each academic program take the Plan test. The school does not require students to take the ACT test but those that are college-bound in each academic program do so.

The General Studies Program is designed to provide students with the opportunity to study college preparatory courses at a less rigorous pace. It is designed to prepare students for entrance into college, community college, trade/professional school, and/or the workplace. Individualized instruction, learning technology usage by teacher and student, and cooperative learning are instructional strategies that are emphasized in the General Studies program. Refer to Tables 1, 2, 3, 4, and 5 in Appendix A for enrollment data.

Students are admitted to the school and placed in one of the academic programs based on report card grades from seventh and eighth grades and test scores on the Terra Nova, a test that is produced by CTB McGraw-Hill. The percentile scores in reading comprehension, language arts, and mathematics are used to place the students in one of the academic programs. Students take the exam in the month of January of the eighth grade year, or in the fifth month of eighth grade. To gain admissions in the Honors Program, students must score at or above the 80^{th} percentile; to gain admissions in the College Preparatory Program students must score anywhere from the 30^{th} to the 79^{th} percentile; to gain admissions in the General Studies Program students must score at or below the 29^{th} percentile. A student may have a mixed academic schedule of honors and college prep, or general studies and college prep if percentile scores score in different academic programs. For example, a student may have college prep courses except for honors mathematics if the mathematics Terra Nova score is in the honors range.

The General Studies program is characterized as a remedial educational program within a three-tiered tracking system. The class sizes are designed to accommodate opportunities to individualize instruction and to integrate technology in the curriculum through teacher tasks and student work. The Accelerated Reader program is used to improve reading comprehension. The courses in the General Studies program use a constructivist approach for students to create meaning from the knowledge themselves. Students in the program are aware they are in a low-track program compared to the college preparatory and honors track programs. Nevertheless, the students have aspirations to continue their education beyond high school either in a four-year university or a vocational career program.

The learning technologies used at the school consist of teachers incorporating technology in curriculum development, in instructional strategies, and students using technology to produce academic work. For example, the biology teacher demonstrates to students the techniques to dissect a virtual frog on a website; students will be working with a partner the next day to dissect real frogs. The teacher uses a Tablet PC (a laptop computer with handwriting recognition) that is connected to a wireless LCD-projector (Liquid Display Crystal) that projects the image from the computer to a screen in front of the classroom. The students listen and observe the procedures and instruction for the dissection. After the virtual dissection, the teacher opens a video file on the computer on the evolution of amphibians to stimulate a discussion and analysis on the topic. The students are to use the days lesson in their science lab report's abstract.

Learning technologies can also take the shape of teachers and students working together such as exploring geography and analyzing history through architecture. The world history teacher projects a series of websites to take students on a virtual fieldtrip to Argentina, Brazil, Nicaragua, Dominican Republic, and Spain. The emphasis of this virtual fieldtrip is to study Spanish architecture during colonial expansion and the impact on the indigenous people. The teacher uses the wireless LCD-projector to present the websites; the students are each on a computer in the computer lab viewing the websites along with the teacher. The students read and learn more about European expansion and colonization using the world history book.

Learning technologies are best utilized when they are used to produce intellectual work. For example, students in business management have a project to create a five-year business plan that includes a budget and a website that markets the business. The students use presentation software to create and present the business plan; spreadsheet software is used to create the budget that itemizes expenses and expected revenues; and finally the website is created to market the business.

The school provides teachers with professional development that teaches them how to use technology for instructional teaching strategies and to develop curriculum so that technology is intuitively used in the learning process.

B. Statement of the Problem

Does a remedial low-track academic program that includes individualized instruction using learning technologies for academically at-risk high school students with college aspirations increase the likelihood that students will succeed in school by increasing their academic achievement in English, mathematics, reading, and scientific reasoning as demonstrated by standardized test scores?

Also, is there a significant difference in achievement in English, mathematics, reading, and scientific reasoning between male and female students who experienced the same remedial low-track academic program that includes individualized instruction using learning technologies in a single-sex school environment?

C. Purpose of the study

The purpose of the study is to measure the benefits of a remedial low-track academic program that includes individualized instruction using learning technologies by comparing standardized test scores as a measure of academic achievement; and if there is a difference in academic achievement between male and female students that have experienced the same curriculum in a single-sex schooling environment.

D. Hypotheses

H1: Male and female students in the class of 2007 will have higher Plan test scores in *English* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H2: Male and female students in the class of 2007 will have higher Plan test scores in *mathematics* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H3: Male and female students in the class of 2007 will have higher Plan test scores in *reading* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H4: Male and female students in the class of 2007 will have higher Plan test scores in *scientific reasoning* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H5: Male and female students in the class of 2007 will have higher Plan *composite* test scores as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H6: Male and female students in the class of 2007 will have higher ACT test scores in *English* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H7: Male and female students in the class of 2007 will have higher ACT test scores in *mathematics* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H8: Male and female students in the class of 2007 will have higher ACT test scores in *reading* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H9: Male and female students in the class of 2007 will have higher ACT test scores in *scientific reasoning* as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H10: Male and female students in the class of 2007 will have higher ACT *composite* test scores as a result of individualized instruction which incorporates learning technologies than male and female students in the class of 2006.

H11: The male students in the class of 2007 will have higher Plan test scores than female students in *mathematics* as a result of experiencing the same curriculum in single-sex schooling environments.

H12: The male students in the class of 2007 will have higher Plan test scores than female students in *scientific reasoning* as a result of experiencing the same curriculum in single-sex schooling environments.

H13. The female students in the class of 2007 will have higher Plan test scores than male students in *English* as a result of experiencing the same curriculum in single-sex schooling environments.

H14: The female students in the class of 2007 will have higher Plan test scores than male students in *reading* as a result of experiencing the same curriculum in single-sex schooling environments.

H15: The difference in the *composite* score on the Plan test will not be significant for the female and male students in the class of 2007.

H16: The male students in the class of 2007 will have higher ACT test scores than female students in *mathematics* as a result of experiencing the same curriculum in single-sex schooling environments.

H17: The male students in the class of 2007 will have higher ACT test scores than female students in *scientific reasoning* as a result of experiencing the same curriculum in single-sex schooling environments.

H18: The female students in the class of 2007 will have higher ACT test scores than male students in *English* as a result of experiencing the same curriculum in single-sex schooling environments.

H19: The female students in the class of 2007 will have higher ACT test scores than the male students in *reading* as a result of experiencing the same curriculum in single-sex schooling environments.

H20: The difference in the *composite* score on the ACT test will not be significant for the female and male students in the class of 2007.

H21: The students in the class of 2007 will experience greater gains than the class of 2006 in *composite* scores from Explore to Plan.

H22: The students in the class of 2007 will experience greater gains than the class of 2006 in *composite* scores from Plan to ACT.

E. Significance of the study

This is a study of the academic achievement of low-educational track students that have college-aspirations and is unique for several reasons. First, this study is timely in light of the recent concerns about student achievement in college from low-educational tracks in high school. Many of these concerns draw attention to such issues as the quality and type of instruction students receive in low-educational tracks for students that may be *at-risk* of dropping out of high school or college, and the unique instructional and learning advantages single-sex education offers.

Second, the study seeks to determine the benefits an individual instructional program that incorporates learning technologies has on academic achievement in English, mathematics, reading, and scientific reasoning as measured by standardized test scores.

Third, this study compares the achievement scores on standardized tests of two groups in single-sex schooling environment whereas the overwhelming majority of research in single-sex schooling compares academic achievement to coeducational schooling. The literature review reveals that most studies focus on comparing single-sex schooling to coeducational schooling, or single-sex schooling to single-sex classes in coeducational schools; there are few studies comparing single-sex schooling to single-sex schooling and changes in curricular instruction.

By analyzing the achievement scores on standardized tests used for college admissions, this study can provide an insight on the academic preparation of low-educational track students that have college aspirations.

II. LITERATURE RIVIEW

A. Remedial Education and At-risk Learners

The term *at-risk* is ambiguous because of the evolution of its meaning and the different interpretations of how students become *at-risk* or are placed *at-risk* (O'Brien et al., 1997). The leading definition is that *at-risk* students are identified as such because of low literacy attainment. This identification is made because literacy ability influences a range of school performances. Slavin et al. (1989) state that *at-risk* students are those in danger of failing to complete their education with the skills necessary to survive in modern society. The term came into wide use after the National Commission on Excellence in Education proclaimed the U.S. a "nation at risk." *At-risk* students have learning problems and adjustment difficulties, and they often fail even though they are capable of succeeding. The term *at-risk* signals the long-term consequences of school failure.

Some researchers worry that the use of the term *at-risk* is ill-advised because it blames students for the problems by isolating them and does not hold schools accountable for their education (Fine, 1995). The above definition of *at-risk* suggests that the settings in which students are schooled places them at risk (Fine, 1995; Allington and McGill-Franzen, 1993; Waxman, 1992). This definition places the burden on the school to remedy what places the student at risk. Schools can do this in a number of ways: changing the school and classroom culture to reflect one of academic scholarship, limit the classroom size to 20 students, or use a curriculum that promotes students' knowledge construction, in-depth understanding, and elaborate written communication. Schools that use programs that are unresponsive to the needs of students do not prepare students for educational options beyond high school (Waxman, 1992). Students enrolled in these programs often begin their high school careers lagging behind their peers.

Students that are in remedial low-level track courses in high school experienced difficulties early in their academic careers. Fischer (2000) states that 38% of fourth grade students struggle to learn basic reading skills. Many children are not caught early and continue into high school reading at low levels. Increasingly, these students are in danger of completing their education without the skills necessary to function in a higher education environment. Schools may compound or exacerbate educational deficiencies by failing to attend to the needs of students with low literacy attainment; elementary school students who fail in reading in early grades are likely to remain behind in reading throughout school (Juel, 1988).

Other perspectives on *at-risk* students suggest that students have characteristics that predispose them to being *at-risk*. For example, *at-risk* students have been defined as pupils that are predisposed to failure in school and are *at-risk* of dropping out of school because they have educational disadvantages; exhibit low achievement and have difficulties adapting to school; show outward signs of distress and failure due to alcohol and drug abuse, unplanned pregnancy, attempted suicide, crime, delinquency, or truancy; are children from poor urban backgrounds or whose ethnicity are ALANA (African, Latino/a, Asian, Native American) which have historically been recognized as particularly needy in terms of education and special resources (Cuban, 1989); or have genetic or psychological inadequacies that predispose them to failure in school (Bitting, Cordeiro, and Baptiste, 1992).

Historically, the quality of remedial low-level education tracks students receive in high school has helped their overall long-term achievement very little. Students receiving such instruction have the potential to stay at low levels throughout high school and as a result not be adequately prepared for college. The instruction students are exposed to in remedial low-level tracks requires little knowledge construction. In courses such as English, the sciences, and the social sciences there is virtually no expectation for students to interpret, analyze, synthesize, or evaluate information. The dominant expectation is that students will merely reproduce information gained by reading, listening, or observing (Consortium on Chicago School Research, 1998).

Students in remedial courses are seldom asked to produce writings that require explanations of generalizations, classifications and relationships relevant to a situation, problem, or theme. Students in college preparatory and honors courses often are asked to make attempts at argument, convince, or persuade and to develop or test hypotheses. Whereas remedial low-level track courses seem to reach their academic peak on tasks which call for an account of particular events or series of events (such as "This is what happened"), a generalized narrative, or a description of a recurrent pattern of events or steps in a procedure ("This is what happens," "This is the way it is done"). More often than not, the work students produce in remedial low-level tracks are short-answer exercises. The task or its parts can be answered with only one or two sentences, clauses, or phrasal fragments that complete a thought; or are fill-in-the-blank, matching, or multiple-choice exercises (Consortium on Chicago School Research, 1998).

In terms of written mathematical communication, students in college preparatory or honors courses are exposed to tasks that allow them to demonstrate or elaborate their understanding, ideas, or conclusions through written mathematical communication. Tasks that require written mathematical communication are tasks that ask students to generate prose, such as writing a paragraph explaining the solution path; or symbolic representation, such as making graphs, tables, equations, diagrams, or drawings.

In terms of mathematics courses and knowledge construction, the tasks students in low-academic tracks produce call for very little or no mathematical organization and mathematical interpretation of information. The dominant expectation is for students to retrieve or reproduce fragments of knowledge or to repeatedly apply previously learned algorithms and procedures (Consortium on Chicago School Research, 1998). Nevertheless, there are students in low-level tracks that have college aspirations. Higher education empowers individuals to control their own educational pursuits which are the best option young people have to change their socioeconomic conditions (Freire, 1971). However, high school students in remedial low-level tracks are recipients of remedial education.

There is a link between student preparation in high school and the need to take remedial education courses in higher education institutions. This point is illustrated by the number of students who need remedial courses in higher education institutions as a result of outcomes on university placement exams. In 1995, nearly all public two-year higher education institutions and 81 percent of public four-year higher education institutions offered remedial courses. The number of students who took at least one year of remedial coursework in college increased to 35 percent between 1998 and 2003 (Cavanagh, 2003).

The students who need remedial courses in college fall into two categories, recent high school graduates who begin college within a year of graduation and adults who enroll in college a year or more after high school graduation (Abraham and Creech, 2000). These groups of students do not complete a rigorous college-preparatory curriculum; or completed a college-preparatory curriculum but earned low grades; or failed to take college-preparatory mathematics course during senior year of high school (Abraham and Creech, 2000).

A review of the literature reveals mixed results on the intervention methods to improve student achievement for students in remedial low-level tracks. According to Allington and McGill-Franzen (1993), low achievers who are challenged by reading and are placed in special programs are not likely to improve their achievement. However, Woodruff, Schumaker, and Deshler (2002) evaluated the effectiveness of intensive instruction in reading decoding skills with 9th-grade students *at-risk* for school failure or with learning disabilities. The study consisted of sixty-two students who were identified as reading one or more grade levels below ninth grade. The students were removed from their English classes for four to eight weeks and received small-group instruction in word identification strategy. Students that received the small-group instruction had gained an average of 3.9 grade levels in reading decoding skills, whereas the control group had an average gain of 0.4. The authors conclude that that intense strategy instruction within a relatively short period of time can increase students' reading decoding skills.

In terms of mathematics and college preparation, Hoyt (1999) studied the levels of math preparation in high school, and remedial placement and subsequent performance in math courses offered at the college level. The study found that recent high school graduates who successfully completed more advanced math courses in high school had higher ACT math test scores, higher math placement test scores, and were less likely to take remedial courses when in college. Furthermore, the study found that 35 percent of the high school students in the study did not successfully complete Algebra 2 or intermediate Algebra, and this course was cited as necessary to avoid placement in remedial coursework. However, upon further investigation, Hoyt and Sorensen (2001) found that students entering Utah Valley State College had high rates of remedial placement after successfully completing college preparatory intermediate algebra and geometry; furthermore, more than a third of the students who finished four years of English placed in remedial English. Placement in remedial courses was determined by their ACT or Computerized Adaptive Placement Assessment and Support Systems test scores. The college required students to have an ACT test score of 19.

Inadequate preparation at any level of education has a trickle-effect for states and higher education institutions with negative consequences. The states of Arkansas, Oklahoma, Tennessee, and West Virginia expect entering freshmen to score 19 or higher on the ACT English and math tests before they can enroll in beginning college-level courses. Among the Southern Regional Education Board states, students who score from 16 to 19 are placed in remedial courses; the percentage of students who score below 19 in English range from 37 percent to 58 percent (Abraham and Creech, 2000). Nationally, 44 percent of students score below 19 on the ACT English test and 48 percent score below 19 on the ACT mathematics test. In 1996, the state of Illinois spent $26.9 million, 1.1 percent of total budget, on remedial education at the post-secondary level (Mazzeo, 2002). The financial cost of remedial education at the post-secondary level to Michigan's businesses and higher education institutions is between $311 million and $1.15 billion (Greene, 2000).

The issue of student preparation for post-secondary work is so prominent that 30 state legislatures, governing boards, and university systems considered policy initiatives that limit the extent of remedial education in four-year universities or deny college admissions to students who fail placement tests, while 11 state or state systems have enacted legislation or regulations in remedial education coursework in higher education (Mazzeo, 2002).

B. Tracking and Ability Grouping

Tracking is a form of ability grouping in secondary schools that has been viewed as the institutional mechanism by which students are selected or channeled for different educational experiences. Students' location in a tracking system may have intended and unintended benefits and consequences for their career trajectories within and beyond the educational system. Tracking is also an administrative and curricular arrangement that is designed to accommodate the differences in the knowledge and skills that students bring to schools. The criteria and procedures used to place students in curricular tracks are shaped by schools' organizational characteristics and policies on tracking. Thus, the effect of students' characteristics on students' track location is constrained by the opportunity structure of the schools students attend. Therefore, an analysis of track placement in high schools should include school-level and individual-level characteristics.

Tracking is considered to be a result of the interaction between individual abilities and efforts and the opportunities generated by the school (Hallinan and Sorensen, 1983).

Tracking appeared in the U. S. in the early 1900s. Extensive immigration from Europe occurred in the early 1900s in the U.S. A method to assimilate the diverse European populations and homogenize them was through the school system. Tracking was employed at this time in conjunction with the widespread use of IQ tests. Thus, recently arrived immigrants were perceived to be inferior and unrefined, and could be admitted to the same school but placed in different classes (Ansalone, 2003).

In the early twentieth century, tracking was rationalized to meet the presumed needs of working class students. Students from upper socioeconomic status were represented in the higher tracks but many educators explicitly argued for tracking based on class. Educators argued that schools should help students accommodate to an industrial society. The key factor in the change was enrollment.

At the turn of the twentieth century, high school enrollment significantly increased. Immigration and child labor laws in states such as Massachusetts facilitated the exclusion of teens from work. The result was a nine-fold increase in students attending public high schools, from just over 200,000 in 1890 to over 1.8 million in 1920, which also meant that the number of high schools also increased from 2500 to over 14,000 (Dorn, 1996). The solution was to develop a tracking or differentiated curriculum for the children of laborers because they would too become laborers and thus deserve a curriculum that was "useful" for their inevitable destiny.

There are several student characteristics that may be associated with placement in the tracking system of high schools. Among these characteristics are gender, race-ethnicity, and achievement as measured by standardized tests, socioeconomic status, achievement in school grades, and educational expectations or aspirations. These characteristics are illustrated by the following: when it comes to gender, there are more boys in lower education tracks; regarding race and ethnicity there are more African Americans and Latino in lower education tracks; students with stanine scores with a range of one to four on standardized tests are in lower education tracks; students that are in low socio economic status tend to be in lower education tracks; students that earn poor or failing grades on subjects tend to be categorized in lower education tracks; and students that have low academic expectations of themselves or lack aspiration to pursue higher education due to the fact that they have had negative experiences with the schooling process as a result of perennially being in lower education tracks (Hallinan and Oakes, 1994). The exact estimates of the influence of each of these individual variables fluctuate from research study to research study but each variable predicts track placement.

Characteristics of education that are associated with tracking are instruction and motivation. Regarding instruction, empirical research provides considerable evidence that the quality and quantity of instruction increases with track level (Hallinan and Oakes, 1994). The second characteristic is student motivation and effort. Generally, the higher the track level, the greater the student's academic status, self-esteem, and motivation to learn (Hallinan and Oakes, 1994).

There are four kinds of ability grouping for instruction. Whole-class or mixed grouping is heterogeneous grouping within grades. Whole-class instruction occurs when students in a grade are taught as a group. If the grade has more than one classroom, the students are separated into groups so that each group or classroom represents the whole spectrum of students' skills. This grouping produces heterogeneous classes because the skill levels of the students within each class vary considerable (Mosteller et al., 1996).

Between class grouping or XYZ skill grouping is homogenous grouping within grades. In this method of grouping, students in a grade are stratified into two or three skill levels, such as high, medium, low. This type of grouping is implemented by using prior achievement in the subject being taught, performance on a standardized aptitude test, or on a teacher rating (Mosteller et al., 1996).

Cross-grade grouping or the Joplin Plan is homogenous grouping across grades. Under this method, distinct grade levels are abandoned, such as grades four, five and six; and instead the focus is on each student's skill level on reading. Thus, when working on reading, students are grouped based on the same skill level regardless of the original grade level. When reading class ends, students return to their original grades (Mosteller et al., 1996).

Within-class grouping is homogenous grouping within classes. In this method, the teacher of a whole class sorts the students into subgroups within the class based on their skills levels, usually using the same levels as XYZ groups. However, the distinction here is that all three subgroups of students stay in the same classroom. Hence, while the teacher teaches one skill subgroup a new lesson, the other skill subgroups work on the lesson given the day before. The teacher gives short lessons to each subgroup separately. These subgroups may have different assignments and their educational goals may not be the same (Mosteller et al., 1996).

Disadvantages of tracking

There are studies whose outcomes state a negative effect on students' opportunity to learn. Despite research demonstrating the ineffectiveness of low-track classes, schools continue the practice (Oakes, Gamoran, and Page, 1992). Lower ability tracks contain disproportionate number of students of low socioeconomic status, whom are largely Latino and African American. Oakes (1990) suggest that the disparities for African Americans and Latinos are so significant that considerable talent is lost from students with such ethnicities. According to Smith (1997), the percentage of high school seniors who reported being in the college preparatory or academic track were 46% European American, 36% African American, 31% Latino, 40% Asian American, and 23% Native American. Those reporting in the general track were 43% of European Americans, 49% African Americans, 56% Latino, 40% Asian American, and 61% Native Americans. Those reporting in the vocational track were 11% European American, 15% African Americans, 13% Latino, 9% Asian American, and 17% Native Americans. This means that almost half of Asian Americans and European Americans report being in the highest track; while African Americans, Latinos, and Native Americans are more likely to be in the general track and have the highest number in the lowest or vocational tracks. Moreover, within the vocational track, low-income African American and Latino students disproportionately take classes related to low-skill jobs (Oakes, 1983).

Another critique of low educational tracks is the belief that students cannot perform higher order thinking tasks without certain prerequisite skills. The quality of instruction and the assignments students receive are variables influencing student achievement. Higher order thinking tasks and instruction can be used in lower tracks to challenge students at their instructional level. This process is facilitated in a classroom where instruction is tailored or differentiated (Anderson, 1993; Good, 1982; Greenbaum, 1990; National Education Association, 1990). However, Oakes (1985) argues that skill grouping or tracking separates academically stronger students from less strong students, and separates children from different socioeconomic statuses, and it also separates children by ethnicity by having Latinos and African American students overrepresented in lower tracks. A harmful effect of tracking and ability grouping is the effect it has on low-tracked students' self-esteem (Oakes, 1985). Moreover, there are fewer opportunities for students to work on assignments that are higher order thinking that require students to construct knowledge.

Benefits and assumptions of tracking

Advocates of tracking argue that tracking permits teachers to tailor instruction to the ability level of their students. A good fit between a student's ability and the level of instruction is believed to maximize the effectiveness and efficiency of the instructional process and promote cognitive development (Hallinan and Oakes, 1994). Tracking enhances student achievement by improving the self-concept of students by permitting them to progress at their own pace. According to this perspective, student affective development is influenced when a student's academic work is not compared with that of students that are more advanced (Ansalone, 2003). Tracking enhances reading skills for disadvantaged groups because the ability grouping provides a level environment in which positive learning can proceed. Students participate more actively when tracked by ability and report better attitudes toward school (Mosteller et al., 1996).

C. Individualized instruction

Individualized instruction has been promoted as an instructional and pedagogical approach to improve the academic achievement of students with the academic characteristics of students that are in the low educational tracks (Gibbons, 1971). Individualized instruction is especially effective in working with *at-risk* students (Hamby, 1989). It is a process, a procedure, a pedagogical framework that, "demands that the teacher assume the dual roles of subject-matter coach, consultant and facilitator, and teacher-adviser to a select group of students" (Keefe and Jenkins, 2000:43).

The original individual instruction program is one-on-one tutoring (Gibbons, 1971). The oldest instructional approach to individualization in the classroom is team teaching, where multiple teachers combine their expertise to work with a group of students (Bishop, 1971). The team of teachers can provide differentiated instruction that is more closely associated with the individual student's abilities.

An earlier method of individualized instruction is the use of correspondence courses in1873 which were available in the form of weekly reading and translating assignments that were sent to the student, the assignments were mailed back to the teacher, who corrected them with notes and comments tailored to the student's need (Gibbons, 1971). By 1888, self-paced units plans were developed and used to allow a student to set their own pace on the coverage of the course (Gibbons, 1971).

The use of independent study programs was popular in the 1960s. Independent study refers to any program that for some portion of the school day is characterized by the attainment of some freedom in the curriculum's constraints or scope (Gibbons, 1971). The use of ability grouping for teaching is used to individualized instruction and reduces the differences among students and encourages development through controlled social interactions (Gibbons, 1971).

Individualizing instruction focuses the instructional strategies on each individual student's skills, abilities, interests, learning styles, motivations, goals, rate of learning, self-discipline, problem-solving ability, degree of retention, participation, strengths, weaknesses and prognosis for moving ahead in various curriculum areas and projects (Dunn and Dunn, 1972). Individualized instruction is oriented to allow each student to work at his or her own pace, through a learning program that meets the student's language interests, needs, and abilities (Lewis, 1971). According to Disick (1975), individualized instruction is an approach to teaching and learning that offers choices in four areas: objectives of learning, rate of learning, method/style of learning, and content learning. The more choices students have in the four areas, the more individualized the program is considered.

Individualization requires an instructional approach that allows the student to engage in activities that are uniquely appropriate to the student's own style and pace. The instruction promotes independence, provides opportunities for study beyond the regular curriculum, and permits maximum use of instructional resources (Bishop, 1971). The educational program places more responsibility for learning on the student. The learning experiences, activities, and self-assessments in the educational program allow the student to become self-directed and proactive while progressing through the educational program. An individualized program considers how much time the student is capable of spending in study and concentration during a given day (Dunn and Dunn, 1972).

In the traditional teacher-centered classroom, attention to the individual needs of students is peripheral to full-class teaching and often occurs after formal classroom instruction has ended. In the student-centered individualized instruction program, the goal is to meet the varying needs of students with a planned effort to maximize personalized teacher-student contacts and to provide instruction that is tailored to individual learning requirements. It is the preplanned aspect of individualized instruction that, "differentiates it from the spontaneous instances of individualization which may or may not occur in a traditionally taught class" (Disick, 1975: 6).

Keefe and Jenkins (2000) provide six elements for individualized instruction that should be present in an individualized instruction program. The six elements are 1) the teacher has a dual role of coach and adviser; 2) the diagnosis of relevant learning characteristics that include the student's developmental level, cognitive learning style, and prior knowledge and skills; 3) a culture of collegiality in the school that is characterized by a constructivist environment and collaborative learning arrangements; 4) an interactive learning environment that is characterized by small school or small class sizes, thoughtful conversation, active learning activities, and authentic student achievement; 5) flexible scheduling and pacing with adequate structure to allow students to master skills and objectives; and 6) authentic assessments that are valid, fair and supportive of learning .

Teacher-coaches offer the same kind of instruction, demonstration, practice, and feedback to their students that athletic coaches give to their student-athletes. The teacher-coach is a facilitator of learning, one who helps students find appropriate resources and engages students in learning activities. The teacher-coach is the presenter of information when resources may not be readily available, a literacy and mathematics skills coach, and a facilitator of small group discussions (Keefe and Jenkins, 2000).

Coaches monitor and supervise attempts at problem-solving, assist students on their own problem-solving, provide feedback, offer new ways of thinking so that students can compare and contrast their own ideas with other ideas, use resources that allow students to comprehend and construct meaning, and coaches use whatever resources are useful to engage students in learning- presentations, discussions, learning technologies, cooperative group learning, etc. (Keefe and Jenkins, 2000). The teacher-adviser gets to know students much better than in a conventional school. The idea is to help students with decisions about learning options during and beyond high school, and general life goals (Keefe and Jenkins, 2000).

Individual instruction begins with diagnosing each student's strengths and areas of improvement in each content-area followed by prescribing instructional strategies and curriculum materials that build on the strengths and reduce the areas of improvement. The curriculum materials and teacher assignments are designed to stimulate curiosity, offer repetition without reducing interest, and create a personal involvement with the act of learning for the student (Dunn and Dunn, 1972).

An instructional strategy to individualize instruction is described by Jeter (1980) called, Individually Guided Education (IGE). The IGE approach calls for specification of basic learning goals by the teacher and the use of criterion-referenced tests to determine if students are progressing satisfactorily. There are seven components of an IGE program: 1) a unique set organizational-administrative arrangements and processes, 2) instructional programming for the individual student, 3) evaluation of student learning tied to instructional programming for the individual student, 4) compatible curriculum materials, with instructional programming for the individual student, 5) a program of home-school-community relations, 6) facilitative environments in the school district and state, and 7) continuing research and development to keep IGE attuned to changing societal conditions.

Individualized instruction is used in special education. The Individualized Education Program (IEP) provides the foundation for learning. The IEP is developed in collaboration with teachers, parents, school administrators, and related specialists. Some school are using IEPs with students who score below grade level on standardized tests (Schargel and Smink, 2001). Some alternative schools also use individualized instruction. The City-as-School Program in Buffalo, New York has had 65% of their students graduate. Also, the Free Options Program at the Borough Academies in New York City graduates 86% of its senior class (Schargel and Smink, 2001). Both of these programs have average graduation rates for similar students.

Jeter (1980) also describes the Individually Prescribed Instruction (IPI), in which various combinations of instructional materials, testing procedures, and teacher practices are used to accommodate individual student differences. The program is structured for students in kindergarten through grade six in mathematics, reading, science, and spelling. The program works with a series of placement tests that are given to each student at the beginning of the school year. The outcomes on the tests reveal the level of mastery in each content-area and pinpoint the specific units on which student should begin. For each unit of study, a pretest is administered covering the unit objectives to determine which objectives or skills have been mastered, usually at 85 percent, and which need further study. The teacher evaluates the results of the pretest and designs learning prescriptions for achieving the objectives yet to be mastered.

The prescription can be individual tutoring, group work, or using learning technologies. The student works on each objective of the unit that needs mastering, and at specific points in the curriculum the student completes a curriculum-embedded test that measures mastery of the objective the student is currently learning. If the student demonstrates mastery on the objective, then the student moves on to the next objective. When the student demonstrates satisfactory achievement on all objectives in a unit, a posttest covering the unit as a whole is administered. If the posttest reveals that mastery is not attained on some of the objectives, instruction is repeated for those skills. If mastery is demonstrated on all objectives of the unit, the student moves on to the next unit.

One can notice that the IPI model calls for the teacher to spend much time administering tests, diagnosing learning needs, writing learning prescriptions, analyzing student progress, and providing individual guidance to students. Not a lot of time is devoted to lecturing, but some time is devoted to instructing small groups of students who have common learning problems (Jeter, 1980).

According to Dunn (1992), individualized instruction can be dichotomized to learning and motivation. To individualize learning means to recognize and build upon students' unique past experiences, prior knowledge, and to recognize and use students' interests, goals, and confidence. Hence, effective individualized instruction considers individualized learning and individualized motivation.

To individualize learning, a teacher must asses a student's prior knowledge. The more connections made between a concept and existing knowledge, the more meaningful, and thus the more useful the new information will be.

A criticism of individualized instruction is that the concept has no precise meaning (Jeter, 1980). When used broadly, individualized instruction involves adapting instructional procedures to fit students' individual needs and characteristics. Hence, there may be many ways to do that, so no one method is necessarily best. However, Jeter (1980) recognizes that students that are the same age have different cognitive and affective characteristics and cannot be expected to learn the same body of knowledge, in the same length of time, in the same way.

Individualized learning by way of constructivism

The pedagogical theory of constructivism centers on the fact that the most effective teaching allows students to give meaning to new learning while employing the use of prior knowledge (Dunn, 1992). Constructivism holds that individual students construct knowledge by giving meaning to their current experiences and background knowledge. Constructivist instruction builds on student styles and skills, and encourages students to seek out personal knowledge of a topic. According to Dunn (1992), constructivist teachers set up problems for students to solve, allowing them to draw inferences and conclusions beginning with their prior knowledge. These teachers: 1) recognize that prior knowledge is a major factor of comprehending new material; 2) connects curriculum content to what is familiar from culture and experiences; and 3) include techniques like individual and group summarizing, brain-storming, Socratic dialogue, and problem-solving processes.

High achieving learning environments have proven effective for *at-risk* students when the chosen activities are meaningful, authentic, related to students' culture, experiences, and prior knowledge (Dunn, 1992). Effective instructional strategies for *at-risk* students also include one-on-one remediation whenever necessary, especially in reading (Dunn, 1992).

Individual motivation

Individualized motivation considers academic goals. Academic behaviors such as completing homework assignments, focusing and paying attention in class, or studying do not exist in isolation. Rather these behaviors have a purpose and this purpose should be clear to students. Hence, the teacher works with the student to develop goals, and link the goals to behaviors. Students must make the connection that the specific behaviors will lead to academic achievement. Expectation in motivation is used by communicating that the behavior can be achieved with the skills and resources at hand (Dunn, 1992).

D. Single-sex education

The last decade has witnessed a resurgence of interests in single-sex education to meet varied goals and objectives. Among these goals and objectives are to enhance the academic achievement of girls in specific subjects, and to support classroom social organization (Pollard, 1999). It seems that equal access to educational opportunities and resources can be accomplished through coeducational classes. However, gender stereotyping and gender bias can be major factors in coeducational classrooms. Girls generally tend to receive less attention and are given fewer opportunities for learning and problem solving than boys. In addition, girls may feel inhibited and constrained in some coeducational classes, and thus become less motivated to engage in classroom activities and in turn perform less well as a result (Pollard, 1999).

Another goal of single-sex schooling is to improve the classroom behavior and participation of boys. Boys tend to engage in more antisocial behavior than girls and a perceived remedy is an all-male educational environment (Pollard, 1999). Nevertheless, public single-sex schools have not proliferated due to federal constraints as a result of the Title IX legislation. The passage of Title IX mandates equal access to all respects of schooling regardless of gender.

Title IX of the Education Amendments of 1972 is aimed at prohibiting sex discrimination on the basis of gender in educational institutions that receive federal financial assistance. Title IX is also aimed at changing societal norms regarding women's and men's role, and emphasizing access to the same educational experiences in school for both sexes. While Title IX applies to private institutions, it does not prohibit single-sex education (Herr and Arms, 2004). In other words, private or religious schools that do not receive government funds can operate schools in single-sex environments. However, Title IX does prohibit the institutions it covers from operating single-sex academic programs or extracurricular activities; there are areas of exemption, such as contact sports in physical education. Other areas of exemptions are in academic programs dealing with human sexuality, or in chorus classes within the music program based on vocal ranges.

The resurgence in interest in single-sex education in the public sector comes from provisions in the No Child Left Behind Act of 2002 that allotted $3 million in funds to promote experimentation with innovative single-sex classes and schools (Herr and Arms, 2004). The provisions in the No Child Left Behind Act that allows public school districts to use federal funds for single-sex schools and classes stems from bipartisan language in the legislation provided by Senator Hillary Rodham Clinton, Democrat from New York, and Senator Kay Bailey Hutchinson, Republican from Texas.

The changes address two specific areas, single-sex classes and single-sex schools. The change under the No Child Left Behind Act would allow schools and districts to offer single-sex classes when the single-sex nature of the class is substantially related to providing a diversity of educational options, or meeting the particular identified needs of students. The schools and districts must treat male and female students the same in providing single-sex classes. Student participation in single-sex classes would be on a voluntary basis, and a substantially equal coeducational class in the same subject would be required. Schools and districts would be required to evaluate single-sex classes periodically to ensure consistency with the nondiscrimination requirements. With regard to single-sex schools, a school district may provide a single-sex public school when it offers comparable benefits and opportunities to students of the opposite sex in another school. In other words, a school district must have two comparable single-sex schools, one for boys and one for girls.

The research in single-sex education has largely focused on private schools, and generally Catholic ones. Since Title IX prohibits gender discrimination in education, very few public, single-sex schools exist in the U.S. The majority of single-sex school research comes from international studies where public single-sex schooling is more prevalent. The research on single-sex school settings does not provide conclusive findings that coeducational schooling is more beneficial than single-sex schooling.

Quantitative studies of achievement tests and measures that examine more affective issues suggest that in some cases single-sex groupings appear to enhance scores for one gender and/or the other. However, there is no empirical evidence that groups alone might in and of themselves be a causal factor (Streitmatter, 1999).

Academic benefits of single-sex schooling

Riordan's (1985) study compared academic outcomes of Catholic single-sex schools with students in Catholic and public coeducational high schools and found that boys and girls outperformed their peers in coeducational schools. With the exception of mathematics SAT scores, boys in Catholic single-sex schools performed better than boys in coeducational public or Catholic high schools. Girls in the single-sex schools demonstrated the highest scores of all groups, outperforming female and male peers in coeducational schools on all measures. When comparing girls who attended coeducational Catholic schools to those in single-sex Catholic schools, girls in single-sex schools demonstrated higher mathematics scores.

In another study, Riordan (1990) investigated student achievement by examining gender as well as ethnic group differences in comparing single-sex and coeducational Catholic high schools. The results of the study suggest that single-sex schooling increases academic achievement in white, Latina, and African American females, as well as Latino and African American males.

Lee and Byrk (1986) found that boys in single-sex schools have higher academic achievement than boys in coeducational schools. Moreover, girls in single-sex schools have higher academic achievement than girls in coeducational schools. This study examined the effects of single-sex schooling on academic achievement by comparing students in their sophomore and senior years in forty-five single-sex and thirty coeducation Catholic high schools. The results of the study revealed that sophomore boys in single-sex schools had higher test scores in reading, mathematics, and writing than boys in coeducational schools; whereas girls in single-sex schools had higher test scores in science and reading than girls in coeducational schools, and girls also tended to hold less rigid sex-role stereotypes and higher post-secondary aspirations than their coeducational peers.

A separate study found that boys and girls in single-sex schools were found to have higher reading achievement and a greater number of English and foreign language credits than boys and girls in coeducational schools (Marsh, 1989a). In that same study, Marsh also found that boys had greater achievement growth in mathematics, science, and vocabulary than girls in both coeducational and single-sex schools. The outcomes for girls revealed that their achievement in writing grew more than that of boys, enrolled in more English courses, spent more time on homework, earned better grades, and reported less stereotypical views of societal gender roles.

Marsh (1989b) claims that the differences found by Lee and Byrk (1986) could be caused by differences in the students who attend the schools rather than an effect produced by the schools themselves. Marsh (1989b) criticized Lee and Byrk (1986) for not controlling for preexisting differences in academic achievement and self-concept in the students who attended the schools in their study.

Hamilton (1985) studied Jamaican high school students in single-sex and coeducational schools and found that boys and girls in single-sex schools outscored those in coeducational school. Results from the study reveal that girls in single-sex schools had the highest academic performance, followed by boys in single-sex schools, then boys in coeducational schools, and lastly girls in coeducational schools.

Carpenter and Hayden's (1987) study investigates whether single-sex or coeducational schools affects girls' academic achievement in grade 12 of high school in Victoria and Queensland, Australia. The researchers found that in Queensland, girls whose fathers have prestigious jobs have higher average academic marks during senior year of high school than other girls. In the study, the independent variable was father's occupational prestige and parents' education. When social origins, social influence, and curriculum are controlled for, the students in single-sex school had higher academic achievement.

Lee and Marks (1990) completed a follow-up study to determine if the previously identified benefits of single-sex schooling had any effect in post-secondary education. Lee and Marks (1990) found that the male and female students who graduated from single-sex secondary schools tended to be enrolled in more prestigious colleges and universities and were more likely to aspire to graduate school than their peers from coeducational schools.

To account for academic differences between the genders, King and Gurian (2006) focused on the physiology of the brain. These authors state that the brains of male students generally have more cortical areas dedicated to spatial-mechanical functioning than the brains of female students; therefore, males tend to perform better in tasks that require spatial-mechanical functioning, such as in geometry mathematics and the sciences. Also, King and Guarin (2006) state that the brains of female students generally have greater cortical emphasis on verbal-emotive processing; therefore, females tend to use more words on average than males do, and allows female students to think more verbally.

No differences between single-sex and coeducation schooling

LePore and Warren (1997) speculated that their results were substantially different from previous research findings, especially those of Lee and Bryk (1986), because of changing dynamics in Catholic schools that make them mirror public schools. LePore and Warren's study results failed to demonstrate educational benefits for girls in single-sex schools over coeducational schools. For example, more African American and Latino students are a greater percentage of a Catholic school's student body and thus have the same educational needs of their public school counterparts.

Also, Catholic schools have experienced a shift in faculty, with more lay teachers in the faculty than religious teachers, such as nuns and brothers of the Church. LePore and Warren (1997) conclude in this study that these shifts cause Catholic schools to mirror public schools which may account for school type not being a significant variable for academic achievement. Moreover, the authors speculate that increased awareness in gender-equity issues in schools may lead to less gender-bias issues for girls, thus there are no benefits for single-sex schooling.

Although Haag (1998) found that single-sex schooling for girls has shown to increase their confidence in mathematics and science, a study done by Harvey (1985) found that when gender groups in coeducation settings were compared, there was little difference in academic performance. Harvey (1985) sampled students in England to examine the effect single-sex and coeducational teaching groups have on science achievement. The 2900 students were in coeducational schools with single-sex classes, coeducational schools with coeducational science classes and single-sex girls' and boys' schools. Harvey found that when gender groups in coeducation settings were compared, there was little difference in academic performance with the exception that girls in single-sex classes in the coeducational schools did better in physics than girls in coeducational classes. Harvey concludes that girls in coeducational schools that are in single-sex science classes outperform girls in science in single-sex schools. This conclusion contradicts the previous research of Lee and Byrk (1986), and Riordan (1985) that girls in single-sex schools have higher science achievement than girls in coeducational settings. However, even in Harvey's study, girls are placed in single-sex classrooms, adding some credibility to grouping students by gender in coeducational schools.

The U.S. Department of Education's Office of Planning, Evaluation, and Policy Development commissioned a review to document the outcome evidence for or against the efficacy of single-sex education as an alternative form of school organization using quantitative and qualitative literature (Mael et al., 2005). The literature on single-sex schooling was reviewed using a systematic three phase approach. The initial phase was an exhaustive search of the literature which yielded 2,221 studies and screening these studies for subjects which were full-time high school students (the intervention used in the study being single-sex schools but not single-sex classes in a coeducational school). After the screening in the first phase, the researchers narrowed the studies to 379. The second phase of the review eliminated studies that were essays, opinion pieces, and the like and only quantitative studies with statistical controls and qualitative ones were kept which amounted to 114 studies. There were 26 qualitative studies, but only four met the criteria for coding. The qualitative studies contribute to theory building and provide direction for hypothesis testing. The primary focus of the review was quantitative research. The third phase coded the remaining studies, such as sample characteristics, psychometric properties, internal validity, effect, and bias. Of the 88 quantitative studies, 40 were retained for further analysis.

In general the reviewers found that more studies reported positive effects on all-subject achievement test scores due to single-sex schooling than studies reporting the positive effects of coeducational schools on the same outcomes (Mael et al., 2005). The studies examining the English, mathematics, science, and civics achievement outcomes also reported positive findings for single sex schools. However, only a third of the 40 studies reported findings favoring single-sex schools, the remainder of the studies were split between null and mixed results. The reviewers did not find any positive effects of single-sex schooling on longer-term indicators of academic achievement, such as postsecondary test scores, college graduation rates, or graduate school attendance rates.

The following is a tally of the studies performed in the United States with positive findings favoring single-sex education. (Mael et al., 2005) Of the studies analyzing all-subject achievement test scores four favored single-sex schooling, three had findings benefiting females and two benefiting males; one study favored coeducational schooling for females and males. Of the studies analyzing mathematics achievement test scores three favored single-sex schooling, one had findings benefiting females and three benefiting males; one study had mixed results, and six studies had null findings. Of the studies analyzing science achievement test scores two favored single-sex schooling, two had findings benefiting females and one benefiting males; one study had mixed results, and four studies had null findings. Of the studies analyzing verbal and English achievement test scores three favored single-sex schooling and eight had null findings. Only one study analyzed the social studies achievement test scores with favorable findings for single-sex schooling. Of the studies analyzing postsecondary test scores, one favors single-sex schooling and one has null findings. Only one study analyzed college graduation rates and only one study analyzed graduate school attendance and both had null findings. Regardless of academic achievement content-area, each time socioeconomic status was controlled for, no differences were found in academic achievement test scores. However, when controlling for socioeconomic status, gains or differences are found in the lower socioeconomic status group, but the differences are negligible the higher the socioeconomic status (Mael et at, 2005).

Academic differences between male and female students

Other researchers have focused on academic differences between male and female students to question if differences exist at all. One study found that male students in elementary school through high school score significantly lower than female students do on standardized measures of reading achievement (Grigg, Daane, Ying, & Campbell, 2003).

Regarding mathematical ability, some studies have concluded that males perform better in mathematics than females, while other studies showing that females sometimes do better than males (Alkhateeb, 2001). While these studies compare male subjects with female subjects on a particular test of general mathematical understanding and ability, Van Nelson and Leganza (2006) state that there may be different types of mathematical ability just as there are different branches of mathematics. Different components of mathematical ability are logical reasoning, symbol manipulation, computational ability, and the ability to see spatial relationships. Moreover, successful completion of a mathematics course may be more important to a student's future success in mathematics than a measure of their mathematical ability (Van Nelson & Leganza, 2006). The meta-analysis study by Hyde, Fennema, and Lamon (1990) indicated that there is little support for the assumption that males excel in mathematical ability and there are complex patterns that need to be acknowledged. Some of these patterns the study found are the gender differences in the understanding of mathematical concepts, that females outperform males in mathematical computation, and any gender differences favoring males in problem solving do not emerge until the high school years. Hyde, Fennema, and Lamon’s study (1990) supports the notion that there are different mathematical abilities and that mathematical ability should not be considered collectively as one skill.

There are no research studies that focus on comparing student achievement of boys and girls in single-sex schools that have the same curriculum. There are no research studies comparing student achievement of boys and girls in single-sex schools that are in a remedial education program that incorporates individual instruction, or learning technologies. Moreover, there are no research studies examining single-sex schooling and rates of teenage pregnancy, college performance, differential treatment by teachers, parental satisfaction, bullying in school, and teacher satisfaction. Also, there are no research studies examining single-sex schooling and long-term indicators of academic achievement, such as college grade point average, meritorious scholarships of funding attained, postgraduate licensure test scores, and any career achievement that could be tied to quality of schooling (Mael et al., 2005).

E. Learning Technologies

A question most school administrators and teachers ask is, if the use of learning technologies raises student achievement. The review of the literature reveals that there is little evidence that helped answer the question during the 1980s and much of the 1990s. According to Cuban (1986), schools have required teachers to use new and often unproven technology in the classroom, and that computers were the latest example. During the 1980s, the Apple Classroom of Tomorrow project attempted to introduce more innovative uses of computers in a set of schools across the U.S. with inconclusive evaluations of the program. Cuban (2001) reviewed case studies at various grade levels and found that claims about the benefits of computers were overstated. Nevertheless, computer-based teaching was especially effective among populations of at-risk students (Protheroe, 2005).

Assessments of the impact of technology are actual assessments of the instruction supported by the technology. The effectiveness of the technology is tied to the effectiveness of the instructional design, content, and teaching strategies used by the teacher (Glennan & Melmed, 1996). The results from the National Assessment of Educational Progress (NAEP) assessments in mathematics, science, and reading for 4th and 8th grade students reveals that the quality of computer work is more important than the quantity. In addition, students could receive a substantial benefit, no benefit, or even negative consequences from working with computers in the classroom, depending on how the teachers chose to use technology.

Technology has been integrated across the curriculum in elementary, middle, and high schools with documented evidence of having a positive impact on student achievement. The use of technology for history-specific tasks appears to have no correlation with performance on the NAEP history assessment; but using technology for general academic assignments does appear to have a positive impact on student achievement in history (Weglinsky, 2006). Students scored higher on the NAEP U.S. history assessment when they reported using technology for word processing, communicating with e-mail, creating tables, graphs, and charts to complete academic work. The use of computers to help students solve complex problems which incorporates the use of higher-order thinking skills produces greater benefits than using computers to drill students on a set of skills (Wenglinsky, 2006); although in other studies the use of educational technology for drill and practice of basic skills in mathematics could be highly effective (Protheroe, 2005). Wenglinsky (1998) analyzed NAEP data from 1996 to find that 8th graders who use computers for applications rather than for drill and practice showed significant gains in their average test scores; and concludes that technology used for non-routine mathematical applications fosters student understanding, intuition, and deepens students' mathematical learning. However, Schacter and Fagnano (1999) performed meta-analyses and found that computer-based instruction moderately improved student learning.

Success and positive attitudes toward mathematics and science can lead to students taking courses in computer science or information technologies in post-secondary education. Concerns about low rates of enrollment in computer science and information technologies education programs become more pronounced when gender differences are examined. Female students are underrepresented in high-technology learning environments (Crombie et al., 2000). Female students enroll in computer science and information technologies programs at lower rates than their male counterparts and only represent a small percentage of the information technology career field.

As the 21st century becomes more and more pervasive with technology and computer science, there is a concern for the low level of female enrollments in such post-secondary programs. Researches have found that positive computer experiences are a significant predictor of positive attitudes toward computers, and that positive attitudes toward computers are the best predictor of future behavior with respect to enrolment in computer science or information technologies academic programs (Crombie et al., 2000).

The use of learning technologies by students to produce academic work impacts the quantity and quality of students' thinking and writing. The use of word processing programs reduce the fears students in low-track programs may have associated with writing. Editing and revising student work may occur quickly and thus promote more writing. Furthermore, student motivation is impacted when the finished product has a professional quality that generates a sense of accomplishment. Learning technologies lend themselves to student artistic expression. Multimedia projects such as video production, digital photography, and animation have broad appeal, and encourage artistic expression. Learning technological tools allow students to instantly seek information anywhere around the world using maps and demographic data, and from websites dedicated to news that deliver newsroom-quality stream of current events into the classroom.

Learning technologies consists of the designs and the environments that engage students in active, constructive, intentional, authentic, and cooperative learning.

Moreover, learning technologies are used as a social medium to support learning by allowing students to collaborate, discuss, debate, and build consensus among members of a community; and for supporting discourse among knowledge-building communities (Jonassen et al., 1999).

Consequently, using learning technologies in the classroom provide opportunities for students to produce authentic intellectual work that has value beyond school. Students use technology to produce authentic intellectual work when teachers assign such tasks. When teachers have technology readily at their disposal, then they assign higher-order thinking tasks to students. While every lesson may not need to use technology, teachers consider the lesson's objectives before deciding to integrate learning technologies. Hence learning technologies are tools to support knowledge construction: for representing students' ideas, understandings, and beliefs for producing organized, multimedia knowledge bases by students (Jonassen et al., 1999).

According to the National Council of Teachers of Mathematics (2000), technology is an essential component of effective mathematics instruction. House's (2002) study investigated how computers were incorporated into a mathematics lesson in Japan and found that students spend about two-thirds of the class time receiving classroom instruction with the last third of class on computers. The students worked on a problem designed to show that the sum of the triangle's interior angles is 180 degrees. A key finding in the researcher's observation was students' progress was individually monitored and feedback was provided on their performance; and the computer activities and problems were selected to enhance the retention of material that was covered in homework and the classroom part of the lesson.

House's (2002) observations reinforces the idea that the use of learning technologies can provide a unique mathematical perspective, allow students to represent mathematics differently, which may facilitate learning. Similarly, Irish (2002) found that using a mathematics software program developed to teach students with learning and cognitive disabilities supplemented with regular class review improved the accuracy of basic multiplication facts of "two's" and "nine's."

Teachers, who specifically have a laptop computer at their disposal, develop curriculum at school and home. Curriculum development can take the shape of tasks that requires students to do more writing while utilizing Internet projects, content-area simulation CD-ROMs, data analysis and graphs with Excel, etc. The rationale is that by using a laptop computer, teachers will know how to utilize software programs (MS Office, CD-ROMs, etc), and thus will be comfortable to develop curriculum using tasks that requires students to use their own computers and/or the ones in school. Furthermore, teachers that design tasks that require the use of technology often require students to produce work using higher-order thinking which ultimately contributes to improving student achievement.

Accelerated reader

A learning technologies tool is the Accelerated Reader program, produced by Renaissance Institute. The Accelerated Reader program is software that measures reading comprehension. It is the most widely advertised and used software available (Biggers, 2001). Students first use the software by taking its Standardized Test for Assessment of Reading (STAR) which is a norm-referenced reading test. Students choose the best word to complete a sentence and the software instantly delivers the next question. Upon completion, the STAR generates a grade equivalent score that can be used to give a current approximation of a student's zone of proximal development. Based on this information, the teacher assign students popular literature novels that match the student's grade equivalency.

After the student reads a novel, the student uses a classroom or library computer to log on to his/her account, chooses the book title from a list, and takes an answers multiple choice reading comprehension questions. The test measures the student's knowledge and comprehension of the story, immediate feedback is given of their score and the number of questions correct. The students earn a number of points based on difficulty level and how many questions were answered correctly. The points accumulate to make the students eligible for incentives, if any, the teacher provides. As reading comprehension improves, students are encouraged to read more challenging books.

The Accelerated Reader program is not an instructional one but one that promotes independent reading and measures comprehension. Since the software only measures reading comprehension, its critics state as a limitation that the program does not allow for written responses, extension activities, or repeated interaction with the text (Biggers, 2001). Pavonetti, Brimmer, and Cipielewski's (2003) study investigates whether seventh-grade students who were exposed to Accelerated Reader during elementary school tend to do more reading of books than those who did not participate. The study consisted of 1536 seventh graders. The students were divided into two groups, those who had Accelerated Reader in elementary school and those who did not. A t-test comparing the two groups showed no significant difference between the groups. Thus the researchers concluded that having Accelerated Reader in elementary school does not appear to make a difference on reading. A research design limitation of their study is that the students came from 10 different middle schools from rural and small city schools and could not verify if the Accelerated Reader program was implemented the same amongst the participating schools.

Another criticism of the Accelerated Reader program centers over the use of extrinsic rewards through its point system to encourage students to read and to read independently. According to Briggs and Clark (1997), the Accelerated Reader program devalues reading by rewarding students with extrinsic motivators such as points and prizes for their reading. The extrinsic rewards system precludes the development of intrinsic appreciation and/or love of reading. Hence, struggling readers may be conditioned to read only when extrinsic rewards are guaranteed. However, Briggs and Clark (1997) showed that Accelerated Reader students reported reading more hours per week and checking out more library books per grading period than the non-Accelerated Reader students. The authors conclude that the more students use the Accelerated Reader program effectively, the better chance they will have of passing the Texas Assessment of Academic Skills.

Cuddeback and Cepreno (2002) studied if the Accelerated Reader program is beneficial to the reading development of young emergent reader's comprehension and attitudes toward reading. In their study, 12 of 36 students from a rural school who did not meet the district first grade benchmarks used the Accelerated Reader program in the four weeks of summer school for 30 to 40 minutes a day. Summer school was the first four days of the week for four hours. Prizes were awarded each week based on the number of points students accumulated. The authors concluded from the findings that the

Accelerated Reader program contributed to reading comprehension improvement when used along with other reading materials and instructional strategies.

F. Summary

The term *at-risk* has been applied to describe students that are in danger of failing to complete their education with the requisite skills to succeed in a society (Slavin et al., 1989). Other definitions of *at-risk* suggest that students have unique characteristics that predispose them to being *at-risk*. Some of these characteristics are not completing secondary or higher education schooling because of educational disadvantages, these disadvantages lead to low achievement which leads to difficulties adapting to school. *At-risk* students may exhibit outward signs of distress and failure if drugs or alcohol are abused, an unplanned pregnancy occurs, attempts at suicide are made, succumbs to crime or delinquency, become truant (Slavin et al., 1989). *At-risk* students may also be children from poor urban backgrounds or whose ethnicity are African American, Latino/a, Asian, Native American) which have been recognized as particularly needy in terms of education and special resources (Cuban, 1989). *At-risk* students have also been identified as having genetic or psychological inadequacies that predispose them to failure in school (Bitting, Cordeiro, and Baptiste, 1992). In short, *at-risk* students are those in danger of failing to complete their education.

The quality of remedial low-track education in high schools generally keeps students at such low levels of instruction throughout high school that as a result, students are not prepared for college although they have aspirations of going to college. There is a link between student preparation in high school and student enrollment in remedial courses in college. The evidence is in the number of students who took at least one year of remedial coursework in college, which increased to 35 percent between 1998 and 2003 (Cavanagh, 2003).

Students that are unprepared for college coursework or have little options beyond high school attend schools that are unresponsive to their needs (Waxman, 1992). The high schools that use tracking and ability grouping channel students for different educational experiences. Student track placement is based on individual student abilities and efforts, and the opportunities generated by the school (Hallinan and Sorensen, 1983). However, lower ability tracks contain disproportionate number of students of low socioeconomic status, whom are largely Latino and African American; moreover, Oakes (1990) states that the disparities for African Americans and Latinos are so significant that considerable talent is lost from these ethnic groups. Although research demonstrates the ineffectiveness of tracking to improve academic achievement, schools continue the practice (Oakes, Gamoran, and Page, 1992).

Individual instruction is an instructional and pedagogical approach to improve the academic achievement of students in remedial low educational tracks (Gibbons, 1971). In an individualized instructional environment the teacher becomes a facilitator of knowledge and an advisor to the group of students in the low-track. After diagnosing each student's strengths and areas of improvement, the teacher prescribes a program of study focusing on the student's skills, abilities, interests, learning styles, motivations, rate of learning, and academic goals or standards (Dunn and Dunn, 1972). Instructional tasks and assignments follow a constructivist approach that allows students to give meaning to new learning while using their prior knowledge (Dunn, 1992).

Most research on single-sex education reveals the benefits of proving instruction to students in single-sex schools or in single-sex classrooms (Riordan, 1985, 1990; Lee and Byrk, 1986; Marsh, 1989a; Lee and Marks, 1990). However, there are some studies concluding that single-sex education has no effect on academic achievement (LePore and Warren, 1997; Haag, 1998). Single-sex education has not proliferated in public schools because of restrictions in the federal Title IX legislation of 1972; however, provisions in the No Child Left Behind Act of 2002 promotes school districts to experiment with single-sex schools or single-sex classrooms to address the achievement gap educational disadvantaged students.

Using learning technologies to produce intellectual work stimulates curiosity while engaging the student, which complements the strategies in an individualized instruction program for *at-risk* students. A separate area of concern in education is the low enrollment figures of females in computer related courses and career fields (Crombie et al., 2000). Incorporating learning technologies in the curriculum provides opportunities for students to construct knowledge and produce work using higher-order thinking skills, and promote information technologies for both boys and girls. Learning technologies by design provoke students to raise questions, enter debates, formulate opinions, and engage in problem solving and critical thinking which contribute to improving student achievement and success.

III. METHODOLOGY

A. Research Design

The purpose of this study is twofold: first, to determine whether a remedial education program for *at-risk* high school students that incorporates individualized instruction and learning technologies increases student performance as measured by standardized tests. The second purpose is to determine whether there are differences in achievement between males and females in single-sex schools who experience the same curriculum. The study focuses on an independent co-institutional Catholic high school's General Studies program. The educational approach used in the General Studies program, which is based on individualized instruction with learning technologies suggests that the class of 2007 should attain higher results in standardized tests than similar non-General Studies students in the class of 2006 in mathematics, scientific reasoning, English, and reading on the Explore, Plan, and ACT standardized tests.

This study researches the relationship between student achievement on standardized tests and individualized instruction that incorporates learning technologies for *at-risk* students with college aspirations over a period of three years. The research design is between-subjects because it compares differences in standardized test scores on mathematics, scientific reasoning, English, and reading between the experimental group and the control group. The analysis compares the standardized test scores between the class of 2006 and 2007; and compares the standardized test scores between males and females in the class of 2007.

This is a quantitative methodology using a quasi-experimental design, with an experimental group and a control group. The design compliments this study because there is a condition that complicates or prevents complete experimental design. In this study, random assignment did not occur because the researcher needed to use intact groups in the class of 2006 and the class of 2007. This condition is significant enough that a true experimental design, as described by Bell (1999), cannot be used. However, the quasi-experimental design does incorporate features of a true experimental design, such as identifying two identical groups, of which one is given a treatment (class of 2007) and the other is not (class of 2006). Differences in outcome variables between the two groups can arguably be attributed to the treatment even though some threats are introduced to the design.

The independent variables are individualized instruction in a remedial education program in a single-sex environment, the use of learning technologies in a remedial education program in a single-sex environment, and the students' gender. The dependent variables are student achievement of boys and girls in single-sex environments in reading, English, mathematics, and scientific reasoning on the Explore, Plan, and ACT standardized tests.

B. Subjects

The sample consists of 28 male students and 19 female students from the class of 2006 and 36 male students and 15 female students from the class of 2007. No students from either graduating class transferred out of the school. The total sample size is 99 students, 47 from the class of 2006 and 52 from the class of 2007. The former is the control group; the latter is the experimental group. The ethnic diversity of the male and female students is a mix of African Americans, Latino/as, European Americans, and a small percentage of others and are between ages of 14 and 17, see Tables 2 and 3. All

General Studies students in the class of 2006 and 2007 are included in this study's sample. The curriculum the two sets of classes experienced is the same, in terms of textbooks, teachers, facilities, school culture. The teachers who work with the students in the class of 2007 received professional development on developing curriculum and instructional strategies methodologies in individualized instruction and learning technologies.

The difference between the experiences of the two classes is the individualized instruction along with learning technologies that the class of 2007 experienced. The learning technologies consist of teachers incorporating the use of technology in their instructional strategies, and developing curriculum that requires students to use learning technologies. The program has not changed in any significant way. Thus the only explanation in change of achievement can be attributed to the individualized instruction along with the learning technologies.

C. Measures

The English, mathematics, reading, scientific reasoning, and composite scores on the 9th-grade Explore, 10th-grade Plan, and 11th-grade ACT standardized tests are the measures to assess student achievement in English, mathematics, reading, and scientific reasoning.

The Explore Test

The Explore test contains four multiple-choice tests in English, mathematics, reading, and science reasoning. These tests are designed to measure students' curriculum-related knowledge and the cognitive skills for future education and careers. The Explore tests are designed to be developmentally and conceptually linked to those of

Plan and the ACT Assessment; the three exams are produced by the same company. The continuity is reflected by having the names of the multiple choice tests be the same across the test series. The score scales are the same on all three tests. All three test programs are similar in their focus on higher-order thinking skills and in their common curriculum base (ACT, 2001). The scores range for the English, mathematics, reading, and scientific reasoning tests on the Explore test are 1 to 25.

The Explore English Test

The English test consists of 40 test items with 30 minutes of time is allotted to answer them. The English test measures the student's understanding of the conventions of standard written English (punctuation, grammar and usage, and sentence structure) and of rhetorical skills (strategy, organization, and style). The test emphasizes the analysis of-the kinds of prose that Students are required to read and write in most middle– and secondary-school educational programs, rather than the rote recall of rules and grammar. The English test consists of four prose passages each accompanied by a number of multiple-choice items. Different passage types are employed to provide a variety of rhetorical situations. Some test items refer to underlined portions of the passage and offer several alternatives to the portioned underlined. The student must decide which choice is most appropriate in the context of the passage. The test questions are numbered consecutively (ACT, 2001).

The Explore Mathematics Test

The Explore mathematics test consists of test questions with 30 minutes of time is allotted to answer them. The mathematics test measures students' mathematical reasoning. The test emphasizes quantitative reasoning rather than memorization of formulas or computational skills. The test emphasizes the ability to solve practical quantitative problems that are encountered in middle school or junior high school courses. The items covered in the mathematics test include four cognitive levels: knowledge and skills, direct application, understanding concepts, and integrating concepts. The items in the mathematics test are classified by four content-areas: pre-Algebra, elementary Algebra, Geometry, and statistics and probability (ACT, 2001).

The Explore Reading Test

The Explore Reading test consists of 30 test items with 30 minutes of tine is allotted to answer them. The reading test measures the student's level of reading comprehension as a product of skill in referring and reasoning. In other words the test requires students to derive meaning from text by referring to what is explicitly stated, and reasoning to determine implicit meanings and to draw conclusions, comparisons, and generalizations. The test items asks the student to use referring and reasoning skills to determine main ideas; locate and interpret significant details; understand sequences of events; make comparisons; comprehend cause and effect relationships; determine the meaning of context-dependent words, phrases, and statements; draw generalizations; and analyze the author's or narrator's voice and method. The test comprises three prose passages that are representative of the kinds of text commonly encountered in middle school or junior high curricula, passages on topics in the social sciences, prose fiction, and the humanities. Each passage is accompanied by a set of multiple-choice test items (ACT, 2001).

The Explore Scientific Reasoning Test

The Explore scientific reasoning test consists of 28 items with 30 minutes of time is allotted to answer them. The science reasoning test measures scientific reasoning skills acquired up to 8th grade. The test presents six sets of scientific information, each followed by a number of multiple-choice test items. The scientific information is conveyed in one of three formats: data representation (graphs, tables, and other schematic forms), research summaries, (descriptions of several related experiments), or conflicting viewpoints (expressions of several related hypotheses or views that are inconsistent with one another). The items require students to recognize and understand the basic features of, and concepts related to, the information provided; to examine critically the relationship between the information provided and the conclusions drawn or hypotheses developed; and to generalize from given information the gain new information, draw conclusions, or make predictions. The science reasoning test is based on the type of content that is typically covered through 8th grade and draws its Content from: the life sciences, Earth and space science, and physical sciences. The test emphasizes scientific reasoning rather than the recall of scientific content, skill in mathematics, or skill in reading (ACT, 2001).

Explore Sampling, Reliability, and Validity

In the fall of 1999 ACT conducted a national study so that the Explore and Plan are on the same scale. Eighth and tenth graders participated in the scaling, while eighth, ninth, and tenth graders participated in the norming; the scores of more than 25,000 students were collected. To obtain a nationally representative sample, schools were sorted by geographic region within a school size stratification category. The goal of the sampling was to estimate any proportion to within 0.05 with probability of 0.95 (ACT, 2001). Table 6 shows that the reliability measures of Explore's raw score and scale score are close to the number one which indicates good statistical reliability.

Table 6

Estimated Reliabilities and Standard Errors of Measurement for Explore Tests for Fall Ninth Grade

	English	Mathematics	Reading	Science Reasoning	Composite
Raw Score Reliability	.90	.89	.89	.87	
Scale Score Reliability	.87	.83	.83	.81	.95
SEM	1.60	1.69	1.70	1.35	.80

In terms of validity, the scale scores on the four tests have correlations for ninth-grade students in the interval 0.67 to 0.78, indicating that examinees who score well on one test also tend to score well on another (ACT, 2001). Table 7 in Appendix B contains the Explore national norms data.

The Plan Test

Plan contains four multiple-choice tests in English, mathematics, reading, and scientific reasoning. These tests are designed to measure students' curriculum-related knowledge and the cognitive skills important for future education and careers. The score ranges of the English, mathematics, reading, and scientific reasoning tests on the Plan are 1 to 32.

The Plan English Test

The Plan English test consists of 50 test items with 30 minutes of time is allotted to answer them. The English test measures student understanding of the conventions of standard English (punctuation, grammar and usage, and sentence structure) and of rhetorical skills (strategy, organization, and style). The test emphasizes the analysis of the kinds of prose that students are required to read and write in most secondary and postsecondary programs, rather than the rote recall of rules of grammar. The test consists of several prose passages, each accompanied by a number of multiple-choice test items. Different passage types are used to provide a variety of rhetorical situations (ACT, 1999).

The Plan Mathematics Test

The Plan mathematics test consists of 40 test items with 40 minutes of time is allotted to answer them. The mathematics test measures the student's mathematical reasoning skills. The test emphasizes quantitative reasoning rather than memorization of formulas or computational skills. In particular, it emphasizes the ability to solve practical quantitative problems that are encountered in many first- and second-year high school courses (pre-algebra, first-year algebra, and plane geometry). While some material from second-year courses is included on the test, most items, including the geometry items, emphasize content presented before the second year of high school. The items included in the mathematics test cover four skill areas: knowledge and skills, direct application, understanding concepts, and integrating concepts. The items in the mathematics test are classified according to four content categories: pre-algebra, elementary algebra, coordinate geometry, and plane geometry (ACT, 1999).

The Plan Reading Test

The Plan reading test consists of 25 test items with 20 minutes of time is allotted to answer them. The reading test measures the student's level of reading comprehension as a product of referring and reasoning skills. The test requires students to derive meaning from several passages by referring to what is explicitly stated and reasoning to determine implicit meanings and to draw conclusions, comparisons, and generalizations.

Each passage is followed by several multiple-choice test items. The test focuses on the kinds of skills readers use in studying written materials across a range of subject areas, rather than on information from outside the passage, rote recall of facts, isolated vocabulary items, rules of formal logic. The test includes three prose passages based on topics in prose fiction, the humanities, and the social sciences (ACT, 1999).

The Plan Scientific Reasoning Test

The Plan scientific reasoning test consists of 30 test items with 25 minutes of time is allotted to answer them. The science reasoning test measures scientific reasoning skills acquired through grade ten. The test presents five sets of scientific information, each followed by a number of multiple-choice test items. The scientific information is conveyed in one of three different formats: data representation, (graphs, tables, and other schematic forms), research summaries (descriptions of several related experiments), or conflicting viewpoints (expressions of several related hypotheses or views that are inconsistent with one another). The items require students to recognize and understand the basic feature of, and concepts related to, the information provided; to examine critically the relationship between the information provided and the conclusions drawn from or hypotheses developed; and to generalize from given information to gain new information, draw conclusions, or make predictions. The science reasoning test is based on materials drawn from the content areas of biology, the Earth and space sciences, chemistry, and physics. The test emphasizes scientific reasoning skills rather then recall of scientific content, skill in mathematics, or skill in reading (ACT, 1999).

Plan Sampling, Reliability, and Validity

In the fall of 1995, ACT conducted a study to provide a new set of nationally representative norms for students taking the Plan test during and after the fall of 1996. To compute the norms, the sample consisted of 7403 tenth-grade students who were chosen to represent various regions of the US. The targeted precision level was to estimate any proportion to within 0.05 with probability 0.95. The actual obtained level of precision for the norms is estimated to within 0.02 with probability 0.95 (ACT, 1999).

Table 8
Estimated Reliabilities and Standard Errors of Measurement for Plan Tests for Fall Ninth Grade

	English	Mathematics	Reading	Science Reasoning	Composite
Raw Score					
Reliability	.92	.85	.80	.84	
Scale Score					
Reliability	.87	.83	.83	.81	.94
SEM	1.59	1.99	2.28	1.62	.95

Table 8 shows that the reliability measures of Plan's raw score and scale score are close to the number one which indicates good statistical reliability. In terms of validity, a series of course work variables and clusters were created based on course work taken and grades earned. Simple correlations between Plan scores and all course work and grade variables from the high school course and grade information form and the answer folder were calculated, see Table 9 below.

Table 9
Simple Correlations Between Plan Scores, Self-reported High School Course Work, and Grades for a Representative Sample of Students from One Southeastern State

Course work	English	Mathematics	Reading	Science Reasoning	Composite
Any English course	0.00	.01	.01	-.01	0.00
Algebra 1, Algebra 2, or Geometry	.37	.40	.30	.24	.38
Biology or physical science	.13	.13	.12	.09	.14
N	5491				

Table 10 in Appendix C contains the Plan national norms data.

The ACT Test

The ACT Test has four multiple-choice tests in English, mathematics, reading, and science reading. The tests are designed to measure skills that are acquired in secondary education. The tests in the ACT are designed to be developmentally and conceptually linked to those of Explore and Plan. The score ranges of the English, mathematics, reading, and scientific reasoning tests on the ACT are 1 to 36.

The ACT English Test

The ACT English test consists of 75 test items with 45 minutes of time is allotted to answer them. The English Test measures understanding of the conventions of standard written English (punctuation, grammar, and usage, and sentence structure) and of rhetorical skills (strategy, organization, and style). Spelling, vocabulary, and rote recall of rules of grammar are not tests. The test consists of five prose passages, each of which is accompanied be a sequence of multiple-choice test items. Different passage types are employed to provide a variety of rhetorical situations. Passages are chosen for their appropriateness in assessing writing skills and to reflect students' interests and experiences. Most items refer to underlined portions of the passage and offer several alternatives to the portion underlined. The student must decide which choice is most appropriate in the contest of the passage, or which choice best answers the question posed (ACT, 1997).

The ACT Mathematics Test

The ACT mathematics test consists of 60 test items with 60 minutes of time is allotted to answer them. The mathematics test measures the mathematical reasoning skills that students in the United States have typically acquired in courses taken up to the beginning of grade twelve. The test has multiple-choice items that require students to use their mathematical reasoning skills to solve practical problems in mathematics. Knowledge basic formulas and computational skills are assumed as background for the problems, but memorization of complex formulas and extensive computation are not required. The material covered on the test emphasizes the major content areas that are prerequisite to performance in entry-level courses in college mathematics. The six content-areas the test covers are pre-algebra, elementary algebra, intermediate algebra, coordinate geometry, plane geometry, and trigonometry (ACT, 1997).

The ACT Reading Test

The ACT reading test consists of 40 test items with 35 minutes of time is allotted to answer them. The reading test measures reading comprehension as a product of skill in referring and reasoning. The test requires students to derive meaning from several texts by referring to what is explicitly stated and using reasoning to determine implicit meanings and to draw conclusions, comparisons, and generalizations. The test comprises four prose passages that are representative of the level and kinds of text commonly encountered in first-year college courses in the social sciences, the natural sciences, prose fiction, and the humanities. The test items do not test the rote recall of facts from outside the passage, isolated vocabulary questions, or rules of formal logic. The test focuses upon the complexity of skills readers must use when studying written material across a range of subject areas (ACT, 1997).

The ACT Scientific Reasoning Test

The ACT scientific reasoning test consists of 40 test items with 35 minutes of time is allotted to answer them. The science reasoning test measures the interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences. The content represented in the science reasoning test comes from biology, chemistry, physics, and Earth and space science. The test presents seven sets of scientific information, each followed by a number of multiple-choice test items. The scientific information is presented in the following formats: data representation (graphs, tables, and other schematic forms), research summaries (descriptions of several related experiments), or conflicting viewpoints (expressions of several related hypotheses or views that are inconsistent with each other). The test-items cover three cognitive levels: understanding, analysis, and generalization. The "understanding" test-items require students to recognize and understand the basic features of, and concepts related to, the provided information. The "analysis" test-items require students to examine critically the relationship between the information provided and the conclusions drawn or hypotheses developed. The "generalizations" test-items require students to generalize from given information to gain new information, draw conclusions, or make predictions (ACT, 1997).

ACT Sampling, Reliability, and Validity

In October 1995, ACT conducted a national study involving 24,000 high school students. The target population consisted of students enrolled in twelfth grade in public and private schools. The sample size of 2,356 college-bound students was chosen with the goal of achieving a precision level that would enable estimating any probability to within 0.05 with probability 0.95. The actual obtained level of precision for the norms was estimation of any probability to within 0.12 with probability 0.95. Two reasons are given to explain why the obtained level of precision is far from the goal of 0.05 (ACT, 1997). First, fewer schools were available for analysis than had been targeted. Second, among those schools that did participate, there was an unusual amount of homogeneity within a school, meaning that schools had students who all did well or all did poorly. This phenomenon had an adverse impact on the efficiency of the sample.

Table 11
Scale Score Reliability and Average Standard Error of Measurement for ACT Tests-in 1995-96

	English	Mathematics	Reading	Science Reasoning	Composite
Scale Score Reliability	.91	.91	.86	.84	.96
SEM	1.55	1.43	2.20	1.75	.89

Table 11 shows that the reliability measures of ACT's raw score and scale score are close to the number one which indicates good statistical reliability. In terms of validity, correlation coefficients were calculated between Plan scores earned in fall 1991 and ACT scores earned during junior or senior year prior to graduating in 1994 (see Table 12). The sample consisted of 73,818 students representing 1174 high schools.

Table 12
Correlation Coefficients Among ACT scores and Plan scores

Plan test	English	Mathematics	Reading	Science Reasoning	Composite
English	.80	.61	.71	.64	.78
Mathematics	.63	.82	.58	.68	.76
Reading	.68	.54	.72	.64	.73
Science Reasoning	.65	.62	.67	.69	.74
Composite	.82	.75	.78	.77	.88

Table 13 in Appendix D contains the ACT Assessment national norms data.

D. Procedure

The Explore, Plan, ACT test series were taken when students were in high school. The Explore test was taken in the fall of 9th-grade, the Plan test was taken in the fall of

10th-grade and the ACT test was taken in the spring of 11th-grade. The ACT organization (the test is also named after the company) provided the results to the high school. Table 14 outlines the testing sequence of the subjects in the study.

Table 14
Testing Timeline

Class	Explore	Plan	ACT
2006	October 2002	October 2003	April 2005
2007	October 2003	October 2004	April 2006

The registrar is the guardian of students' transcripts which record students' name, grades on coursework, attendance figures, and outcomes on academic achievement tests. In July 2006, the registrar provided a list of the Explore, Plan, and ACT test scores with no information identifying a student with his or her test scores, a generic identification number was used to tie the test scores. The archival data came from the students' transcripts. The data the registrar provided contained a generic identification number, year of graduation, student gender, student ethnicity, Explore scores, Plan scores, and ACT scores. This procedure guaranteed data and student confidentiality because students' names or any other identifying information were not tied to their test scores.

E. Analysis Plan

The *independent-samples t-test* procedure compared means for two groups which indicated if differences between Explore (9th-grade) scores are statistically significant between the classes of 2006 and 2007 at the start of the school year. This procedure determined if the classes of 2006 and 2007 were equal at the start of the school year.

The *multiple analysis of variance* is a procedure that tested the equality of mean vectors of more than two groups. The class of 2006 Plan and ACT scores were compared to the class of 2007 Plan and ACT scores simultaneously. The multiple analysis of variance revealed if the differences in Plan scores of the classes of 2006 and 2007 are significant; and if the differences in ACT scores of the classes of 2006 and 2007 are significant. The Plan and ACT scores of the male and female students in the class of 2007 were also compared. The multiple analysis of variance revealed if the differences in English, mathematics, reading, scientific reasoning, and composite Plan and ACT scores for the male and female students in the class of 2007 are significant.

The effect statistics produced by *the multiple analysis of variance* are Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root. Pillai's Trace is a positive-value statistic that reaches the number one; the increasing value of the statistic indicates effects that contribute more to the model. There is evidence that Pillai's Trace is more robust than the other statistics. Wilk's Lambda is a positive-value statistic that ranges from zero to one; the decreasing value of the statistic indicates effects that contribute more to the model. Hotelling's Trace is the sum of the eigenvalues of the test matrix; it is a positive-valued statistic for which increasing value indicates effects that contribute more to the model. Hotelling's Trace is always larger than Pillai's Trace, but when the eigenvalues of the test matrix are small, these two statistics will be nearly equal; this indicates that the effect probably does not contribute much to the model. Roy's Largest Root is the largest eigenvalue of the test matrix; it is a positive-value statistic for which increasing value indicates effects that contribute more to the model. Roy's Largest Root is always larger than or equal to Hotelling's Trace. When these two statistics are equal, the effect is predominately associated with just one of the dependent variables, there is a strong correlation between the dependent variables, or the effect does not contribute to the model.

F. Study Limitations

The limitations of the study is that it is compares the achievement of males and females in single-sex schooling who have experienced the same curriculum without comparing the achievement of students in a coeducational schooling environment. The study is also limited by the samples' demographic: since the achievement scores of only students in a low-track secondary educational program are used, the results may not be applicable to upper-track academic programs.

A limitation of the study is the lack of control for standardization of instruction by the faculty who teach the courses in the General Studies program. Although the teachers were trained to develop curriculum and instructional strategies that incorporate individualized instruction and learning technologies, the daily use of this instruction varied from teacher to teacher. However, students generally experienced consistency in the program regarding instruction.

Another limitation of the study is that the ACT testing series starting with the ninth grade Explore test, followed by the tenth grade Plan test, and the eleventh grade ACT test may not capture the full impact the individualized instruction program with learning technologies had on the academic achievement of the General Studies students. However, this study assumes the test series is a valid measure of achievement for the curriculum.

The final limitation of the study is that the sample size decreased from 43 to 21 when analyzing the gains in composite mean scores from the Plan to the ACT test for the combined male and female students in the class of 2007; and from 39 to 23 for the students in the class of 2006. The mean composite score, 14.7, is lower for the Plan test when the sample size for the class of 2007 is 43, and it increases to 15.24 when the sample size is 21. Not all the students in both classes sat for the ACT test which is the reason for the drop in sample size from the Plan to the ACT test.

IV. Results

The purpose of the study is to measure the impact of a remedial low-track academic program. The academic program for the treatment group, the male and female students in the class of 2007, consists of individual instruction while incorporating learning technologies in student assignments, instruction, and assessment. The program is designed to improve low skill levels in English, mathematics, reading, and scientific reasoning. The study compares the standardized test scores of the male and female students from the classes of 2006, the control group, and 2007, the treatment group, on the Explore, Plan, and ACT tests as measures of academic achievement in 9^{th}, 10^{th}, and 11th-grades respectively. The study also determines if there is a difference in academic achievement between male and female students in the class of 2007 that have experienced the same curriculum in a single-sex schooling environment.

A. 9th-grade Explore test results by gender comparing the classes of 2006 and 2007

Table 15
Descriptive Statistics for Explore English Scores for Male Students

	Mean	*SD*	*n*
Class 2006	11.82	1.87	28
Class 2007	12.03	2.05	36

The male students in the class of 2007, *M*(12.03), *SD*(2.05), *n*(36), have mean scores on the English Explore test that are greater than the scores of the class of 2006 students, *M*(11.82), *SD*(1.87), *n*(28) (Table 15). The differences are not significant, *t*(-.42), *df*(62), $p > .05$ (Table 16).

Table 17
Descriptive Statistics for Explore English Scores for Female Students

	Mean	*SD*	*n*
Class 2006	12.95	2.70	19
Class 2007	11.80	2.57	15

The female students in the class of 2007, *M*(11.80), *SD*(2.57), *n*(15), have mean scores on the English Explore test that are less than the scores of the class of 2006 students, *M*(12.95), *SD*(2.7), *n*(19) (Table 17). The differences are not significant, *t*(1.26), *df*(32), $p > .05$ (Table 18).

Table 19
Descriptive Statistics for Explore Mathematics Scores for Male Students

	Mean	*SD*	*n*
Class 2006	13.07	2.24	28
Class 2007	12.53	2.95	36

The male students in the class of 2007, *M*(12.53), *SD*(2.95), *n*(36), have mean scores on the mathematics Explore test that are less than the scores of the class of 2006 students, *M*(13.07), *SD*(2.24), *n*(28) (Table 19). The differences are not significant, *t*(.81), *df*(62), $p > .05$ (Table 20).

Table 21
Descriptive Statistics for Explore Mathematics Scores for Female Students

	Mean	*SD*	*n*
Class 2006	13.05	2.20	19
Class 2007	11.93	2.66	15

The female students in the class of 2007, *M*(11.93), *SD*(2.66), *n*(15), have mean scores on the mathematics Explore test that are less than the scores of the class of 2006 students, *M*(13.05), *SD*(2.2), *n*(19) (Table 21). The differences are not significant, *t*(1.26), *df*(32), $p > .05$ (Table 22).

Table 23
Descriptive Statistics for Explore Reading Scores for Male Students

	Mean	*SD*	*n*
Class 2006	12.07	1.78	28
Class 2007	12.22	1.76	36

The male students in the class of 2007, *M*(12.22), *SD*(1.76), *n*(36), have mean scores on the reading Explore test that are greater than the scores of the class of 2006 students, *M*(12.07), *SD*(1.78), *n*(28) (Table 23). The differences are not significant, *t*(-.34), *df*(62), $p > .05$ (Table 24).

Table 25
Descriptive Statistics for Explore Reading Scores for Female Students

	Mean	*SD*	*n*
Class 2006	12.68	1.53	19
Class 2007	12.6	1.72	15

The female students in the class of 2007, *M*(12.6), *SD*(1.72), *n*(15), have mean scores on the reading Explore test that are less than the scores of the class of 2006 students, *M*(12.68), *SD*(1.53), *n*(19) (Table 25). The differences are not significant, *t*(.15), *df*(32), $p > .05$ (Table 26).

Table 27
Descriptive Statistics for Explore Scientific Reasoning Scores for Male Students

	Mean	*SD*	*n*
Class 2006	14.00	1.70	28
Class 2007	14.53	2.27	36

The male students in the class of 2007, *M*(14.53), *SD*(2.27), *n*(36), have mean scores on the scientific reasoning Explore test that are greater than the scores of the class of 2006 students, *M*(14.3), *SD*(1.7), *n*(28) (Table 27). The differences are not significant, *t*(-.4), *df*(62), $p > .05$ (Table 28).

Table 29

Descriptive Statistics for Explore Scientific Reasoning Scores for Female Students

	Mean	*SD*	*n*
Class 2006	15.00	1.25	19
Class 2007	14.73	1.71	15

The female students in the class of 2007, *M*(14.73), *SD*(1.71), *n*(15), have mean scores on the scientific reasoning Explore test that are less than the scores of the class of 2006 students, *M*(15), *SD*(1.25), *n*(19) (Table 29). The differences are not significant, *t*(.53), *df*(32), *p* > .05 (Table 30).

Table 31

Descriptive Statistics for Explore Composite Scores for Male Students

	Mean	*SD*	*n*
Class 2006	12.89	1.40	28
Class 2007	12.97	1.65	36

The male students in the class of 2007, *M*(12.97), *SD*(1.65), *n*(36), have mean scores on the composite Explore test that are greater than the scores of the class of 2006 students, *M*(12.89), *SD*(1.4), *n*(28) (Table 31). The differences are not significant, *t*(-.2), *df*(62), *p* > .05 (Table 32).

Table 33

Descriptive Statistics for Explore Composite Scores for Female Students

	Mean	*SD*	*n*
Class 2006	13.53	1.31	19
Class 2007	12.93	1.62	15

The female students in the class of 2007, *M*(12.93), *SD*(1.62), *n*(15), have mean scores on the composite Explore test that are less than the scores of the class of 2006 students, *M*(13.53), *SD*(1.31), *n*(19) (Table 33). The differences are not significant, *t*(1.18), *df*(32), *p* > .05 (Table 34).

B. 10th-grade Plan test results by gender comparing the classes of 2006 and 2007

Table 35
Descriptive Statistics for Explore and Plan English Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	11.96	1.90	24
Class 2007	12.14	2.00	29
Plan			
Class 2006	13.92	2.88	24
Class 2007	13.38	2.00	29

The male students in the class of 2007, *M*(13.38), *SD*(2), *n*(29), have mean scores on the English Plan test that are less than the scores of the class of 2006 students, *M*(13.92), *SD*(2.88), *n*(24) (Table 35). The differences are not significant, MANOVA between subjects *SS*(3.79), *df*(1), $p > .05$. The MANOVA effect statistics (Pillai's Trace, Wilks' Lambda, Hotellings' Trace, and Roy's Largest Root) reveal no contributing effects to the model (Table 36). The first hypothesis that English Plan test scores for the male students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 37
Descriptive Statistics for Explore and Plan English Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.87	2.90	15
Class 2007	11.71	2.64	14
Plan			
Class 2006	13.00	2.45	15
Class 2007	13.79	2.61	14

The female students in the class of 2007, *M*(13.79), *SD*(2.61), *n*(14), have mean scores on the English Plan test that are greater than the scores of the class of 2006 students, *M*(13), *SD*(2.45), *n*(15) (Table 37). The differences are not significant, MANOVA between subjects *SS*(4.47), *df*(1), $p > .05$. The MANOVA effect statistics reveal a contributing effect to the model, since Pillai's Trace is 0.969 (Table 38). The first hypothesis that English Plan test scores for the female students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 39
Descriptive Statistics for Explore and Plan Mathematics Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	13.17	2.24	24
Class 2007	12.79	2.79	29
Plan			
Class 2006	13.83	2.97	24
Class 2007	14.93	2.73	29

The male students in the class of 2007, *M*(14.93), *SD*(2.73), *n*(29), have mean scores on the mathematics Plan test that are greater than the scores of the class of 2006 students, *M*(13.83), *SD*(2.97), *n*(24) (Table 39). The differences are not significant, MANOVA *SS*(15.82), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 40). The second hypothesis that mathematics Plan test scores for the male students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 41
Descriptive Statistics for Explore and Plan Mathematics Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	13.27	2.12	15
Class 2007	11.79	2.69	14
Plan			
Class 2006	13.67	1.50	15
Class 2007	14.29	2.40	14

The female students in the class of 2007, *M*(14.29), *SD*(2.4), *n*(14), have mean scores on the mathematics Plan test that are greater than the scores of the class of 2006, *M*(13.67), *SD*(1.5), *n*(15), students (Table 41). The differences are not significant, MANOVA *SS*(2.78), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 42). The second hypothesis that mathematics Plan test scores for the female students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 43
Descriptive Statistics for Explore and Plan Reading Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.13	1.94	24
Class 2007	12.52	1.35	29
Plan			
Class 2006	13.21	2.92	24
Class 2007	13.66	2.24	29

The male students in the class of 2007, *M*(13.66), *SD*(2.24), *n*(29), have mean scores on the reading Plan test that are greater than the scores of the class of 2006 students, *M*(13.21), *SD*(2.92), *n*(24) (Table 43). The differences are not significant, MANOVA SS(15.82), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 44). The third hypothesis that reading Plan test scores for the male students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 45
Descriptive Statistics for Explore and Plan Reading Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.73	1.67	15
Class 2007	12.50	1.74	14
Plan			
Class 2006	14.73	2.92	15
Class 2007	14.14	2.41	14

The female students in the class of 2007, *M*(14.14), *SD*(2.41), *n*(14), have mean scores on the reading Plan test that are less than the scores of the class of 2006, *M*(14.73), *SD*(2.92), *n*(15), students (Table 45). The differences are not significant, MANOVA SS(2.78), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 46). The third hypothesis that reading Plan test scores for the female students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 47
Descriptive Statistics for Explore and Plan Scientific Reasoning Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	14.17	1.79	24
Class 2007	14.62	1.90	29
Plan			
Class 2006	15.25	2.40	24
Class 2007	16.34	1.70	29

The male students in the class of 2007, *M*(16.34), *SD*(1.7), *n*(29), have mean scores on the scientific reasoning Plan test that are greater than the scores of the class of 2006, *M*(15.25), *SD*(2.4), *n*(24), students (Table 47). The differences are not significant but the p-value is close to .05, MANOVA SS(15.74), *df*(1), $p = .058$. The MANOVA effect statistics reveal no contributing effects to the model (Table 48). Although the data does not support the fourth hypothesis for male students, the data reveals a trend in the model and scientific reasoning achievement.

Table 49

Descriptive Statistics for Explore and Plan Scientific Reasoning Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	15.20	1.32	15
Class 2007	14.57	1.65	14
Plan			
Class 2006	16.00	1.65	15
Class 2007	15.57	1.74	14

The female students in the class of 2007, *M*(15.57), *SD*(1.74), *n*(14), have mean scores on the scientific reasoning Plan test that are less than the scores of the class of 2006, *M*(16), *SD*(1.65), *n*(15), students (Table 49). The differences are not significant, MANOVA SS(1.33), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 50). The data does not support the fourth hypothesis for the female students in the class of 2007.

Table 51
Descriptive Statistics for Explore and Plan Composite Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.92	1.38	24
Class 2007	13.17	1.44	29
Plan			
Class 2006	14.04	1.46	24
Class 2007	14.69	1.44	29

The male students in the class of 2007, *M*(14.69), *SD*(1.44), *n*(29), have mean scores on the composite Plan test that are greater than the scores of the class of 2006, *M*(14.04), *SD*(1.46), *n*(24), students (Table 51). The differences are not significant, MANOVA *SS*(5.51), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 52). The data does not support the fifth hypothesis for the male students in the class of 2007.

Table 53
Descriptive Statistics for Explore and Plan Composite Scores for Females Students

	Mean	*SD*	*n*
Explore			
Class 2006	13.60	1.40	15
Class 2007	12.79	1.58	14
Plan			
Class 2006	14.53	1.13	15
Class 2007	14.71	1.68	14

The female students in the class of 2007, *M*(14.71), *SD*(1.68), *n*(14), have mean scores on the composite Plan test that are greater than the mean scores of the class of 2006, *M*(14.53), *SD*(1.13), *n*(15), students (Table 53). The differences are not significant, MANOVA *SS*(.24), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 54). The fifth hypothesis that composite test scores for the female students in the class of 2007 are greater than the male and female students in the class of 2006 is not supported by the data.

C. 11th-grade ACT test results by gender comparing the classes of 2006 and 2007

Table 55
Descriptive Statistics for Plan and ACT English Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.15	2.85	13
Class 2007	13.57	2.38	14
ACT			
Class 2006	14.15	3.60	13
Class 2007	12.93	2.59	14

The male students in the class of 2007, *M*(12.93), *SD*(2.59), *n*(14), have mean scores on the English ACT test that are less than the scores of the class of 2006, *M*(14.15), *SD*(3.6), *n*(13), students (Table 55). The differences are not significant, MANOVA *SS*(10.12), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 56).

Table 57
Descriptive Statistics for Plan and ACT English Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	13.40	2.59	10
Class 2007	15.14	2.04	7
ACT			
Class 2006	14.80	3.82	10
Class 2007	14.57	4.12	7

The female students in the class of 2007, *M*(14.57), *SD*(4.12), *n*(7), have mean scores on the English ACT test that are less than the scores of the class of 2006, *M*(14.8), *SD*(3.82), *n*(10), students (Table 57). The differences are not significant, MANOVA *SS*(.22), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 58). The sixth hypothesis that English ACT test scores for the male and female students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 59
Descriptive Statistics for Plan and ACT Mathematics Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.15	2.48	13
Class 2007	15.86	.95	14
ACT			
Class 2006	15.38	2.18	13
Class 2007	16.50	1.91	14

The male students in the class of 2007, *M*(16.5), *SD*(1.91), *n*(14), have mean scores on the mathematics ACT test that are greater than the scores of the class of 2006, *M*(15.38), *SD*(2.18), *n*(13), students (Table 59). The differences are not significant, MANOVA *SS*(8.39), *df*(1), $p > .05$. The MANOVA effect statistics reveal contributing effects to the model (Table 60). The seventh hypothesis that mathematics ACT test scores for the male students in the class of 2007 are greater than the class of 2006 is supported by the data.

Table 61
Descriptive Statistics for Plan and ACT Mathematics Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	13.90	1.60	10
Class 2007	15.00	1.83	7
ACT			
Class 2006	14.90	1.97	10
Class 2007	15.00	1.73	7

The female students in the class of 2007, *M*(15), *SD*(1.73), *n*(7), have mean scores on the mathematics ACT test that are greater than the class of 2006, *M*(14.9), *SD*(1.97), *n*(10), students (Table 61). The differences are not significant, MANOVA *SS*(.04), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 62). The seventh hypothesis that mathematics ACT test scores for the female students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 63
Descriptive Statistics for Plan and ACT Reading Scores for Male Students by Year

	Mean	*SD*	*n*
Plan			
Class 2006	12.77	3.09	13
Class 2007	13.36	2.31	14
ACT			
Class 2006	15.85	2.41	13
Class 2007	13.36	2.24	14

The male students in the class of 2007, *M*(13.36), *SD*(2.24), n(14), have mean scores on the reading ACT test that are less than the class of 2006, *M*(15.85), *SD*(2.24), *n*(14), students (Table 63). The differences are significant, MANOVA *SS*(41.76), *df*(1), *p*

< .01. The MANOVA effect statistics reveal no contributing effects to the model (Table 64). The eighth hypothesis that reading ACT test scores for the male students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 65
Descriptive Statistics for Plan and ACT Reading Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.10	3.11	10
Class 2007	14.29	2.93	7
ACT			
Class 2006	15.80	2.57	10
Class 2007	13.57	2.51	7

The female students in the class of 2007, *M*(13.57), *SD*(2.51), *n*(7), have mean scores on the reading ACT test that are less than the class of 2006, M(15.8), *SD*(2.57), *n*(10), students (Table 65). The differences are not significant, MANOVA *SS*(20.45), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 66). The eighth hypothesis that reading ACT test scores for the female students in the class of 2007 are greater than the class of 2006 is not supported by the data.

Table 67
Descriptive Statistics for Plan and ACT Scientific Reasoning Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	15.62	2.36	13
Class 2007	17.43	1.45	14
ACT			
Class 2006	16.00	2.27	13
Class 2007	18.07	2.76	14

The male students in the class of 2007, *M*(18.07), *SD*(2.76), *n*(14), have mean scores on the scientific reasoning ACT test that are greater than the class of 2006, *M*(16), *SD*(2.27), *n*(13), students (Table 67). The differences are significant, MANOVA *SS*(28.92), *df*(1), $p < .05$. The MANOVA effect statistics reveal contributing effects to the model (Table 68), the between subjects statistics reveal significant differences between the 2006 and 2007 male students in both the Plan, $p < .05$, and ACT, $p < .05$. The ninth hypothesis that scientific reasoning ACT test scores for the male students in the class of 2007 are greater than the class of 2006 is supported by the data.

Table 69
Descriptive Statistics for Plan and ACT Scientific Reasoning Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	15.90	1.79	10
Class 2007	15.71	1.80	7
ACT			
Class 2006	15.40	2.50	10
Class 2007	15.00	3.27	7

The female students in the class of 2007, *M*(15), *SD*(3.27), *n*(7), have mean scores on the scientific reasoning ACT test that are less than the class of 2006, *M*(15.4), *SD*(2.5), *n*(10), students (Table 69). The differences are not significant, MANOVA *SS*(.66), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 70). The data does not support the ninth hypothesis that scientific reasoning ACT for the female students in the class of 2007 are greater than the class of 2006 is supported by the data.

Table 71
Descriptive Statistics for Plan and ACT Composite Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.15	1.63	13
Class 2007	15.21	1.19	14
ACT			
Class 2006	15.31	1.80	13
Class 2007	15.29	1.60	14

The male students in the class of 2007, *M*(15.29), *SD*(1.6), *n*(14), have mean scores on the composite ACT test that are less than the class of 2006, *M*(15.31), *SD*(1.8), *n*(13), students (Table 71). The differences are not significant, MANOVA *SS*(.003), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model (Table 72). The tenth hypothesis that the composite ACT test score for the male students in the class of 2007 is greater than the class of 2006 is not supported by the data.

Table 73
Descriptive Statistics for Plan and ACT Composite Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.50	1.27	10
Class 2007	15.29	1.50	7
ACT			
Class 2006	15.20	2.15	10
Class 2007	14.57	2.07	7

The female students in the class of 2007, *M*(14.57), *SD*(2.07), *n*(7), have mean scores on the composite ACT test that are less than the class of 2006, *M*(15.2), *SD*(2.15), *n*(10), students (Table 73). The differences are not significant, MANOVA *SS*(1.63), *df*(1), $p > .05$. The MANOVA effect statistics reveal no contributing effects to the model

(Table 74). The tenth hypothesis that the composite ACT test score for the female students in the class of 2007 is greater than the class of 2006 is not supported by the data.

D. Class of 2007 Plan test results for male and female students

Table 75

Independent Samples T-test for Plan Mathematics Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.29	2.40	14
Males	14.93	2.73	29

	F	*p*
Levene's Test for Equality of Variances	.096	.76

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	.76	41	.45	.65

The class of 2007 male students, *M*(14.93), *SD*(2.73), *n*(29), have mean scores on the mathematics Plan test that are greater than the female students, *M*(14.29), *SD*(2.4), *n*(14), but the differences are not significant, *t*(.76), *df*(41), $p > .05$ (Table 75). The data does not support the eleventh hypothesis that the mathematics score on the Plan test for the male students is greater than the female students.

Table 76

Independent Samples T-test for Plan Scientific Reasoning Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	15.57	1.74	14
Males	16.34	1.70	29

	F	*p*
Levene's Test for Equality of Variances	.59	.45

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	1.39	41	.17	.773

The class of 2007 male students, *M*(16.34), *SD*(1.7), *n*(29) have mean scores on the scientific reasoning Plan test that are greater than the female students, *M*(15.57), *SD*(1.74), *n*(14), but the differences are not significant, *t*(1.39), *df*(41), $p > .05$ (Table 76). The data does not support the twelfth hypothesis that the scientific reasoning score on the Plan test for the male students is greater than the female students.

Table 77

Independent Samples T-test for Plan English Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	13.79	2.61	14
Males	13.38	2.01	29

	F	*p*
Levene's Test for Equality of Variances	.59	.45

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	-.56	41	.58	.41

The class of 2007 female students, *M*(13.79), *SD*(2.61), *n*(14), have mean scores on the English Plan test that are greater than the male students, *M*(13.38), *SD*(2.01), *n*(29), but the differences are not significant, *t*(-.56), *df*(41), $p > .05$ (Table 77). The data does not support the thirteenth hypothesis that the English score on the Plan test for the female students is greater than the male students.

Table 78
Independent Samples T-test for Plan Reading Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.14	2.41	14
Males	13.66	2.24	29

	F	*p*
Levene's Test for Equality of Variances	.052	.82

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	-.65	41	.52	.49

The class of 2007 female students, *M*(14.14), *SD*(2.41), *n*(14), have mean scores on the reading Plan test that are greater than the male students, *M*(13.66), *SD*(2.24), *n*(29), but the differences are not significant, *t*(-.65), *df*(41), $p > .05$ (Table 78). The data does not support the fourteenth hypothesis that the reading score on the Plan test for the female students is greater than the male students.

Table 79
Independent Samples T-test for Plan Composite Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.71	1.68	14
Males	14.69	1.44	29

	F	*p*
Levene's Test for Equality of Variances	.11	.75

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	-.05	41	.96	.025

The class of 2007 female students, *M*(14.71), *SD*(1.68), *n*(14), have mean scores on the composite Plan test that are greater than the male students, *M*(14.69), *SD*(1.44), *n*(29), but the differences in means are not significant, *t*(-.05), *df*(41), $p > .05$ (Table 79). The data supports the fifteenth hypothesis that there are no significant differences in composite scores on the Plan test for the male and female students.

E. ACT test results comparing the class of 2007 by gender

Table 80
Independent Samples T-test for ACT Mathematics Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	15.00	1.60	8
Males	16.33	2.00	15

	F	*p*
Levene's Test for Equality of Variances	.30	.59

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	1.65	21	.113	1.33

The class of 2007 male students, *M*(16.33), *SD*(2), *n*(15), have mean scores on the mathematics ACT test that are greater than the female students, *M*(15), *SD*(16), *n*(8), but the differences are not significant, *t*(1.65), *df*(21), $p > .05$ (Table 80). The data does not support the sixteenth hypothesis that the mathematics score on the ACT test for the male students is greater than the female students.

Table 81
Independent Samples T-test for ACT Scientific Reasoning Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	15.25	3.11	8
Males	17.93	2.71	15

	F	*p*
Levene's Test for Equality of Variances	.40	.53

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	2.15	21	.043*	2.68

The class of 2007 male students, *M*(17.93), *SD*(2.71), *n*(15), have mean scores on the scientific reasoning ACT test that are greater than the female students, *M*(15.25), *SD*(3.11), *n*(8), and the differences are significant, *t*(2.15), *df*(21), $p < .05$ (Table 81). The data supports the seventeenth hypothesis that the scientific reasoning score on the ACT test for the male students is greater than the female students.

Table 82
Independent Samples T-test for ACT English Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.38	3.85	8
Males	13.13	2.62	15

	F	*p*
Levene's Test for Equality of Variances	.144	.71

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	-.92	21	.368	1.24

The class of 2007 female students, *M*(14.38), *SD*(3.85), *n*(8), have mean scores on the English ACT test that are greater than the male students, *M*(13.13), *SD*(2.62), *n*(15), but the differences are not significant, *t*(-.92), *df*(21), *p* > .05 (Table 82). The data does not support the eighteenth hypothesis that the English score on the ACT test for the female students is greater than the male students.

Table 83
Independent Samples T-test for ACT Reading Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	13.63	2.33	8
Males	13.27	2.19	15

	F	*p*
Levene's Test for Equality of Variances	.018	.90

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	-.366	21	.72	.36

The class of 2007 female students, *M*(13.63), *SD*(2.33), *n*(8), have mean scores on the reading ACT test that are greater than the male students, *M*(13.27), *SD*(2.19), *n*(15), but the differences are not significant, *t*(-.36), *df*(21), $p > .05$ (Table 83). The data does not support the nineteenth hypothesis that the reading score on the ACT test for the female students is greater than the male students.

Table 84
Independent Samples T-test for ACT Composite Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.63	1.92	8
Males	15.27	1.53	15

	F	*p*
Levene's Test for Equality of Variances	.007	.94

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	.88	21	.39	.64

The class of 2007 male students, *M*(15.27), *SD*(1.53), *n*(15), have mean scores on the composite ACT test that are greater than the female students, *M*(14.63), *SD*(1.92), *n*(8), but the differences are not significant, *t*(.88), *df*(21), $p > .05$ (Table 84). The data does not support the twentieth hypothesis that the composite score on the ACT test is not significant for the female and male students.

F. Classes of 2006 and 2007 Explore to Plan and Plan to ACT test gains comparison

Table 85

Descriptive Statistics for Explore and Plan Composite Scores

	Mean	*SD*	*n*
Explore			
Class 2006	13.18	1.41	39
Class 2007	13.05	1.48	43
Plan			
Class 2006	14.23	1.35	39
Class 2007	14.70	1.51	43

The students in the class of 2007, experienced a mean gain of 1.65 in the composite score and is greater than the mean gain experienced by the students in the class of 2006, 1.05, from Explore to Plan (Table 85). However, the gains made by the students in the class of 2007 or 2006 are not significant, *SS*(3.68), *df*(1), *F*(3.55), $p > .05$ (Table 86). The data does not support the twenty-first hypothesis that the students in the class of 2007 have greater gains than the class of 2006 in composite scores from the ninth-grade Explore test to the tenth-grade Plan test.

Table 87

Descriptive Statistics for Plan and ACT Composite Scores

	Mean	*SD*	*n*
Plan			
Class 2006	14.30	1.46	23
Class 2007	15.24	1.26	21
ACT			
Class 2006	15.26	1.91	23
Class 2007	15.05	1.75	21

The students in the class of 2007 experienced a mean loss of .19 in composite scores from the Plan to ACT tests. The students in the class of 2006 experienced a mean gain of .96 in composite scores from the Plan to ACT tests (Table 87). The gains made by the students in the class of 2006 and the loss in mean scores by the students in the class of 2007 are significant, *SS*(7.22), *df*(1), *F*(5.22), $p < .05$ (Table 88). The data does not support the twenty-second hypothesis that the students in the class of 2007 have greater gains than the class of 2006 in composite scores from the tenth-grade Plan test to the eleventh-grade ACT test.

G. Summary

This chapter summarized the data collected for the study. The research study used quantitative data collection. Data was gathered for this study to investigate two research questions. The data analysis reveals that the treatment groups, male and female students in the class of 2007, have mathematics scores on the Plan and ACT tests that are greater but not statistically significant than the students in the class of 2006. Although mean scores on the mathematics and scientific reasoning for the male students is greater than the female students and the mean scores on the English and reading for the female students is greater than the male students in the class of 2007, the differences in mean scores between the two groups are not significant male and female students.

V. Discussion

A. Findings and Implications

This chapter interprets the findings, places the implications of the findings in context with the literature, the limitations of the study, and comments about future directions for further research.

The differences in scores on the Explore test in English, mathematics, reading, scientific reasoning, and composite for the male and female students in the classes of 2006 and 2007 are not statistically significant. The male and female students in both academic classes began their ninth grade academic year achieving about the same level.

The male students in the class of 2007 were found to have scores on the English Plan and ACT tests that are less than the students in the class of 2006. The individualized instructional program that incorporates learning technologies' impact on the male students in the class of 2007 yielded a growth in mean English scores from the Explore to Plan that was less than the growth for the male students in the class of 2006. The data for the ACT English test reveals similar results for the male students in the class of 2007 that are found on the English Plan test. The mean score for the male students in the class of 2007 declined from the Plan to the ACT tests in English; the mean score in English for the male students in the class of 2006 from the Plan to the ACT tests remained the same.

The female students in the class of 2007 were found to have scores on the Plan English test that are greater than the class of 2006 but the scores were less on the English ACT test. The female students in the class of 2007 experienced a growth from the Explore test to the Plan tests that was greater than the growth experienced by the female students in the class 2006 on the same tests. The multiple analysis of variance effect statistics reveals that the use of individualized instruction along with learning technologies had an impact on English scores from 9th-grade to 10th-grade for the female students. The mean score for the female students in the class of 2007 declined from the Plan to the ACT tests in English; whereas the mean score in English for the female students in the class of 2006 from the Plan to the ACT test improved. The data does not support the hypothesis for English achievement on the Plan and ACT tests.

The male students in the class of 2007 were found to have scores on the reading Plan test that are greater than the students in the class of 2006; but the male students in the class of 2007 scores on the reading ACT test were less than the students in the class of 2006 and this difference is significant. The female students in the class of 2007 were found to have scores on the reading Plan and ACT tests that are less than the students in the class of 2006. The data only supports the hypothesis for the male students in the class of 2007 from the ninth-grade Explore test to the tenth-grade Plan test.

The male students in the class of 2007 were found to have scores on the mathematics Plan and ACT tests that are greater than the male students in the class of 2006. The female students in the class of 2007 were also found to have scores on the mathematics Plan and ACT tests that are greater than the female students in the class of 2006. The data supports the hypotheses for the male and female students in the class of 2007 from ninth-grade Explore test through eleventh-grade ACT test.

The male students in the class of 2007 were found to have scores on the scientific reasoning Plan and ACT tests that are greater than the male students in the class of 2006. The differences on the ACT test between the two groups are significant. The same was not found for the female students in the class of 2007. Their scientific reasoning scores on the Plan and ACT tests are less than the scores of the female students in the class of 2006. The findings for the males are consistent with the literature that the use of technology helps students think about the scientific method or reinforces such thinking. Scientific reasoning is interpreting graphical data to scientific concepts and the use of technology incorporates such thinking. The data supports the hypotheses only for the male students in the class of 2007 from the ninth-grade Explore test through eleventh-grade ACT test.

The male students in the class of 2007 were to found to have scores on the composite Plan test that are greater than the male students in the class of 2006. Although the composite ACT test score mean for the male students in the class of 2007 are less than the male students in the class of 2006, the difference is two-hundredths of a point. The female students in the class of 2007 were found to have scores on the composite Plan that are greater than the female students in the class of 2006; and like their male counterparts, the composite ACT test score mean for the female students in the class of 2007 is less than the female students in the class of 2006. It seems that any differences in mean scores in favor of the male and female students in the class of 2007 tend to equalize when students took the ACT test. Therefore, the data supports the hypothesis for the male and female students in the class of 2007 from the ninth-grade Explore test through the tenth-grade Plan test.

When gender differences are examined amongst the male and female students in the class of 2007, the data supports the conventional thought that male students outperform female students in mathematics and science while female students tend to outperform males in English and reading.

The male students had Plan and ACT mathematics mean test scores that are greater than the females. The same was also found for scientific reasoning; the male students had mean test scores that are greater than the females on the Plan and ACT tests. Although the differences are not significant, the findings are consistent with the literature that males tend to have higher rates of achievement than females in mathematics.

The female students had Plan and ACT English mean test scores that are greater than the male students. The reading Plan and Act mean test scores for the female students are also greater than the male students. Although the differences are not significant, the findings are consistent with the literature that females tend to have higher rates of achievement than males in English and reading.

The composite mean test score on the Plan for the female students is greater than the male students. The opposite is true for the ACT test; the composite mean test score for the male students is greater than the female students. This is a predicted result since the mean differences in scores on the English, mathematics, reading, and scientific reasoning between the male and female students in the class of 2007 are not significant.

The intent of any academic program is to improve and increase student achievement a year at a time. When examining the composite scores from the 9th-grade Explore test to the 10th-grade Plan test for male and female students combined, the students in the class of 2007 experienced greater gains than the class of 2006. Although the gains are not significant, the mean gain difference between the two classes is 0.6, and the significant value of the within subjects statistics is 0.63 which implies trend exists that the individual instruction program with learning technologies during the first year of high school made a positive impact on student achievement.

The composite scores from the 10th-grade Plan to the 11th-grade ACT test for male and female students combined in the classes of 2006 and 2007 from do not reflect the achievement results from the previous year upon examination. The composite scores for the students in the class of 2007 experienced a decline while the students in the class of 2006 continued to experience gains.

The relative immaturity of the individualized instructional program that incorporates learning technologies may be a cause for the different outcomes on the subject tests when comparing the treatment and control groups: positive findings in mathematics, mixed results in English, reading, and scientific reasoning. The male and female students in the treatment group improved their mathematics achievement over the control group from ninth-grade through eleventh grade. The female students in the treatment group had higher English scores on the tenth-grade test than the control group, but the same was not found for the male students in the treatment group; and both groups did not have scores that were higher than the control group on the eleventh-grade exam. The achievement of the male students in the treatment group in reading and scientific reasoning improved from the ninth-grade to the tenth-grade over the control group but the same was not found from the tenth-grade to the eleventh-grade. The female students in the treatment group did not experience the same achievement as their male counterparts on the reading and scientific reasoning tests from ninth-grade to tenth-grade.

The outcome of this study has findings in mathematics and scientific reasoning in a curriculum utilizing individualized instruction with learning technologies. The findings are consistent for the students in the class of 2007 in mathematics which seem to have greater external validity for students of similar populations regardless of gender. The findings in scientific reasoning are consistent only for the male students, but that does not necessarily mean the program failed the female students since the female student sample size reduced to seven students. The immaturity of the program may be a cause for the disparity in scientific reasoning achievement between the male and female students in the class of 2007.

B. Study limitations

A point to note is that the sample size decreases from 43 to 21 students for the combined male and female students when analyzing the gains in composite mean scores for the class of 2007 from the Plan to the ACT test; and from 39 to 23 for the students in the class of 2006. The mean composite score, 14.7, is lower for the Plan test when the sample size for the class of 2007 is 43, and it increases to 15.24 when the sample size is 21. Not all the students in both classes sat for the ACT test which is the reason for the drop in sample size from the Plan to the ACT test.

The female students also had mean scores on the 9th-grade Explore exam that were less than the male students in English and mathematics, two critical areas . The students are taught in a co-institutional educational program where male and female students follow the same curriculum in two separate campuses and are allowed to make adjustments to the educational program to meet the needs of the students at the respective campuses. The curriculum, as a new initiative in the learning technologies component, deviated to focus on the skills sets of students in this demographic.

The statistical analysis conducted on the achievement scores on the English, mathematics, reading, scientific reasoning, and composite tests is the repeated measures of variance. The repeated measures of variance analysis is used to determine if the differences in mean scores between the Explore to Plan tests and the Plan to ACT tests are significant and if the academic program had an effect on the students in the class of 2007. The statistical analysis can be a three-factor analysis that examines the scores of the Explore, Plan, and ACT tests simultaneously. However, this model would yield results from a smaller sample size and lacks power. Therefore, the outcome from the Explore to Plan has greater validity than the outcome from the Plan to ACT.

C. Future directions

The individual instructional program with learning technologies had the strongest impact on scientific reasoning for the male students. Future studies may focus exclusively on this variable, especially for female students. Although this study did not reveal a positive impact on females, the academic program in the co-institutional educational model may not have been implemented adequately in science courses. The impact the academic program has on male students in scientific reasoning does not seem to be isolated to male students. Similar findings to the male population may be revealed for female students.

The field of education during first decade of the 21st century is experiencing a growth in the integration of learning technologies in the curriculum as the cost of computers becomes affordable for schools to outfit themselves and professional development focuses on improving student achievement using technology as learning tools of production. Technology can have a greater impact on student achievement not only for at-risk students with college aspirations but for all students. Future studies may isolate the role technology has on student achievement in an individualized educational program when students have a computer, such as a laptop, to use for all their courses.

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VII. APPENDIX

Appendix A- Enrollment data of high school in the study

Table 1
Student Enrollment in Academic Year 2005-2006

	Class 2006	Class 2007
Male campus	185	157
Female campus	113	101
Total	298	258

Table 2
Male Student Ethnicity in Academic Year 2005-2006 by Class

	Class 2006	Class 2007
European American	34%	35%
African American	33%	29%
Latino/a	28%	29%
Asian American	2%	3%
Bi-ethnic	3%	3%
Native American	0%	1%

Table 3
Female Student Ethnicity in Academic Year 2005-2006 by Class

	Class 2006	Class 2007
European American	46%	37%
African American	25%	22%
Latino/a	21%	35%
Asian American	4%	2%
Bi-ethnic	4%	4%
Native American	0%	0%

Table 4
Male Students in Academic Programs in Academic Year 2005-2006 by Class

	Class 2006	Class 2007
Honors Program	9%	16%
College Preparatory	80%	68%
General Studies	11%	16%

Table 5
Female Students in Academic Programs in Academic Year 2005-2006 by Class

	Class 2006	Class 2007
Honors Program	12%	18%
College Preparatory	76%	71%
General Studies	12%	11%

Appendix B

Table 7
Explore National Norms for Fall Ninth-Grade Students

Scale Score	English	Mathematics	Reading	Science Reasoning	Composite
1	1	1	1	1	1
2	1	1	1	1	1
3	1	1	1	1	1
4	1	1	1	1	1
5	1	2	1	1	1
6	1	2	1	1	1
7	2	3	1	1	1
8	4	5	2	1	1
9	10	7	8	2	3
10	18	10	14	2	6
11	26	13	24	3	12
12	32	21	33	8	21
13	43	29	41	15	31
14	51	37	54	24	41
15	55	51	60	38	52
16	65	62	67	53	61
17	69	72	73	64	70
18	80	83	80	74	79
19	86	88	87	85	85
20	86	88	87	90	91
21	90	93	93	94	94
22	95	93	93	94	97
23	98	98	98	98	99
24	98	98	98	98	99
25	99	99	99	99	99
M	14.90	15.40	14.90	16.60	15.60
SD	4.40	4.10	4.10	3.10	3.50

Appendix C

Table 10
Plan National Norms for Fall Tenth-Grade Students

Scale Score	English	Mathematics	Reading	Science Reasoning	Composite
1	1	1	1	1	1
2	1	1	1	1	1
3	1	1	1	1	1
4	1	1	1	1	1
5	1	1	1	1	1
6	1	1	1	1	1
7	1	1	1	1	1
8	2	2	3	1	1
9	3	3	5	1	1
10	8	5	9	3	2
11	12	7	13	4	5
12	16	11	20	7	10
13	24	18	26	10	18
14	32	26	38	18	26
15	38	36	45	29	35
16	45	49	52	39	44
17	52	58	58	51	54
18	62	66	67	63	64
19	69	74	70	76	72
20	76	79	75	81	80
21	80	86	82	89	85
22	87	89	86	91	90
23	90	92	91	95	93
24	92	95	92	98	96
25	95	96	96	98	98
26	96	98	97	99	99
27	98	99	98	99	99
28	98	99	99	99	99
29	99	99	99	99	99
30	99	99	99	99	99
31	99	99	99	99	99
32	99	99	99	99	99
M	17.20	17.10	16.80	17.50	17.30
SD	4.80	4.20	4.90	3.60	3.90

Appendix D

Table 13
ACT National Norms for College-bound High School Students 1995
Percent at or below

Scale Score	English	Mathematics	Reading	Science Reasoning	Composite
1	1	1	1	1	1
2	1	1	1	1	1
3	1	1	1	1	1
4	1	1	1	1	1
5	1	1	1	1	1
6	1	1	1	1	1
7	1	1	1	1	1
8	3	1	2	1	1
9	5	1	4	1	1
10	10	1	8	3	1
11	16	1	14	7	4
12	20	6	21	11	9
13	26	9	29	23	17
14	32	19	34	28	26
15	37	30	39	38	34
16	43	40	45	43	42
17	49	49	50	51	50
18	56	58	57	61	56
19	62	64	60	69	62
20	66	70	66	74	68
21	71	76	71	78	74
22	75	81	73	83	80
23	79	83	77	88	84
24	83	87	81	91	88
25	86	90	83	95	91
26	90	93	86	96	94
27	93	95	90	97	96
28	96	97	92	98	97
29	97	98	94	99	98
30	98	99	95	99	99
31	99	97	97	99	99
32	99	98	97	99	99
33	99	99	98	99	99
34	99	99	99	99	99
35	99	99	99	99	99
36	99	99	99	99	99

Appendix E

Table 15
Descriptive Statistics for Explore English Scores for Male Students

	Mean	*SD*	*n*
Class 2006	11.82	1.87	28
Class 2007	12.03	2.05	36

Table 16
Independent Samples T-test for Explore English Scores for Male Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.00	.99

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	-.42	62	.68	-.21

Table 17
Descriptive Statistics for Explore English Scores for Female Students

	Mean	*SD*	*n*
Class 2006	12.95	2.70	19
Class 2007	11.80	2.57	15

Table 18
Independent Samples T-test for Explore English Scores for Female Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.08	.78

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	1.26	32	.22	1.15

Table 19

Descriptive Statistics for Explore Mathematics Scores for Male Students

	Mean	*SD*	*n*
Class 2006	13.07	2.24	28
Class 2007	12.53	2.95	36

Table 20

Independent Samples T-test for Explore Mathematics Scores for Male Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	1.76	.19

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	.81	62	.42	.054

Table 21

Descriptive Statistics for Explore Mathematics Scores for Female Students

	Mean	*SD*	*n*
Class 2006	13.05	2.20	19
Class 2007	11.93	2.66	15

Table 22

Independent Samples T-test for Explore Mathematics Scores for Female Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.08	.78

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	1.26	32	.22	1.12

Table 23

Descriptive Statistics for Explore Reading Scores for Male Students

	Mean	*SD*	*n*
Class 2006	12.07	1.78	28
Class 2007	12.22	1.76	36

Table 24

Independent Samples T-test for Explore Reading Scores for Male Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.05	.82

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	-.34	62	.74	-.15

Table 25

Descriptive Statistics for Explore Reading Scores for Female Students

	Mean	*SD*	*n*
Class 2006	12.68	1.53	19
Class 2007	12.6	1.72	15

Table 26

Independent Samples T-test for Explore Reading Scores for Female Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.72	.40

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	.15	32	.88	.08

Table 27

Descriptive Statistics for Explore Scientific Reasoning Scores for Male Students

	Mean	*SD*	*n*
Class 2006	14.00	1.70	28
Class 2007	14.53	2.27	36

Table 28

Independent Samples T-test for Explore Scientific Reasoning Scores for Male Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.41	.52

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	-.4	62	.69	-.21

Table 29

Descriptive Statistics for Explore Scientific Reasoning Scores for Female Students

	Mean	*SD*	*n*
Class 2006	15.00	1.25	19
Class 2007	14.73	1.71	15

Table 30

Independent Samples T-test for Explore Scientific Reasoning Scores for Female Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	1.40	.25

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	.53	32	.6	.27

Table 31

Descriptive Statistics for Explore Composite Scores for Male Students

	Mean	*SD*	*n*
Class 2006	12.89	1.40	28
Class 2007	12.97	1.65	36

Table 32

Independent Samples T-test for Explore Composite Scores for Male Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	1.02	.32

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	-.2	62	.84	-.08

Table 33

Descriptive Statistics for Explore Composite Scores for Female Students

	Mean	*SD*	*n*
Class 2006	13.53	1.31	19
Class 2007	12.93	1.62	15

Table 34

Independent Samples T-test for Explore Composite Scores for Female Students

Effect	*F*	*p*
Levene's Test for Equality of Variances, Equal Variances Assumed	.69	.41

T-test for Equality of Means

	t	*df*	*p (2-tailed)*	*Mean difference*
Year Explore English	1.18	32	.25	.60

Table 35

Descriptive Statistics for Explore and Plan English Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	11.96	1.90	24
Class 2007	12.14	2.00	29
Plan			
Class 2006	13.92	2.88	24
Class 2007	13.38	2.00	29

Table 36

Multiple Analysis of Variance for Explore to Plan English Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.02	.51	2	.603
Wilks' Lambda	.98	.51	2	.603
Hotelling's Trace	.02	.51	2	.603
Roy's Largest Root	.02	.51	2	.603

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore English	.42	.111	1	.74
Year Plan English	3.79	.639	1	.43

Table 37

Descriptive Statistics for Explore and Plan English Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.87	2.90	15
Class 2007	11.71	2.64	14
Plan			
Class 2006	13.00	2.45	15
Class 2007	13.79	2.61	14

Table 38

Multiple Analysis of Variance for Explore to Plan English Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.969*	408.081	2	.082
Wilks' Lambda	.031	408.081	2	.082
Hotelling's Trace	31.39	408.081	2	.082
Roy's Largest Root	31.39	408.081	2	.082

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore English	.962	1.25	1	.27
Year Plan English	4.47	.69	1	.41

Table 39

Descriptive Statistics for Explore and Plan Mathematics Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	13.17	2.24	24
Class 2007	12.79	2.79	29
Plan			
Class 2006	13.83	2.97	24
Class 2007	14.93	2.73	29

Table 40

Multiple Analysis of Variance for Explore to Plan Mathematics Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.057	1.516	2	.229
Wilks' Lambda	.940	1.516	2	.229
Hotelling's Trace	.061	1.516	2	.229
Roy's Largest Root	.061	1.516	2	.229

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Mathematics	1.83	.281	1	.598
Year Plan Mathematics	15.82	1.96	1	.167

Table 41

Descriptive Statistics for Explore and Plan Mathematics Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	13.27	2.12	15
Class 2007	11.79	2.69	14
Plan			
Class 2006	13.67	1.50	15
Class 2007	14.29	2.40	14

Table 42

Multiple Analysis of Variance for Explore to Plan Mathematics Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.16	2.50	1	.10
Wilks' Lambda	.84	2.50	1	.10
Hotelling's Trace	.19	2.50	1	.10
Roy's Largest Root	.19	2.50	1	.10

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Mathematics	15.89	2.73	1	.11
Year Plan Mathematics	2.78	.71	1	.41

Table 43

Descriptive Statistics for Explore and Plan Reading Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.13	1.94	24
Class 2007	12.52	1.35	29
Plan			
Class 2006	13.21	2.92	24
Class 2007	13.66	2.24	29

Table 44

Multiple Analysis of Variance for Explore to Plan Reading Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.025	.64	2	.53
Wilks' Lambda	.975	.64	2	.53
Hotelling's Trace	.026	.64	2	.53
Roy's Largest Root	.026	.64	2	.53

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Reading	2.02	.75	1	.39
Year Plan Reading	2.62	.40	1	.53

Table 45

Descriptive Statistics for Explore and Plan Reading Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.73	1.67	15
Class 2007	12.50	1.74	14
Plan			
Class 2006	14.73	2.92	15
Class 2007	14.14	2.41	14

Table 46

Multiple Analysis of Variance for Explore to Plan Reading Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.014	.18	2	.83
Wilks' Lambda	.986	.18	2	.83
Hotelling's Trace	.014	.18	2	.83
Roy's Largest Root	.014	.18	2	.83

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Reading	.39	.14	1	.72
Year Plan Reading	2.53	.35	1	.56

Table 47

Descriptive Statistics for Explore and Plan Scientific Reasoning Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	14.17	1.79	24
Class 2007	14.62	1.90	29
Plan			
Class 2006	15.25	2.40	24
Class 2007	16.34	1.70	29

Table 48

Multiple Analysis of Variance for Explore to Plan Scientific Reasoning Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.072	1.94	2	.16
Wilks' Lambda	.930	1.94	2	.16
Hotelling's Trace	.078	1.94	2	.16
Roy's Largest Root	.078	1.94	2	.16

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Scientific Reasoning	2.71	.79	1	.38
Year Plan Scientific Reasoning	15.74	3.77	1	.058

Table 49

Descriptive Statistics for Explore and Plan Scientific Reasoning Scores for Female Students

	Mean	*SD*	*n*
Explore			
Class 2006	15.20	1.32	15
Class 2007	14.57	1.65	14
Plan			
Class 2006	16.00	1.65	15
Class 2007	15.57	1.74	14

Table 50

Multiple Analysis of Variance for Explore to Plan Scientific Reasoning Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.054	.75	2	.48
Wilks' Lambda	.950	.75	2	.48
Hotelling's Trace	.058	.75	2	.48
Roy's Largest Root	.058	.75	2	.48

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Scientific Reasoning	2.86	1.29	1	.27
Year Plan Scientific Reasoning	1.33	.46	1	.502

Table 51

Descriptive Statistics for Explore and Plan Composite Scores for Male Students

	Mean	*SD*	*n*
Explore			
Class 2006	12.92	1.38	24
Class 2007	13.17	1.44	29
Plan			
Class 2006	14.04	1.46	24
Class 2007	14.69	1.44	29

Table 52

Multiple Analysis of Variance for Explore to Plan Composite Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.049	1.29	2	.29
Wilks' Lambda	.95	1.29	2	.29
Hotelling's Trace	.051	1.29	2	.29
Roy's Largest Root	.051	1.29	2	.29

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Composite	.86	.43	1	.52
Year Plan Composite	5.51	2.62	1	.11

Table 53

Descriptive Statistics for Explore and Plan Composite Scores for Females Students

	Mean	*SD*	*n*
Explore			
Class 2006	13.60	1.40	15
Class 2007	12.79	1.58	14
Plan			
Class 2006	14.53	1.13	15
Class 2007	14.71	1.68	14

Table 54

Multiple Analysis of Variance for Explore to Plan Composite Scores for Females Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.16	2.46	2	.11
Wilks' Lambda	.84	2.46	2	.11
Hotelling's Trace	.19	2.46	2	.11
Roy's Largest Root	.19	2.46	2	.11

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Explore Composite	4.80	2.16	1	.153
Year Plan Composite	.24	.12	1	.74

Table 55

Descriptive Statistics for Plan and ACT English Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.15	2.85	13
Class 2007	13.57	2.38	14
ACT			
Class 2006	14.15	3.60	13
Class 2007	12.93	2.59	14

Table 56

Multiple Analysis of Variance for Plan to ACT English Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.04	.51	2	.61
Wilks' Lambda	.96	.51	2	.61
Hotelling's Trace	.04	.51	2	.61
Roy's Largest Root	.04	.51	2	.61

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan English	2.29	.33	1	.57
Year ACT English	10.12	1.04	1	.32

Table 57

Descriptive Statistics for Plan and ACT English Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	13.40	2.59	10
Class 2007	15.14	2.04	7
ACT			
Class 2006	14.80	3.82	10
Class 2007	14.57	4.12	7

Table 58

Multiple Analysis of Variance for Plan to ACT English Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.20	1.71	2	.22
Wilks' Lambda	.80	1.71	2	.22
Hotelling's Trace	.24	1.71	2	.22
Roy's Largest Root	.24	1.71	2	.22

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan English	12.51	2.20	1	.16
Year ACT English	.22	.01	1	.91

Table 59

Descriptive Statistics for Plan and ACT Mathematics Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.15	2.48	13
Class 2007	15.86	.95	14
ACT			
Class 2006	15.38	2.18	13
Class 2007	16.50	1.91	14

Table 60

Multiple Analysis of Variance for Plan to ACT Mathematics Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.25	3.96	2	.03*
Wilks' Lambda	.75	3.96	2	.03*
Hotelling's Trace	.33	3.96	2	.03*
Roy's Largest Root	.33	3.96	2	.03*

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Mathematics	19.56	5.72	1	.025*
Year ACT Mathematics	8.39	2.01	1	.17

*$p \leq .05$

Table 61

Descriptive Statistics for Plan and ACT Mathematics Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	13.90	1.60	10
Class 2007	15.00	1.83	7
ACT			
Class 2006	14.90	1.97	10
Class 2007	15.00	1.73	7

Table 62

Multiple Analysis of Variance for Plan to ACT Mathematics Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.12	.91	2	.43
Wilks' Lambda	.89	.91	2	.43
Hotelling's Trace	.13	.91	2	.43
Roy's Largest Root	.13	.91	2	.43

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Mathematics	4.98	1.74	1	.21
Year ACT Mathematics	.04	.01	1	.92

Table 63

Descriptive Statistics for Plan and ACT Reading Scores for Male Students by Year

	Mean	*SD*	*n*
Plan			
Class 2006	12.77	3.09	13
Class 2007	13.36	2.31	14
ACT			
Class 2006	15.85	2.41	13
Class 2007	13.36	2.24	14

Table 64

Multiple Analysis of Variance for Plan to ACT Reading Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.26	4.15	2	.03*
Wilks' Lambda	.74	4.15	2	.03*
Hotelling's Trace	.35	4.15	2	.03*
Roy's Largest Root	.35	4.15	2	.03*

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Reading	2.33	.32	1	.58
Year ACT Reading	41.76	7.74	1	.01*

$*p \leq .05$

Table 65

Descriptive Statistics for Plan and ACT Reading Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.10	3.11	10
Class 2007	14.29	2.93	7
ACT			
Class 2006	15.80	2.57	10
Class 2007	13.57	2.51	7

Table 66

Multiple Analysis of Variance for Plan to ACT Reading Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.22	1.99	2	.17
Wilks' Lambda	.78	1.99	2	.17
Hotelling's Trace	.28	1.99	2	.17
Roy's Largest Root	.28	1.99	2	.17

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Reading	.14	.02	1	.90
Year ACT Reading	20.45	3.15	1	.09

Table 67

Descriptive Statistics for Plan and ACT Scientific Reasoning Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	15.62	2.36	13
Class 2007	17.43	1.45	14
ACT			
Class 2006	16.00	2.27	13
Class 2007	18.07	2.76	14

Table 68

Multiple Analysis of Variance for Plan to ACT Scientific Reasoning Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.24	3.8	2	.037*
Wilks' Lambda	.76	3.8	2	.037*
Hotelling's Trace	.32	3.8	2	.037*
Roy's Largest Root	.32	3.8	2	.037*

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Scientific Reasoning	22.16	5.86	1	.023*
Year ACT Scientific Reasoning	28.92	4.49	1	.044*

*$p \leq .05$

Table 69

Descriptive Statistics for Plan and ACT Scientific Reasoning Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	15.90	1.79	10
Class 2007	15.71	1.80	7
ACT			
Class 2006	15.40	2.50	10
Class 2007	15.00	3.27	7

Table 70

Multiple Analysis of Variance for Plan to ACT Scientific Reasoning Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.008	.054	2	.95
Wilks' Lambda	.990	.054	2	.95
Hotelling's Trace	.008	.054	2	.95
Roy's Largest Root	.008	.054	2	.95

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Scientific Reasoning	.14	.044	1	.84
Year ACT Scientific Reasoning	.66	.020	1	.78

Table 71

Descriptive Statistics for Plan and ACT Composite Scores for Male Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.15	1.63	13
Class 2007	15.21	1.19	14
ACT			
Class 2006	15.31	1.8	13
Class 2007	15.29	1.6	14

Table 72

Multiple Analysis of Variance for Plan to ACT Composite Scores for Male Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.15	2.15	2	.14
Wilks' Lambda	.85	2.15	2	.14
Hotelling's Trace	.18	2.15	2	.14
Roy's Largest Root	.18	2.15	2	.14

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Composite	7.580	3.79	1	.063
Year ACT Composite	.003	.001	1	.970

Table 73

Descriptive Statistics for Plan and ACT Composite Scores for Female Students

	Mean	*SD*	*n*
Plan			
Class 2006	14.50	1.27	10
Class 2007	15.29	1.50	7
ACT			
Class 2006	15.20	2.15	10
Class 2007	14.57	2.07	7

Table 74

Multiple Analysis of Variance for Plan to ACT Composite Scores for Female Students

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.26	2.39	2	.13
Wilks' Lambda	.75	2.39	2	.13
Hotelling's Trace	.34	2.39	2	.13
Roy's Largest Root	.34	2.39	2	.13

Between subjects

	Type III Sum of Squares	*F*	*df*	*p*
Year Plan Composite	2.54	1.37	1	.26
Year ACT Composite	1.63	.36	1	.56

Table 75

Independent Samples T-test for Plan Mathematics Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.29	2.40	14
Males	14.93	2.73	29

	F	*p*
Levene's Test for Equality of Variances	.096	.76

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	.76	41	.45	.65

Table 76

Independent Samples T-test for Plan Scientific Reasoning Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	15.57	1.74	14
Males	16.34	1.70	29

	F	*p*
Levene's Test for Equality of Variances	.59	.45

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	1.39	41	.17	.773

Table 77

Independent Samples T-test for Plan English Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	13.79	2.61	14
Males	13.38	2.01	29

	F	*p*
Levene's Test for Equality of Variances	.59	.45

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	-.56	41	.58	.41

Table 78

Independent Samples T-test for Plan Reading Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.14	2.41	14
Males	13.66	2.24	29

	F	*p*
Levene's Test for Equality of Variances	.052	.82

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	-.65	41	.52	.49

Table 79

Independent Samples T-test for Plan Composite Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.71	1.68	14
Males	14.69	1.44	29

	F	*p*
Levene's Test for Equality of Variances	.11	.75

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	-.05	41	.96	.025

Table 80

Independent Samples T-test for ACT Mathematics Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	15.00	1.60	8
Males	16.33	2.00	15

	F	*p*
Levene's Test for Equality of Variances	.30	.59

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	1.65	21	.113	1.33

Table 81

Independent Samples T-test for ACT Scientific Reasoning Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	15.25	3.11	8
Males	17.93	2.71	15

	F	*p*
Levene's Test for Equality of Variances	.40	.53

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	2.15	21	.043*	2.68

*p ≤ .05

Table 82

Independent Samples T-test for ACT English Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.38	3.85	8
Males	13.13	2.62	15

	F	*p*
Levene's Test for Equality of Variances	.144	.71

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	-.92	21	.368	1.24

Table 83

Independent Samples T-test for ACT Reading Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	13.63	2.33	8
Males	13.27	2.19	15

	F	*p*
Levene's Test for Equality of Variances	.018	.90

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means Equal variances assumed	-.366	21	.72	.36

Table 84
Independent Samples T-test for ACT Composite Scores for Class 2007 Students

	Mean	*SD*	*n*
Females	14.63	1.92	8
Males	15.27	1.53	15

	F	*p*
Levene's Test for Equality of Variances	.007	.94

	t	*df*	*p (2-tailed)*	*Mean Difference*
T-test for Equality of Means				
Equal variances assumed	.88	21	.39	.64

Table 85

Descriptive Statistics for Explore and Plan Composite Scores

	Mean	*SD*	*n*
Explore			
Class 2006	13.18	1.41	39
Class 2007	13.05	1.48	43
Plan			
Class 2006	14.23	1.35	39
Class 2007	14.70	1.51	43

Table 86

Repeated Measures Analysis of Variance for Explore and Plan Composite Scores

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.043	3.55	1	.063
Wilks' Lambda	.960	3.55	1	.063
Hotelling's Trace	.044	3.55	1	.063
Roy's Largest Root	.044	3.55	1	.063

Within subjects

	Type III Sum of Squares	*F*	*df*	*p*
Sphericity Assumed	3.68	3.55	1	.063
Greenhouse-Geisser	3.68	3.55	1	.063
Huynh-Feldt	3.68	3.55	1	.063
Lower-bound	3.68	3.55	1	.063

Table 87
Descriptive Statistics for Plan and ACT Composite Scores

	Mean	*SD*	*n*
Plan			
Class 2006	14.30	1.46	23
Class 2007	15.24	1.26	21
ACT			
Class 2006	15.26	1.91	23
Class 2007	15.05	1.75	21

Table 88
Repeated Measures Analysis of Variance for Plan and ACT Composite Scores

Effect	*Value*	*F*	*df*	*p*
Pillai's Trace	.11	5.22	1	.027*
Wilks' Lambda	.89	5.22	1	.027*
Hotelling's Trace	.12	5.22	1	.027*
Roy's Largest Root	.12	5.22	1	.027*

Within subjects

	Type III Sum of Squares	*F*	*df*	*p*
Sphericity Assumed	7.22	5.22	1	.027*
Greenhouse-Geisser	7.22	5.22	1	.027*
Huynh-Feldt	7.22	5.22	1	.027*
Lower-bound	7.22	5.22	1	.027*

*p $\leq$ .05

Vita

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The author was born in San Juan, Puerto Rico and attended the public schools of New Haven, Connecticut. He graduated in 1997 from the University of Vermont with a Bachelor of Arts degree in Sociology and minor in Latin American Studies. He graduated in 1999 from Chicago State University with a Master's of Science degree in Education in Curriculum Development and Instructional Strategies. The author has educated middle and high school students and is currently a high school administrator.