

## **The effects of Age and Gender on student achievement in face-to-face and online college algebra classes**

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### **ABSTRACT**

Demand for online learning has increased in recent years due to the convenience of course delivery. However, some students appear to have difficulties with online education resulting in lack of completion. The study utilized a quantitative approach with archival data. The factors of achievement and demographics were compared for face-to-face and online students. Multiple regressions and ANCOVA were performed to analyze the data while controlling age and gender to reveal any significant differences between the two groups. The sample and population for this study were predominantly Hispanic students. Multiple regression findings indicated that age and gender were predictors of student achievement in face-to-face college algebra courses at a college in south Texas. In the equivalent college algebra online courses, neither Age nor Gender impacted students' grade. ANCOVA showed that the average grade of face-to-face students was higher than that of online students.

Keywords: student achievement, online learning, gender, race, face to face learning

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Over the past decade, online learning has had a major influence on society and has contributed to an increase in student enrollment in all higher education disciplines (Allen & Seaman, 2010; Mapuva, 2009). Betts (2009) mentioned that the number of degrees granted through online education programs has increased enormously, and as such, post-secondary representatives and administrators are starting to consider online instruction as the answer to classroom space problems exacerbated by increasing student enrollment. Consequently, online learning has truly begun to play an important role in higher education. Mapuva (2009) stated “e-learning has become an indispensable learning and business tool” (p. 101). Allen and Seaman (2011) also indicated that “Nearly 31% of all higher education students took at least one course online, and over 6.1 million students were taking one online course during the Fall 2010 term” (p. 4).

Improved technology has contributed to increases in overall enrollment in online courses in post-secondary education. The waves of technology are moving quickly, and instructors of higher education are looking toward online classes as the way to stay afloat amid the technological tide. According to Mapuva (2009), expansive research conducted in online learning has been geared toward increasing the enrollment volume of prospective students. Colleges, therefore, have to adapt to different ways of teaching with technology in order to increase student enrollment through online courses.

Although the convenience of online learning is worthy of consideration, student achievement should be the primary concern. Amin and Li (2010) indicated that online student performance does not differ significantly compared to face-to-face student performance. Other researchers have documented a lack of significant differences in student performance between students who enrolled traditionally versus students who enrolled online. Daymont and Blau (2011) demonstrated that online courses can be as effective as traditional courses. Ary and Brune (2011) and Topper (2007) found no significance for either online or face-to-face students regarding course grades. On the other hand, some researchers determined that course format was relevant when considering student performance (Al-Mutairi, 2011; Anthony, 2011; Hannay & Newvine, 2006; and Yukselturk & Bulut, 2007). Thus, the need for more research with regard to online learning and its impact on student achievement is warranted, particularly in establishing the characteristics of successful students and course design.

## **DISTANCE LEARNING IN THE TWENTY-FIRST CENTURY**

Online learning has increased in popularity over the years as indicated by the National Center for Education Statistics (2011). For example, “In 2007-08, about 4.3 million undergraduate students, or 20 percent of all undergraduates, took at least one distance education course. About 0.8 million, or four percent of all undergraduates, took their entire program through distance education” (National Center for Education Statistics, 2011, p. 120). In 2000, the Army contracted with Price Waterhouse Cooper (PWC) for five years to develop and operate the Army University Online Access Program (AUOA) for soldiers to obtain their postsecondary education and to finish their degree requirements (Kidwell, 2000; Wisher, 2001). In 2005, WebCT and Blackboard, the two major classroom management systems, merged into one company (Wisher, 2001). Online and blended or hybrid programs provided opportunities for students to access courses any time and any place. Allen and Seaman (2010) established definitions for an online and blended course whereas, “An online course is defined as having at least 80% of the course content delivered online [and] [b]lended education courses are defined as having between 30% and 80% of the course content delivered online” (p. 6). As of today, online

education has noticeably improved. With faster connection speeds, more classes can be offered online by postsecondary institutions, and more students can participate in online learning. Rainie (2010) mentioned in the report regarding the use of the Internet that

Seventy-four percent of American adults (ages 18 and older) use the Internet..., 60% of American adults use broadband connections at home..., and 55% of American adults connect to the Internet wirelessly, either through a WiFi or WiMax connection via their laptops or through their handheld device such as smart phones. (p. 1)

The Internet and the World Wide Web still play a major role in the learning process and the educational system. The demand for online courses has increased over time as compared to face-to-face courses (Finch and Jacobs, 2012). Furthermore, online and web-enhanced programs provide more opportunities to learners. Therefore, colleges and universities must seek to provide quality instruction. Research has been conducted to help improve these courses and degree plan offerings and identify factors that affect distance education and students. Educators must keep in mind how to merge new technologies, new teaching, and learning delivery formats with the course content and course goals. Educational research is full of information regarding distance learning. Some researchers have focused on student performance and student characteristics, whereas other researchers have emphasized faculty and student perceptions. The literature related to this study concerning student performance and student characteristics as well as the factors that influence student selection of online or traditional courses is discussed in the remaining literature review.

## **STUDENT PERFORMANCE IN ONLINE AND FACE-TO-FACE COURSES**

Research on the topic of student performance in online learning formats as compared to traditional formats has had mixed results. To compare the two methods of instruction, online and face-to-face, Jahng, Krug, and Zhang (2007) reported there was a lack of significant difference in course grades for students in the two methods of instruction. Further studies by Abdullah, Falloon, Solan, Linardopoulos, Ary, Brune, and Anderson (2011), Hatcher, Henson, and LaRosa (2013), and Wagner, Garippo, and Lovaas (2011) concluded with similar results. On the other hand, Bennett, Padgham, McCarty, and Carter (2007) reported the presence of positive results in the course grades of online students when compared to traditional students; students taking distance education classes outperformed those in traditional classes. In addition, Campbell, Floyd, and Sheridan (2011) established that students in online courses learned as much as students in traditional courses as noted by their GPA, but on the final exam, online students performed better than traditional students. Other researchers concluded that face-to-face students outperformed online students. The researchers Dellana, Collins, and West (2000), Sharma, Bryant, and Murphy (2013), and Driscoll, Hunt, Tichavsky, and Thompson (2012) found that the mean grade point average (GPA) of face-to-face students in all courses were significantly higher than the mean GPA for online students.

Instead of using over all GPA, some researchers utilized standalone exam scores. Mirakian and Hale (2007) and Smith and Stephens (2010) also established that exam scores were significantly higher for face-to-face courses as compared to online courses. On the other hand, both Ary and Brune (2011) and Trawick, Lile, and Howsen (2010) found that the traditional

section of a specific course scored significantly higher than an online section of the same course in the majority of the exams.

Experiences in taking online courses also affect outcomes. Beyrer (2010) indicated that students who took the online course performed academically better than their counter parts. Beyrer (2010) indicated that students who previously took online courses and succeeded had a higher success rate in subsequent online courses. Moreover, Ryabov (2012) examined the relative importance of time spent online, prior grades, and demographic characteristics on academic performance in online sociology courses. The results indicated that prior achievement was the most significant predictor for student achievement. Coldwell, Craig, Paterson, and Mustard (2008) documented the presence of the association between student involvement in online learning and academic outcomes.

However, Bennett, Padgham, McCarty, and Carter (2007) determined that the performance of traditional students was significantly better on exams than that of online students in a micro-economics class. Online students performed significantly better than traditional students in macro-economics. The researchers indicated that females had a significantly better final average in traditional classes. Moreover, Bennett et al. (2007) suggested that online students likely performed better in the macro-economic courses because macro-economics is less quantitative and less mathematical than micro-economics.

The way tests were presented also impacted student performance. The researcher Xu (2010) posited that testing security and the establishment of testing guidelines regarding test administration and test presentation to students enrolled in online courses are complicated. No single or simple method exists by which to ensure academically honest testing procedures. Xu's (2010) study repeated measured analysis of variance procedures that were used and demonstrated that test presentation by itself did not influence student test performance. Cumulative analyses of student learning styles and performance demonstrated that students with a surface style scored significantly higher on conceptual problems on a single question presentation modality rather than an all-at-once presentation mode. The author's indication is that students have to be allowed to create their own comfort level within the learning environment and in recalling what they have memorized (Xu, 2010). Finally, Schultz, Schultz, and Sieland (2010) analyzed course grade by proctoring exams for face-to-face and online students. The researchers found no significant difference was found in either method. Consequently, multiple factors should be regarded when determining student achievement.

The problem of predicting student academic performance is important for students as well as for institutions, particularly given new proposed funding models based on completed semester hours for community college students (Texas Higher Education Coordinating Board [THECB], 2008). THECB (2008) has set a limit on the number of times a student can retake a course while the institution still receives funding: "Providing funding at levels that not only allow institutions to continue meeting participation goals, but enable them to put the infrastructure, policies, and programs in place necessary to retain students more effectively and improve student performance" (p. 3).

### **Statement of the Problem**

A post-secondary institution's mission is to provide quality learning by enabling student achievement and serving all student populations. This mission is frequently charged through flexibility and an open admissions policy. Educators in postsecondary institutions face

challenges meeting the demands of online learning students while maintaining student achievement.

In recent years, the increase in postsecondary enrollment for students above 25 years of age was 43%, whereas the increase in enrollment was 27% for students under 25 years of age (National Center for Education Statistics, 2011b). These data reflect that student age may have been an issue for postsecondary institutions to consider.

## **PURPOSE OF THE STUDY**

The purpose of the study was to examine the effects of demographic characteristics on student achievement in the 2010-2013 academic years as measured by course grades in face-to-face versus online college algebra courses at a college in south Texas. Demographic characteristics in this investigation were defined as age, gender, and ethnicity.

## **Research Questions**

The study was guided by the following questions:

1. To what extent do demographic characteristics such as age, gender, and ethnicity, predict student achievement in a face-to-face and an online college algebra course at a college in south Texas for the fall and spring semesters of the years 2010-2013?
2. Do face-to-face and online students differ on achievement scores as measured by course grades while controlling for age, gender, and ethnicity in a college algebra course at a college in south Texas for the fall and spring semesters of the years 2010-2013?

## **Research Hypotheses**

The following hypotheses guided the researcher:

- H<sub>1</sub>: There is a significant relationship between the criterion variable student achievement as measured by the course grade and the predictor variables of age, gender, and ethnicity in a face-to-face college algebra course at a college in south Texas for the fall and spring semesters of the years 2010-2013.
- H<sub>2</sub>: There is a significant relationship between the criterion variable of student achievement as measured by course grade and the predictor variables of age, gender, and ethnicity in an online college algebra course at a college in south Texas for the fall and spring semesters of the years 2010-2013.
- H<sub>3</sub>: There is a significant difference between the students in face-to-face and online courses on student achievement as measured by the course grade while controlling for age, gender, and ethnicity in a college algebra course at a college in south Texas for the fall and spring semesters of the years 2010-2013.

## **Theoretical Framework**

Because online courses offerings will continue to increase in the future, administrators in postsecondary settings need to consider factors that add to student academic achievement in such courses. Tinto (1975) mentioned that academic performance constituted one of the strongest predictors of future academic achievement. Tinto (2005) indicated that individual attributes such as age, gender, and ethnicity impact student performance. The theoretical framework for this study fell under the umbrella of Tinto's theory, where this study was based on the relationship between demographic characteristic of the learner in face-to-face and online courses and the resulting course grade. Bain, Fedynich, and Knight (2009) supported the notion of the influence of demographic factors as their research found that gender and age were factors that influenced the successes of graduate students.

## **Significance of the Study**

Enormous growth has happened in online learning during the last decade (Allen & Seaman, 2011; Amro, Maxwell, & Kupczynski, 2013). Community colleges are responding to the demand by offering more online courses. Presently, 92% of community colleges offer at least one online course as indicated by the American Association of Community Colleges (2008). Several researchers have established that student performance in online courses does not differ from student performance in face-to-face courses (Daymont & Blau, 2008; Dell, Low, & Wilker, 2010; Wagner, Garippo, & Lovaas, 2011). Other researchers (Hannay & Newvine, 2006; Johnson, Dasgupta, Zhang, & Evans, 2009; Lim, Kim, Chen, & Ryder, 2008) have determined that online students outperform face-to-face students, whereas still other researchers (Smith & Stephens, 2010) have documented opposite results. This research can provide valuable information to community colleges not only because funding factors are based on course completion but also to utilize the information to assist those students that would be considered more at risk based on discovering which characteristics affected on-line and/or face-to-face.

## **STUDENT DEMOGRAPHIC CHARACTERISTICS**

The community college consists of a diverse population of students, ranging from 18-years old to adults over 40. Provasnik and Planty (2008) indicated that the median age of community college students is 24 years old (p.12). Researchers have strongly focused on the learners' age, gender, ethnicity, and learning style as variables linked to student performance, especially in online courses (Solimeno, Mebane, Tomai, & Francescato, 2008; Tekinarslan, 2011; Wilson & Allen, 2011).

### **Student Age**

Dabaj and Başak (2008) noted that students over 30 years old preferred the face-to-face setting. However, several researchers indicated that online students were typically 22 years old or older (Ali & Ahmad, 2011; Ashby, Sadera, & McNary, 2011; Bennett, Padgham, McCarty, & Carter, 2007; Block, Udermann, Felix, Reineke, & Murray, 2008; DeVaney, 2009; Doyle, 2009; Falloon, 2011; Melton, Graf, & Foss, 2009; Millan, 2008; Solimeno, Mebane, Tomai, & Francescato, 2008; Tekinarslan, 2011; Wilson & Allen, 2011; Yang, Cho, Mathew, & Worth,

2011; Yukselturk & Bulut, 2007, 2009). Al-Mutairi (2011) mentioned that younger students had a tendency to perform better than mature students in a college setting. In addition, Coldwell, Craig, Colorado and Eberle (2010) and Paterson and Mustard (2008) revealed that student age was not related to academic performance, which was measured by the course grade in online courses (Coldwell, Craig, Paterson, & Mustard 2008; Colorado & Eberle, 2010; Patterson & McFadden (2009).

### **Student Gender**

Whereas student age in relation to online learning has been better delineated, the link between gender and student performance is unclear. Some researchers look at gender regardless of the method of instruction. Al-Mutairi (2011), Bennett, Padgham, McCarty, and Carter (2007), Coldwell, Craig, Paterson, and Mustard (2008), Daymont and Blau (2008), Ryabov (2012) and Smith and Stephens (2010) indicated that female students outperform male students. Similarly, Friday, Friday-Stroud, Green, and Hill (2006) provided evidence of a significant difference between student performance and gender in management courses. In their study, the mean of the traditional class was higher than the mean average of the online class, and the average performance of female students was significantly better than the average performance of male students.

On the other hand, a number of studies suggested no relation between gender and online courses, even though more female students were used in the study by Kupczynski, Ice, Gibson, Richardson, and Challoo (2011). The researchers reported that of 1,438 graduate students who were enrolled in different online courses at the university level, 72% were female. In addition, the researchers indicated there was no association between gender and grades of the student (Kupczynski et al., 2011). Tekinarslan (2011) revealed that gender was not a significant factor concerning self-efficacy scores which impact student success. Hannay and Newvine (2006) sampled adult students where 55% of 217 of undergraduates in a Criminal Justice course were males. Gender was determined as not being related to differences in course quality from the student perspective. Daymont, and Blau (2011) reported that gender was not a factor in student success in online courses as female students perform as well as male students in online courses. Yukselturk, and Bulut (2007) noted twice as many males were enrolled in the online course than females. Sadera, Robertson, Song, and Midon (2009), in a survey of 121 students who were enrolled in online courses, revealed that over 68% of the students who participated in the survey were males, and self-efficacy and task value were significantly higher for male student achievement. Finally, Patterson and McFadden (2009) indicated that gender was not a predictor of student achievement in the online courses. Ultimately, mixed results were found regarding gender in online courses and how gender impacted student performance.

Regardless of method of instruction, other researchers such as Al-Mutairi (2011), Daymont and Blau (2008), Kupczynski, Ice, Gibson, Richardson, and Challoo (2011), Kupczynski, Mundy, and Jones (2011), Wagner, Garippo, and Lovaas (2011), and Wilson and Allen (2011) have documented that more female students were enrolled in online courses than male students. Likewise, Bennett, Padgham, McCarty, and Carter (2007) examined 498 students, of which 92 were online and 406 traditional students, who took Principles of Economics both micro and macro. More females were enrolled in online courses as compared to males, suggesting that gender influences instructional preference. In a similar study, Smith and Stephens (2010) noted that 67 students were enrolled in the face-to-face version of Marketing Principles,

and of the 24 students who were enrolled in the online version of this same course, the online class was composed mostly of female students, whereas the traditional course was primarily comprised by male students. On the contrary, Coldwell, Craig, Paterson, and Mustard (2008) analyzed student tracking data and student demographic data and determined that less female students were enrolled in online courses.

### **Student Ethnicity**

Only limited research studies are available concerning e-learning and ethnicity. Kupczynski, Gibson, Richardson, & Chaloo (2011) in a study where a majority of participants were Hispanic determined that factors such as gender and ethnicity, that traditionally have been documented to play a major role in success in face-to-face classes, were not significant for either the online courses or the face-to-face courses. Similarly, Hodge, Richardson, and York (2009) in an examination of 1,394 students, also indicated there were no significant relationships between final grades and student ethnicity. However, Patterson and McFadden (2009), in a study comprised of 4% African-American students found a significant relationship was between student outcome and ethnicity. Although Wyatt and Bradford (2010) did not find a difference in facilitated learning scores between students of various ethnic groups and non-Hispanic, White students, the average grades for non-Hispanic, White students had a tendency to be higher than all other ethnicities at all grade levels. On the contrary, Ashby, Sadera, and McNary (2011) in an analysis of 167 students, noted that ethnicity has significant differences in course grade levels in the online environments which has an impact on student performance.

The mixed result presented throughout research indicated that ethnicity is a factor that impacted student performance in online classes. Obviously there are many conflicting results on demographic characteristics of online students and the prediction of these characteristics in relation to student achievement. However, it has yet to be determined that ethnicity positively or negatively affects student performance.

### **RESEARCH METHODOLOGY**

A quantitative research methodology was utilized in this study. The quantitative method was used to describe, analyze, and predict certain phenomena (Gay, Mills, & Airasian, 2006). Babbie (2010) mentioned, "Quantification often makes our observations more explicit. It also can make it easier to aggregate, compare, and summarize data" (p. 24). Findings from quantitative statistical procedures helped the researcher answer questions regarding description and comparison (Gall, Gall, & Borg, 2007). Interpreting statistical procedures may provide information regarding research hypotheses as well as possible solutions to problems. Gay, Mills, and Airasian (2012) indicated that "the researcher may also suggest next-step studies designed to investigate another dimension of the problem" (p. 538). Examined in this study was the extent to which age, gender, and ethnicity related to student achievement in a face-to-face versus online college algebra course at a college in south Texas. These quantitative data may explain how the demographic characteristics discussed influenced student course grade (Creswell, 2012). Data for this investigation was collected by the Research and Analytical Services department at this particular college.

## Research Design

This study utilized a quantitative approach based on archival data. The research question used archival data to determine whether age, gender, and ethnicity predicted the course grade for college algebra at a college in south Texas in the fall and spring semesters between the years 2010 and 2013. In a causal-comparative research design, the researcher seeks to identify cause-and-effect relationships among groups in which the independent variable was present or absent (Gall et al., 2007; Gay et al., 2012). The causal comparative studies involved two groups of participants (online and face-to-face), a set of independent variables (age, gender, and ethnicity) and a dependent variable, (academic achievement), measured by course grade. Causal comparative studies categorize individuals into groups (online and face-to-face) and focus on the differences between the groups (Gay et al., 2012).

## Population and Sample

The researcher requested achievement data regarding the population from the director of the Research and Analytical Services (RAS) department at a college in south Texas for students enrolled in college algebra. Therefore, the population was all undergraduate students in college algebra in the fall and spring semesters during academic years 2010-2013, approximately 22,219 students. The sample size depended on the dependent variables, independent variables, and rule of thumb for determining the sample size or the number of subjects required for statistical analyses (VanVoorhis & Morgan, 2007). The dependent variable, which was course grade (A, B, C, D, F/W), consisted of five cells, age consisted of five cells (above 18-24, 25-29, 30-39, 40-49, 50 and above), gender had two cells (female and male), ethnicity had three cells (Caucasian, Hispanic, Others=African-American and White) as the other ethnicities were too small to be considered. Method of instruction had two cells. The total number of cells to be considered was 300 cells, and each cell required 25-30 participants for correlation (Creswell, 2012). Hence, the required sample size was approximately 7,500-9,000 students for an alpha level of .05, a confidence interval of 95%, and a power of about 0.8 (Creswell, 2012).

## INSTRUMENTATION

### Archival Data

The researcher obtained archival data regarding students' course grades and students' demographic characteristics of age, gender, and ethnicity from the RAS at a college in south Texas. Furthermore, the RAS provided information regarding whether students were enrolled in face-to-face or in online college algebra courses. Data to be extracted was the term, subject, delivery method, gender, age, ethnicity, and course grade; therefore, no instrument was needed.

### Procedures

A written permission to complete the study at a college in south Texas was granted by the College's RAS based on Institutional Review Board (IRB) approval from Texas A&M University-Kingsville. The data were collected for college algebra courses for fall and spring 2010-2013 academic years. The researcher emailed the director of the RAS requesting data

collections of each student's course grades, age, gender, and ethnicity.

## **DATA COLLECTION AND RECORDING**

### **Collection and Recording of the Archival Data**

The researcher sent a letter to the RAS after receiving an IRB approval from Texas A & M University-Kingsville, which oversaw the protection of the rights and the welfare of the human subjects, requesting information such as student characteristics, age, gender, ethnicity, and their course grades for college algebra for the fall and spring semesters for academic years 2010-2013. The RAS personnel de-identified the information to protect the identity of the students. The student's grade of A, B, C, or D was recorded as such, but the students' grades of Fail (F), Withdraw (W), and Incomplete (I) were considered equivalent to Fail (F).

## **DATA ANALYSIS**

The selection of data was random. The archival data such as course grades and the demographic characteristics were collected using the Banner Student Records System for 2010-2013. The Statistical Software Package (SPSS) provided an option to run multiple regressions. Multiple regressions allowed the researcher to gather information about relationships between several independent variables such as age, gender, and ethnicity which affected or influenced the dependent variable which was the course grade (Babbie, 2013; Brace, Kemp, & Snelgar, 2006; Creswell, 2012; Devore, 2012). Multiple regressions required a large sample where the number of participants must exceed the number of predictor variables (Babbie, 2013; Brace, 2006; Creswell, 2012; Devore, 2012; Brace, Kemp, & Snelgar, 2006). Descriptive statistics including frequency tables on all the categorical responses such as demographic information were presented (Creswell, 2012).

With regard to the third hypothesis, a One-Way Analysis of Covariance (ANCOVA) was analyzed to measure the main effects between the independent variables such as method of instruction, online, and face-to-face groups, controlling for the covariate variables such as age, gender, and ethnicity, which might influence the dependent variable: the course grade (Green & Salkind, 2011).

### **Descriptive Statistics**

Descriptive statistics are provided for face-to-face and online students regarding the variables in this study including gender, ethnicity, student grade, and age for fall and spring of 2010-2013 (Table 4.1). A sample dataset of  $N = 8,234$  was included in the analysis. Method of instruction was coded as 1=Online and 2=Face-to-Face. Gender was coded as 1=Male and 2=Female. Ethnicity was coded as 1=Other (Asian, African-American and American Indian/Alaskan Native), 2=Caucasian, and 3=Hispanic. Student grade was coded as 1=F, W, and I, 2=D, 3=C, 4=B, and 5=A. The minimum age was 18, and the maximum age was 67. There were 7,791 face-to-face students: 3,221 (41%) were male students and 4,570 (58.7%) were female students. There were 443 online students: 135 (30.5%) male and 308 (69.5%) female.

Regarding gender, there were more female students than male students enrolled in both online and face-to-face courses. Regarding ethnicity, information was provided in Table 4.1. The

investigator divided ethnicity into three groups: Hispanic, Caucasian, and Others (Asian, African-American, and American Indian). For face-to-face distribution, 7,564 (97.1%) were Hispanic students, 193 (2.5%) were Caucasian students, and 34 (0.4%) were Other students. By the same token, for online distribution, 410 (92.6 %) were Hispanic students, 27 (6.1%) were Caucasian students, and 6 (1.4%) were Other students. The population was predominantly Hispanic in both online and face-to-face courses, and a higher percentage of Caucasian students enrolled in the online courses.

Age is another factor indicated in Table 4.1. The mean age of face-to-face students was 25.14 with an *SD* of 6.61, while the mean age of online students was 26.95 with an *SD* of 6.30. The average age of face-to-face students appears to be slightly lower than the average age of online students. According to Table 4.1, the average age of the male online student ( $M = 26.39, SD = 5.63$ ) appeared to be higher than the average age of the male face-to-face student ( $M = 24.6, SD = 6.33$ ). Similarly, the average age of the female online student ( $M = 27.20, SD = 6.57$ ) seemed to be higher than the average age of the female face-to-face student ( $M = 25.42, SD = 6.79$ ).

The average grade for overall face-to-face students is ( $M = 2.98, SD = 1.46$ ); male face-to-face students ( $M = 2.88, SD = 1.47$ ) appeared to be lower than female face-to-face students ( $M = 3.05, SD = 1.45$ ). In the distribution of grades, 1,416 (18.2%) of the total number of students earned a grade of A, 1,787 (22.9%) of the total number of students earned a grade of B, 1,940 (24.9%) of the total students earned a grade of C, 504 (6.5%) of the total number of the students earned a grade of D, and 2,141 (27.5%) of the total number of the students earned a grade of F or W. The average grade for overall online ( $M = 2.20, SD = 1.42$ ), male online students ( $M = 2.16, SD = 1.44$ ), and female online students ( $M = 2.21, SD = 1.42$ ) did not appear to vary much. In online grade distribution, 42 (9.5%) of the total number of the students earned a grade of A, 50 (11.3%) of the total number of the students earned a grade of B, 98 (22.1%) of the total number of the students earned a grade of C, 16 (3.6%) of the total number of the students earned a grade of D, and 237 (53.5%) of the total number of the students earned a grade of F or W. The average grade for overall face-to-face ( $M = 2.98, SD = 1.46$ ) seemed to be higher than the average grade for overall online ( $M = 2.20, SD = 1.42$ ). Furthermore, the average grade of female face-to-face ( $M = 3.05, SD = 1.45$ ) appeared to be higher than the average grade of female online ( $M = 2.21, SD = 1.42$ ). Moreover, the average grade of male face-to-face ( $M = 2.88, SD = 1.47$ ) appeared to be higher than the average grade of male online ( $M = 2.16, SD = 1.44$ ). Looking at the failure grade F/W within their method of instruction, the percentage of failure grades of F/ W for online students, 237 out of 433 (53.5%), appeared to be higher than the percentage of the failure grade F/W for face-to-face students, 2141 out of 7191 (27.5%). For this study, the researchers will answer each question individually.

Table 1.1  
*Frequency and Descriptive Statistics for (N=8,234)*

Variable	Face-to-face				Online			
	<i>N</i>	Percent	<i>M</i>	<i>SD</i>	<i>N</i>	Percent	<i>M</i>	<i>SD</i>
Total	7,791	94.60	---	---	443	5.40	---	---
Gender								
Male	3,221	41.30	---	---	308	69.50	---	---
Female	4,570	58.70	---	---	135	30.50	---	---

Ethnicity								
Hispanic	7,564	97.10	---	---	410	92.6	---	---
Caucasian	193	2.50	---	---	27	6.10	---	---
Others*	43	0.40	---	---	6	1.40	---	---
Age								
Male	---	---	25.14	6.61	---	---	26.95	6.30
Female	---	---	24.76	6.33	---	---	26.39	5.63
18-20	1,481	19.00	---	---	35	7.90	---	---
21-22	2,220	28.50	---	---	85	19.20	---	---
23- 25	1,302	16.70	---	---	82	18.50	---	---
26- 30	1,502	19.30	---	---	137	30.90	---	---
30-69	1,208	19.30	---	---	104	23.5	---	---
Grade								
Female	---	---	2.98	1.46	---	---	2.20	1.42
Male	---	---	3.05	1.45	---	---	2.21	1.42
A	1,416	18.20	---	---	42	9.50	---	---
B	1,787	22.90	---	---	50	11.30	---	---
C	1,940	24.90	---	---	98	22.10	---	---
D	507	6.50	---	---	16	3.60	---	---
W, F**	2,141	27.5	---	---	237	53.50	---	---

*Note: \*Other: Asian, African-American, and American Indian*

*\*\*F and W weighted the same*

### Inferential Statistics

A multiple regression analysis was conducted to determine how well the variables of age, gender, and ethnicity predicted achievement as measured by the course grade in face-to-face college algebra courses. The predictors were age, gender, and ethnicity, while the criterion variable was student achievement as measured by the final grade for a college algebra course taken in the fall and spring of 2010-2013. The linear combination of gender, age, and ethnicity was significantly related to achievement:  $F(3, 7787) = 40.79, p < 0.00$  (Table 4.2). The sample multiple correlation coefficient was .02 indicating that approximately 2% of the variance of the achievement score in the sample can be accounted for by the linear combined set of age, gender, and ethnicity, which is considered a low effect size according to Cohen's (1988) classification.

Table 4.2

*ANOVA for Method of Instruction (Face-to-Face and Online) on Achievement Score*

Method of Instruction	<i>df</i>	<i>F</i>	<i>p</i>
Face-to-Face	3, 7787	40.79	.00
Online	3, 439	.06	.98

\* $p < .05$ , \*\* $p < .01$

In Table 4.3, indices were presented to indicate the relative strength of individual predictors. The bivariate correlation between the predictor variables of age and gender and the

achievement score were positive, while ethnicity, although not significant, was negative. The indices of Age and Gender were significant ( $p < .05$ ).

A Multiple Regression was repeated, removing ethnicity as it was not significant. The Beta Coefficients gave the measure of the contribution of each of the predicted variables (Age and Gender) to the student achievement.

$$\text{Predicted Achievement} = 2.40 + .16 (\text{Gender}) + .12 (\text{Age})$$

Therefore, it is predicted that females will outperform males of the same age, and older students will outperform younger students of the same gender.

In conclusion, the null hypothesis was rejected; age and gender were significant predictors of achievement,  $p < 0.05$ , in a face-to-face college algebra course at a college in south Texas for the fall and spring semesters for the years 2010-2013.

Table 4.3

*The Bivariate and Partial Correlation of the predictors Gender, Ethnicity, and Age on Achievement Score for Face-to-Face students*

Predictors	Correlation between each predictors and achievement	Correlation between each predictors and achievement controlling for all other predictors
Gender	.05**	.04**
Ethnicity	-.01	-.003
Age Group	.09**	.09**

\* $p < .05$ , \*\* $p < .01$

A multiple regression analysis was conducted to determine how well the variables of age, gender, and ethnicity predicted achievement as measured by course grade in online college algebra courses. The predictors were age, gender, and ethnicity, while the criterion variable was student achievement as measured by the final grade for a college algebra course taken in the fall and spring semesters of academic years 2010-2013. The linear combination of gender, age, and ethnicity was not significantly related to achievement:  $F(3, 439) = .06, p = .98$  (Table 4.2). The sample multiple correlation coefficient was .00, indicating that approximately 0% of the variance of the achievement score in the sample could be accounted for by the linear combined set of age, gender, and ethnicity, which is considered a negligible effect size according to Cohen's (1988) classification.

In conclusion, the null hypothesis was not rejected; the combined linear set of age, gender, and ethnicity were not significant predictors of achievement,  $p > 0.05$ , in an online college algebra course at a college in south Texas for the fall and spring semesters for the years 2010-2013.

A One-Way Analysis of Covariance (ANCOVA) was conducted for this study to determine the effect of two methods of instruction on achievement scores. The independent variable (method of instruction) included two levels: face-to-face and online. The dependent variable (student achievement) was measured by the final grades of a college algebra course, and the covariates were the students' ages, genders, and ethnicities. The homogeneity of slopes assumption was tested, and the interactions were not significant for method of instruction and gender:  $F(1, 8226) = 0.38, p = 0.54, \eta^2 = .00$  and ethnicity:  $F(1, 8226) = 0.07, p = 0.79, \eta^2 = .00$ . The interaction between method and age was significant:  $F(1, 8226) = 4.86, p = 0.03, \eta^2 = .00$  as

indicated in Table 4.4. Due to lack of homogeneity between method and age, age was dropped as a covariate. The ANCOVA was statistically significant:  $F(1, 8230) = 127.55, p = .00, \eta^2 = 0.02$  (Table 4.5). The strength of relationship between type of instruction and achievement was low as assessed by partial Eta squared. Type of instruction accounted for 2% of the variance of achievement score holding gender and ethnicity as constant.

Table 4.4  
*Multivariate Tests (Interaction) for Method of Instruction with Covariance Age, Gender, and Ethnicity*

Source	<i>df</i>	<i>F</i>	<i>P</i>	$\eta^2$
Method * Gender	1, 8226	0.38	0.54	0
Method * Ethnicity	1, 8226	0.07	0.79	0
Method * Age Group	1, 8226	4.86	0.03	0

\* $p < .05$ , \*\* $p < .01$

Table 4.2  
*Tests of Between-Subjects Effects for Method of Instruction*

Source	<i>Df</i>	<i>F</i>	<i>P</i>	$\eta^2$
Method of Instruction	1, 8230	127.55	0.00	0.02

\* $p < .05$ , \*\* $p < .01$

In conclusion, the null hypothesis was rejected. The face-to-face method ( $M = 2.98, SD = 1.46$ ) was significantly higher than the online method ( $M = 2.20, SD = 1.42$ ) on student's achievement as measured by the final grade in a college algebra course at a college in south Texas while controlling for gender and ethnicity.

**CONCLUSION**

The achievement score as measured by final grade for face-to-face students was higher ( $M = 2.98$ ) than for online students ( $M = 2.20$ ). This was supported by research which was conducted by Friday, Friday-Stroud, Green, and Hill (2006). The average grade of female students ( $M = 3.00$ ) was higher than the average grade of male students ( $M = 2.85$ ). The findings support research by Bennett, Padgham, McCarty, and Carter (2007); Coldwell, Craig, Paterson, and Mustard (2008); Daymont and Blau (2008); and Ryabov (2012). Some researchers reported that more male students were taking online classes (Ali & Ahmad, 2011; Hannay & Newvine, 2006; Sadera, Robertson, Song, & Midon, 2009; Yukselturk & Bulut, 2007), but the finding of this study indicated that more female students, 308 (69.5%), were taking online courses than male students, 135 (30.50%), which was supported by the research of Kupczynski, Mundy, and Jones (2011); Smith and Stephens (2010), and Tekinarslan (2011). The average age of online students ( $M = 26.95$ ) was higher than the average age of face-to-face students ( $M = 25.14$ ). The finding supports the research which indicated that the average age of online students was 22 years or older (Ashby, Sadera, & McNary, 2011; Bennett, Padgham, McCarty, & Carter, 2007;

Falloon, 2011; Melton, Graf, & Foss, 2009; Millan, 2008; Solimeno, Mebane, Tomai, & Francescato, 2008; Tekinarslan, 2011; Wilson & Allen, 2011; Yang, Cho, Mathew, & Worth, 2011; Yukselturk & Bulut, 2007, 2009).

The predictor variables of age and gender predicted student achievement in college algebra in face-to-face courses using Multiple Regression Analysis. However, the researcher found that none of these variables could predict the student achievement in online courses. Colorado and Eberle (2010) and Kupczynski, Ice, Gibson, Richardson, and Chaloo (2011) indicated that age is not one of the predictors of student achievement in an online setting which supports the findings of this research. Some researchers such as Bain, Fedynich, and Knight (2009), Friday-Stroud, Green, and Hill (2006), Wagner, Garippo, and Lovaas (2011) indicated that gender is a factor that links to student achievement for the online student. The finding of this research supports Daymont and Blau (2011); Yukselturk and Bulut (2007), and Tekinarslan (2011), which indicated that gender was not a factor for predicting online student achievement. Ethnicity was indicated by other researchers as one of the variables that predicted student achievement in the online courses (Ashby, Sadera, & McNary, 2011; Wyatt & Bradford 2010). The findings support research by Hodge, Richardson, and York (2009); Kupczynski, Ice, Gibson, Richardson, and Chaloo (2011) and Patterson and McFadden (2009) that ethnicity is not a predictor of course grade for online students.

In comparing the two groups (face-to-face and online), the finding of this research supports the researchers Bennett, Padgham, McCarty, and Carter (2007); Friday-Stroud, Green, and Hill (2006); Smith and Stephens (2010); Solimeno, Mebane, Tomai, and Francescato (2008), Wagner, Garippo, and Lovaas (2011), and Weber and Lennon (2007) where the researchers concluded that there was a significant difference in the method of instruction, online and face-to-face, and student achievement. Furthermore, the average grade of face-to-face students was higher than the average grade of online students. The finding is inconsistent with some researchers (Amin & Li, 2010; Ary & Brunce, 2011; Phipps, Wellman, & Merisotis, 1998; Summers, Waigandt, & Whittaker, 2005; Topper, 2007) who reported no difference between online students and face-to-face students with respect to student achievement, and other researchers reported that online students outscored face-to-face students (Hannay & Newvine, 2006; Johnson, Dasgupta, Zhang, & Evans, 2009; Lim, Kim, Chen, & Ryder, 2008).

Descriptive analysis for archived data resulted in the following results: the sample consisted of a dominantly Hispanic population in face-to-face courses and online courses. It appeared that younger students between the ages of 18-22 were enrolled in face-to-face classes, and older students between the ages 26-56 years old were enrolled in online classes. The number of female face-to-face students seemed to be more than the number of male face-to-face students, while the number of male online students seemed to be higher than the number of female online students. The average grade for face-to-face students ( $M = 2.98$ ) appeared to be higher than the average grade for online students ( $M = 2.20$ ), even though the average grade of male students ( $M = 2.88$ ) was lower than the average grade of female students ( $M = 3.05$ ) in face-to-face courses. For the online classes, the average grade of female students ( $M = 2.21$ ) was higher than average grade of male students ( $M = 2.16$ ). Finally, the percent of failure of students with grade letter of F/W appeared to be high for online courses (53.5%).

### **Recommendations for Research**

The following are recommendations for future research:

1. The sample was taken from one college using one math course; it is suggested that the study be run again to compare other math courses within the same institution, while also equalizing the sample sizes.
2. Similar studies need to be carried out in other colleges with large sample sizes to strengthen the literature in this area, and qualitative research might produce more detailed results and strengthen this study.
3. More investigation is needed in both settings, online and face-to-face, regarding the reason for gender's impact on student achievement.
4. A study needs to be conducted using summer courses to determine the impact of semester length as compared to fall and spring semesters
5. A qualitative study needs to be conducted to investigate the reason male students outperform female students, so it can be implemented in online courses.
6. More investigation is needed in the demographic characteristics of the online students such as age and gender to discover why female online students performed better than female face-to-face-students.
7. Qualitative research is needed for face-to-face courses to investigate the reason female students outperform male students.
8. More research is needed regarding the age group 18-20 and their high drop rate.

### **Recommendations for Practice**

1. Use of technology is growing to keep the demand of students and society. Workshops and training are necessary for faculty to enhance their skills. As technology gets better, so does online performance and the experience for students and faculty, but faculty need to be trained in the way of improvement. Leaders in education need to adjust to constant change. There is evidence that professional development for faculty boots the achievement level of the students as indicated by Duncan, Lee, Scarloss, & Shapley (2007).
2. Peer mentoring for faculty interested in teaching online courses is needed where more experienced faculty will be paired with less experienced faculty.
3. It is necessary to ensure that all students have rigorous pre-college academic programs at the high school level where leaders at all levels establish policies and programs that lean toward postsecondary courses by setting high expectations. Tinto (1975) mentioned that prior-experience would impact student performance.
4. Workshops need to be conducted for student services staff (including advisors) to bring awareness of factors such as age group and gender in relation to student achievement.
5. Orientation is necessary for online students who will be taking mathematical courses. Limited access to courses should be implemented until students' view an online video on how to use the Blackboard Learning Management System. An orientation to the course can serve as a tool of communication between the learners and the instructor which could change behavior of the learner according to behaviorism theory.

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