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The Effects of Motivation, Technology and Satisfaction 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 class delivery. However, some students appear to have difficulties with online education resulting in lack of completion. The purpose of the study was to examine the impact of factors such as student motivation, technology, and satisfaction on student achievement as measured by course grades in F2F versus online college algebra courses. This study utilized a quantitative approach with archival data and survey design. MANCOVA tests were performed to analyze the data while controlling age and gender to uncover significant differences between the two groups, F2F and online. The sample and population for this study were predominantly Hispanic students.

Motivation and Technology were non-significant, but satisfaction was proven to be significant. In face-to-face courses, females were more satisfied than males. While in online courses, males were more satisfied than females. There was an interaction effect between the methods of instruction and the grade levels of A, B, C, D, and F/W on the dependent variables; Motivation, Technology, and Satisfaction.

Keywords: Online, Face-to-Face, Motivation, Technology, Satisfaction, Gender, Methods of Instruction, MANCOVA, Hispanic

The Effects of Motivation, Technology, and Satisfaction on Student Achievement in Face-to-Face and Online Classes in College Algebra at a College in South Texas

Introduction

Online learning over the past decade has had a major influence on society and has contributed to an increase in student enrollment (Allen & Seaman, 2010; Mapuva, 2009). Allen and Seaman (2016) established that more than 6 million students reported registering in a minimum of one online course in fall 2015. With respect to community colleges, 92% of community colleges offered a minimum of one online course, and 41% of community colleges offered degrees online (American Association of Community Colleges, 2008). Although the convenience of online learning is worth considering, student achievement is the primary concern. Amin and Li (2010) indicated that online student performance does not differ significantly compared to face-to-face (F2F) student performance. Other researchers have documented a lack of statistically significant differences in student performance between students who registered F2F versus students who registered online.

There are variances in research findings regarding online versus F2F courses, (Bennett et al., 2007; Topper, 2007). For example, researchers have utilized different measures as a means of assessing learning outcomes including average overall course grades, exam scores, increase in knowledge, and student satisfaction with the course and instructor (Bennett et al., 2007). Lim, Kim, Chen, and Ryder (2008) used pre/post-tests to assess content knowledge as well as a survey to measure satisfaction. Their study revealed that students in online and blended courses attained higher achievement than students in F2F courses. However, students enrolled in blended courses expressed greater satisfaction than students in online and F2F courses. Similarly, Kupczynski et al. (2011) established that GPA, not gender, has the strongest influence on student satisfaction, wherein students who expected an A also reported the highest degree of satisfaction.

Waschull (2005) contended that self-discipline and motivation play an important role in the success of online courses. Waschull (2005) concluded that factors which predict the success of students enrolled in online courses would not be different than those in F2F courses. However, Yukselturk and Bulut (2007) observed students enrolled in online courses often had different motivations for taking a course or continuing their education. Many of these students were enrolled in an online class to find a job or to improve their knowledge and skills while maintaining family and job responsibilities. Mandernach, Donnelli, and Hebert (2006) agree that motivation, self-determination, and commitment are factors that make a successful online student, they suggest that other factors such as technological competency play a significant role as well.

Waschull (2005) contended that technology has no influence on student performance for online courses, which contradicts some researchers' studies (Bekele, 2010; Tekinarslan, 2011). Others have noted factors such as comfort with technology and technological competency play a significant role as well (Mandernach et al, 2006). Tekinarslan (2011) determined that students with higher computer and internet skill experience scored significantly higher in online courses than students with lower skill levels. Tekinarslan (2011) established that Internet usage, online experience, and prior computer ownership were significantly associated with self-efficacy levels which have been linked to improved student success.

Conceptual Framework

This investigation was based on a relationship between the factors of motivation, satisfaction, technology, and course grade. According to Li and Irby (2008), technology has made teaching outside of the classroom possible for the teacher and the learner. Similarly,

Tekinarslan (2011) mentioned student's computer knowledge and Internet skills affected their academic performance in online courses. Kupczynski, Mundy, and Jones (2011) documented that increasing the level of student's satisfaction increased GPA expectations. In a similar study, Sheridan and Kelly (2010) noted that students valued feedback from instructors as reflected in their satisfaction. As well, Ryabov (2012) suggested that prior achievement was significant in academic achievement which impacted their satisfaction. Waschull (2005) indicated that self-discipline and motivation played a role in their success. Amro, Maxwell, & Kupczynski (2013) mentioned that self-discipline was an important factor in online learning. According to Gharibpanah and Zamani (2011), individual responsibility, motivation, and persistence all influenced achievement. Therefore, students need to set goals, which are part of maturity, thus playing a big part in their success. Hermans, Haytko, and Mott-Stenerson (2009) established that flexibility contributed to student satisfaction and to perceptions of efficacy, both of which were important factors contributing to academic performance.

Problem Statement

Throughout recent years, researchers have analyzed the characteristics of students who enroll in online courses. Their results have assisted postsecondary institutions in targeting students with similar characteristics. Researchers, however, have not extensively examined the characteristics of online courses versus F2F courses with regard to student achievement. Some researchers (Ary & Brune , 2011; Phipps, Wellman, & Merisotis, 1998; Topper, 2007) have documented no variation between online and F2F student success as measured by course grades. Other researchers (Weber & Lennon, 2007), however, have established that the method of delivery, whether F2F or online, does influence student success. New research is necessary to address or modify problems that arise through online courses (Weber & Lennon, 2007).

Post-secondary institutions are charged to provide quality learning to enable student achievement and serve all student populations through flexibility and an open admissions policy. Student demographic characteristics and how they affect performance have been a focus for researchers. Nevertheless, other factors need to be measured such as motivation, satisfaction, and technology for how they impact students' performance in relation to demographic characteristics. To ensure success in post-secondary education, online students need to be self-motivated, disciplined, and mature (Komarraju, Steven, Karau, & Schmeck, 2009; Waschull, 2005). They also need experience and/or access to technology as this can have an impact on students' performance (Tekinarslan, 2011).

Purpose of the Study

The purpose of the study was to examine the impact of factors such as student motivation, technology, and satisfaction on student achievement as measured by course grades in F2F versus online college algebra courses at a college in south Texas for Fall 2013. Motivation was defined based on taking responsibility to learn material needed for later in life. Satisfaction was determined through student feedback on course design and delivery, as well as quality of instruction. Finally, comfort with technology was comprised of student knowledge, usage, and familiarity with basic computer skills.

Research Questions

The study was guided by the following questions:

1. To what extent did motivation, technology, and satisfaction affect student achievement in F2F and online courses in college algebra at a college in south Texas for fall 2013?

2. Were there any differences between online and F2F instruction in the areas of motivation, technology, and satisfaction while controlling the variables of age, gender, and ethnicity?

Significance of the Study

Enormous growth has happened in online learning during the last decade (Allen & Seaman, 2011; Amro et al., 2013, p.294). The growth rate is still increasing since 2015 (Allen & Seaman, 2017). 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 College (2008). Several researchers have established that student performance does not differ in online courses from F2F courses (Daymont & Blau, 2008; Dell, Low, & Wilker, 2011; 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 F2F students, whereas other researchers (Smith & Stephens, 2010) have documented opposite results. This research will provide valuable information to community colleges because some funding factors are based on course completion.

Limitations of the Study

The limitations that were present for this research study were as follows:

1. This study was restricted to only one college in south Texas. As a result, generalizability to other settings was limited. Findings from this study are generalizable to colleges of similar size with similar demographic characteristics in age, gender, and ethnicity.

2. This study was restricted to the use of students who were enrolled in a college algebra course. Accordingly, students enrolled in remedial mathematics courses were not selected for this study.

3. Although 349 surveys were sent out, only 54 (15.47%) were returned.

4. Students who were enrolled in the online courses completed the survey in an online manner, whereas students enrolled in the F2F course completed the survey during F2F class time, a limitation to the study.

Research Methodology

Quantitative research methodology was utilized in this study. This study utilized a quantitative cross-sectional survey design to collect data at specific times to compare groups (Creswell, 2015). The design used involved nonequivalent groups with alternating treatment post-tests where the research goal was to determine which treatment was more effective and the number of treatments could be studied more quickly than with other designs (Gay, Mills, & Airasian, 2012; Gay & Mills, 2016). This study also utilized archival data to determine whether motivation, technology, and satisfaction had an effect on course grade for college algebra and whether it was different for F2F or online. 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; Gay and Mills, 2016. The causal comparative studies involved two groups of participants (online and face-to-face), a set of independent variables (motivation, technology, and satisfaction) 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).

Instrumentation

The survey instrument included in Appendix A was made available to students enrolled in college algebra in the fall of 2013 for the online and F2F classes using *Survey Monkey*. The survey instrument was created from three previously adapted surveys: one on motivation (Motivated Strategies for Learning Questionnaire, MSLQ); one on technology (The Computer Knowledge Survey); and one Satisfaction Survey was taken from a dissertation following written permission from the authors (Appendix C).

Validity

The survey instrument on motivation was modified from a 31question survey (MSLQ), on self-efficacy and motivation which was validated by several authors (Pintrich, Smith, Garcia, & McKeachine, 1991). The instrument on technology was modified from the Computer Knowledge Survey validated by Vural (2010). The validity of the satisfaction instrument was documented by Kupczynski (2006).

Reliability

The internal consistency of the survey on motivation modified from a survey developed by Pintrich et al. (1991) as measured by Lamda-Kis, had values of 0.80 or higher. The Technology survey was reported to have Cronbach's coefficient alpha of 0.894 (Vural, 2010). With respect to reliability of the satisfaction scale, the Cronbach's coefficient alpha was between 0.62-0.83 (Kupczynski, 2006).

Procedures

After the researcher obtained IRB protocol approval 2013-108-R2-A1, a signed data use agreement from Research and Analytical Services (RAS) of a south Texas post-secondary

institution and from the Chair of the Mathematics Department were acquired. *Survey Monkey* was used to survey the college algebra online and F2F students. The researcher sent an e-mail invitation to all students asking them to participate in the survey using college e-mail. A link to the survey was attached. The RAS personnel de-identified this information based on students' name and their identification number. The student's grade of A, B, C, or D was recorded as such, but student grades of F (Fail), W (Withdraw), and I (Incomplete) were considered equivalent to F. The RAS returned the file back to the researcher without identification numbers to protect the identity of the students.

Population and Sample

The total number of students taking college algebra was 2370 students. Information regarding students enrolled in Fall 2013 who replied to the survey was analyzed as follows: Total number of students who participated in the survey was 500. The following surveys were dropped from the data: 5 did not complete the survey, 3 did not give their consent in the first question, 59 left their identification number blank or skipped at least 60% of the survey, 66 entered the wrong identification number. 18 were duplicate identification numbers. A total of 349 surveys, a response rate of 15% were included. With a population of 2,370, it is suitable to sample ten to twenty percent of the population (Gay, Mill & Airasian, 2006).

The descriptive statistics were computed in the form of Frequency (*N*), Percent, Mean (*M*), and Standard Deviation (*SD*) for the variables: age, gender, ethnicity, and final grade. The ages of the students in this sample ranged from 18 to 56. A total of 295 (84.5%) participants were from F2F courses and 54 (15.5%) participants were from online courses, the Mean age for students who responded was 22.70. The mean age of F2F students ($M = 22.36$, $SD = 6.09$) appeared to be lower than the mean age of online students ($M = 24.59$, $SD = 6.78$). Looking at

each age group within their method of instruction, there were 18 out of 54 (33.3%) online students and 130 out of 295(44.1%) F2F students in the 18-19 age group. In the 20-24 age group, 13 of 54 (24.1%) were online and 96 of 295 (32.5%) were F2F. In the 25-26 age group, 23 of 54 (42.6%) were online and 69 of 295 (23.4%) were F2F. It appears students in the older age category are more likely to attend online courses in college algebra, while younger students were more likely to attend F2F courses (Table 1).

In the sample, the total number of respondents who were female was 207 (59%). Of these female students, 180 (86.96%) were F2F students and 27 (13.04%) were online students. Furthermore, the total number of respondents who were male was 142 (41%). Of these male students, 115 (81%) were F2F students and 27 (19%) were online students. It appears that, more female students responded to the survey than male students in the F2F classes (Table 1).

With regard to ethnicity, the majority, 336 (96.3%) were Hispanic. Of these Hispanic students, 284 (84.5%) were from F2F classes and 52 (15.5%) were from online classes.. Therefore, ethnicity will be ignored since 96.3% of the total respondents were Hispanic (Table 1).

In the sample, the average grade for F2F students (M=3.16, SD=1.41), and the average grade of male F2F students (M =3.24, SD =1.38) were higher than the average grade of female F2F students (M =3.10, SD =1.43). In the grade distribution for F2F courses, 63 (20%) students earned a grade of A, 78 (26.4%) students earned a grade of B, 71 (24.1%) students earned a grade of C, 24 (8.1%) students earned a grade of D, and 63 (21.7 %) students earned a grade of F,W, or I. The online average grade (M =2.80, SD =1.14) and the average grade of male online students (M =2.70, SD =1.07) appeared to be lower than the average grade of female online

students (M =2.89, SD =1.22) In the grade distribution for the online courses, 4 (7.4%) students earned a grade of A; 9 (16.7%) students earned a grade of B; 22 (40.7%) students earned a grade of C; 10 (18.5%) students earned a grade of D, and 9 (16.7%) students earned a grade of F/W/I (Table 1).

Table 1
Demographic Frequency and Descriptive Statistics for the Survey (N=349)

Variable	N	Percent	M	SD	N	Percent	M	SD
		F2F				Online		
Total	295	84.53	---	---	54	15.47	---	---
Gender								
Male	115	48	---	---	27	50	---	---
Female	180	52	---	---	27	50	---	---
Ethnicity								
Hispanic	284	96.3	---	---	52	96.3	---	---
Caucasian	9	3	---	---	1	1.9	---	---
Others*	2	0.7	---	---	1	1.9	---	---
Age	---	---	22.36	6.09	---	---	24.59	6.78
18-19	130	44.1	---	---	18	33.3	---	---
20-24	96	32.5	---	---	13	24.1	---	---
25-59	69	23.4	---	---	23	42.6	---	---
Grade	---	---	3.16	1.41	---	---	2.80	1.14
Female	---	---	3.1	1.43	---	---	2.70	1.07
Male	---	---	3.24	1.38	---	---	2.89	1.22
A	59	20	---	---	4	7.4	---	---
B	78	26.4	---	---	9	16.7	---	--
C	71	24.1	---	---	22	40.7	---	---
D	24	8.1	---	---	10	18.5	---	---
F	40	13.6	---	---	4	7.4	---	---
W	23	7.8	---	---	5	9.3	---	---

*Note:*Other: Asian, African-American, and American Indian, **F and W weighted the same*

A Likert-scale response was used for the survey with 1 representing "Strongly Disagree," 2 representing "Disagree," 3 representing "Undecided," 4 representing "Agree," and 5 representing "Strongly Agree". Table 2 contains descriptive statistics of the Mean (M) and Median (MD) for all 26 questions of the survey, for F2F, online and over-all combined scores. When taking into consideration all respondents, the median for motivation was 4 except for one

question "When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade" which had a median of 5. In Technology all individual question had a median of 5. In satisfaction all individual questions had a median of 4 (Table 2).

F2F and online instructions were also compared using the median. In the motivation section, the median for the individual question, "When I have the opportunity in this class, I choose course" for F2F participants ($MD = 5$) appeared to be higher than the online participants ($MD = 4$). In Technology, the online respondents scored lower in the median than F2F respondents in all areas except for the question: "Entering a URL to access a website" ($MD = 5$). In satisfaction, there were no differences in the median score between the two methods of instructions (Table 2).

In motivation, the question, "It is my own fault if I don't learn the material in this course", the F2F method ($M=3.87$) scored higher than the online method ($M=3.65$). For the question, "I'm confident that I can learn the basic concepts taught in this course" the F2F method ($M = 4.36$) scored higher than the online method ($M = 4.07$). The motivation question, "I want to do well in this class because it is important to show my ability to my family, friend, employer, or others" the F2F participants ($M = 4.37$) received a higher rating than the online participants ($M = 4.17$) (Table 2).

In general, technology received the highest mean score for all questions and students appeared to feel quite knowledgeable about E-mail, Browsing the Internet, Managing Folders, and Dealing with Word Processing with Mean scores above 4.40 for all questions for both F2F and online participants. The questions with highest ratings on Technology were "browsing and searching the on internet" and "E-mail (compose, edit, send, receive)"; F2F respondents

(*M*=4.62) scored higher than online respondents (*M*=4.44). Moreover, it seems the only two questions, "Browsing a URL to access a website" and "Printing a website" for online respondents (*M* = 4.46) appeared to be higher than F2F respondents (*M* = 4.50) (Table 2).

Students appeared to be satisfied with the clarity of the course syllabus. For the question, "Getting a good grade in this course is the most satisfying thing for me now", it appears that the F2F respondents (*M* = 4.56) scored higher than the online respondents (*M* = 4.37). "I believe I will receive an excellent grade in this course" resulted with the F2F respondents (*M*=4.05) scoring higher than the online respondents (*M* = 3.46) (Table 2).

Table 2
Median and the Mean Responses for All Three Variables and All the Questions (N=349)

Item Description	Combind		F2F		Online	
	MD	*M*	*MD*	*M*	*MD*	*M*
Motivation						
5. It is my own fault if I don't learn the material in this course.*	4.00	3.84	4.00	3.87	4.00	3.65
6. I'm confident that I can learn the basic concepts taught in ..*	4.00	4.31	4.00	4.36	4.00	4.07
7. I think the course material in this class is useful for me to..	4.00	4.00	4.00	4.03	4.00	3.83
8. When I have the opportunity in this class, I choose course...	5.00	3.71	5.00	3.72	4.00	3.65
9. I want to do well in this class because it is important to ...	4.00	4.35	4.00	4.38	4.00	4.17
10. I prefer class work that is challenging so I can learn new .	4.00	3.94	4.00	3.96	4.00	3.83
11. I think I will be able to use what I learn in this course in.**.	4.00	3.90	4.00	3.90	4.00	3.92
Technology						
12. Word –processing (create .edit, save, print document)	5.00	4.54	5.00	4.56	4.00	4.43
13. Manage files and folders (find, copy, save, rename, delete, ..	5.00	4.53	5.00	4.55	4.00	4.43
14. E-mail (compose, edit, send, receive)	5.00	4.59	5.00	4.61	4.50	4.44
15. Browsing and searching on the internet?	5.00	4.60	5.00	4.62	4.50	4.44
16. Entering a URL to access a website*	5.00	4.49	5.00	4.50	5.00	4.46
17. Printing a website	5.00	4.45	5.00	4.40	4.50	4.46
18. Downloading (saving) Web material to a hard drive..**	5.00	4.49	5.00	4.51	4.00	4.43
Satisfaction						
19. The class syllabus is clearly presented.	4.00	4.45	4.00	4.46	4.00	4.39
20. The class syllabus offers a tentative schedule for the ..	4.00	4.36	4.00	4.34	4.00	4.35

21. The class content is helpful in understanding the subject.	4.00	4.53	4.00	4.33	4.00	4.17
22. Getting a good grade in this course is most satisfying thing..	4.00	4.17	4.00	4.56	4.00	4.37
23. I'm certain I can master the skill being taught in this class.	4.00	4.22	4.00	4.21	4.00	3.93
24. The most satisfying thing for me in this course is trying to..	4.00	4.34	4.00	4.36	4.00	4.24
25. I'm confident I can do an excellent job on the assignments ..	4.00	4.02	4.00	4.07	4.00	3.74
26. I like the subject matter of this course.	4.00	3.88	4.00	3.94	4.00	3.48
27. The class content is helpful in understanding the subject.*	4.00	4.18	4.00	4.23	4.00	3.89
28. I'm certain I can master the skill being taught in this class.*	4.00	4.05	4.00	4.12	4.00	3.63
29. I believe I will receive an excellent grade in this class.*	4.00	3.96	3.50	4.05	3.50	3.46

Note: *MD*=Median and *M*=Mean;
Note: *1 missing data; and **2 missing data

Table 3 displays information related to descriptive statistics; sample size (*N*), Mean of total scale score (*M*), and Standard Deviation (*SD*) in the areas of Motivation, Technology, and Satisfaction for F2F students and online students selected from the Fall semester of 2013. The table also includes the overall average grade for F2F, online, and combined scores of the two groups.

The overall mean score in Technology for all participants was $M = 31.66$, $SD = 4.57$. F2F participants ($M = 31.76$, $SD = 4.58$) achieved a higher score than the online participants (M=31.09, $SD = 4.53$). The Satisfaction overall score for all participants ($M = 50.44$, $SD = 7.42$). F2F participants (M= 50.94, SD =7.36) attained higher scores than the online participants ($M = 47.69$, $SD = 7.10$). Moreover, F2F male participants ($M = 51.86$, $SD = 7.41$) appeared to be more satisfied than female F2F participants ($M = 50.35$, $SD = 7.30$). On the contrary, online female participants ($M = 48.93$, $SD = 6.92$) seemed to be more satisfied than online male participants ($M = 46.27$, $SD = 7.27$). Motivation for all participants ($M = 28.01$, $SD = 4.65$). F2F participants ($M = 28.18$, $SD = 464$) seemed to be higher than the online participants ($M = 27.06$, $SD = 4.64$). In addition, male participants ($M = 28.46$, $SD = 4.82$) achieved higher score than female participants ($M = 27.70$, $SD = 4.51$). F2F male participants (M=28.90, SD=4.82) appeared to be

more motivated than female F2F participants ($M = 27.70$, $SD = 4.47$). On the contrary, online

female participants ($M = 27.56$, $SD = 4.86$) seemed to be more Motivated than online male

participants ($M = 26.56$, $SD = 4.43$) as shown in Table 3.

Finally, the mean average grade for F2F students ($M = 3.16$, $SD = 1.14$) appeared to be

higher than the mean average grade for online students ($M = 2.80$, $SD = 1.39$). For male F2F

students the average grade ($M = 3.24$, $SD = 1.38$) seemed to be higher than the average grade of

female F2F students ($M = 3.10$, $SD = 1.42$). On the other hand, the average grade of male online

students ($M = 2.70$, $SD = 1.07$) appeared to be lower than the average grade of online female

students ($M = 2.89$, $SD = 1.42$) (Table 3).

Table 3
Result of the Three Variables (Motivation, Technology, and Satisfaction) (N=349)

	F2F		Online		Combined	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Motivation	28.18	4.64	27.06	4.64	28.01	4.95
Female	27.71	4.47	27.56	0.69	27.69	4.51
Male	28.91	4.82	26.56	4.84	28.46	4.82
Technology	31.76	4.58	31.09	4.53	31.66	4.57
Female	31.77	4.48	31.11	5.38	31.68	4.60
Male	31.76	4.74	31.07	3.58	31.63	4.54
Satisfaction	50.93	7.37	47.69	7.10	50.43	7.42
Female	50.35	7.30	48.93	6.92	50.16	7.25
Male	51.86	7.41	46.27	7.27	50.83	7.66
Grade	3.16	1.41	2.80	1.39	3.16	1.41
Female	3.10	1.42	2.89	1.42	3.07	1.40
Male	3.24	1.38	2.70	1.07	3.14	1.34
Total (N)	295		54		349	

Note: *M*=Mean of Total Score; and Standard Deviation=*SD*, Motivation=Total Score of 35;
Technology=Total Score of 35; and Satisfaction=Total Score of 60

Inferential Statistics for the Survey

The sample presented in Table 1 was used for this analysis. There were 295 respondents

from F2F courses and 54 respondents from online courses for a total of 349 students. Ethnicity

was not used as a covariance in the analysis since 97.3% of the population was predominately Hispanic. Before running the MANCOVA analysis, the assumptions were inspected. A preliminary test checking the data for normal distribution was assessed by the Shapiro-Wilk's test (p <0.001). Shapiro-Wilk's showed normality for online students' Motivation (p=0.068) but not for Satisfaction (p =0.009) and Technology (p =0.00001). However, the MANCOVA was run anyway as it is fairly robust. There were multivariate outliers in the data, as assessed by boxplot and Mahalanobis distance ($p > 0.001$) for Motivation, Technology and Satisfaction. The 4 outliers were included in the analysis, since the outliers would not affect the result (Laerd Statistics, 2013). There were linear relationships, as assessed by scatterplot; no multi-collinearity, as assessed by the Pearson correlations between Motivation ($r = 0.324$, $p = 0.001$); Technology ($r = 0.439$, $p = 0.00$); Satisfaction($r = 0.083$, $p = 0.002$) and the method of instruction in the online and F2F courses. There was homogeneity of variance–covariance matrices as assessed by Box's M test of equality of covariance matrices ($p = 0.323$). This indicates that the variance in the two groups, F2F and online, is equal across the three variables of Motivation, Technology, and Satisfaction. Homoscedasticity and homogeneity of variances, as assessed by the scatterplot and Levene's Test of homogeneity of variance for Motivation ($p = 0.977$), for Technology ($p = 0.571$), and for Satisfaction ($p = 0.693$) are considered acceptable. The following null hypothesis was quantitatively tested for specific clarification of data for research question 1:

> H_{01}: There are no significant differences between online and F2F instruction on the dependent variables of Motivation, Technology, and Satisfaction while controlling for the variables of age and gender of students in college algebra at a college in south Texas for the fall semester of 2013.

A One-Way Multivariate Analysis of Covariance (MANCOVA) was conducted. A preliminary analysis evaluating the homogeneity of slopes as an interaction term between the covariance and dependent variables was not statistically significant for age: Wilk's Lambda of .99, F (3, 341) = 1.12, p = 0.34 and for gender Wilk's Lambda of .99, F (3, 341) = .88, p =.45.

The MANCOVA for the differences between the two methods of instruction on the combined dependent variables was statistically significant: Wilks' Lambda = 0.97; F (3, 348) = 3.54, p = 0.02; partial η^2 = 0.03 .The effect size was small: 3% of the variables Motivation, Technology, and Satisfaction were explained by the method of instruction (Table 4).

Table 4
Multivariate Test for Method of Instruction

Effect	Value	F	df	p	η^2
Method of Instruction Wilks' Lambda	.97	3.54	3, 343	.02	.03

Note: Dependent Variable = Motivation, Technology, and Satisfaction

Follow-up ANOVAs showed there were no significant differences between F2F and online courses on Motivation: F (1, 345) =2.56, p=.11; partial η^2=.01 and Technology: F (1, 345) =.46, p=.50; partial η^2=0.01. ANOVAs showed that Satisfaction scores were significantly different between F2F and Online courses: F (1, 345) =9.61, p=.00; partial η^2 =.03 (Table 5).

Table 5
Test of Between Subjects Effects for Method of Instruction for the Three Variables

Source	Dependent Variable	df	F	p	η^2
Method of instruction	Motivation	1, 345	2.56	.11	.01
	Technology	1, 345	.46	.50	.00
	Satisfaction	1, 345	9.61	.00	.03

In conclusion, a significant difference was found between F2F ($M = 50.93$, $SD = 7.37$) and online ($M = 47.69$, $SD = 7.10$) on the variable of Satisfaction while controlling for the variables of age and gender in college algebra at a college in south Texas. The null hypothesis was rejected.

The following null hypothesis was quantitatively tested for specific clarification of data for research question 2:

H_{02}: There were no significant differences among the course grade levels on the dependent variables of Motivation, Technology, and Satisfaction while controlling for the variables of age and gender of students in college algebra at a college in south Texas for the fall semester of 2013.

A One Way-Multivariate Analysis of Covariance (MANCOVA) was conducted for the second hypothesis. There was homoscedasticity and homogeneity of variances as assessed by the scatterplot, and the Levene's Test of homogeneity of variance for Motivation $p = .28$, for Technology $p = .07$, and for Satisfaction $p = .31$ was considered acceptable. The variances for all grade levels were equal among variables Motivation, Technology, and Satisfaction. Furthermore, preliminary analysis was conducted to evaluate the homogeneity of slopes between the covariate, age and gender, and the dependent variables, Motivation, Technology, and Satisfaction; the interaction effect was non-significant for age: $F (12, 987) = 1.77$, $p = 0.05$, $\eta^2 = .02$ and for gender: $F (12, 987) = 1.17$, $p = 0.30$, $\eta^2 = .01$: the effect size was considered small. The results of the MANCOVA indicated that the differences among grade levels on the combined dependent variables were not statistically significant: Wilks' Lambda = 0.96, $F (12, 1026) = 1.68$, $p = 0.07$, $\eta^2 = .02$, possibly due to lack of power (Table 6). In conclusion, no

significant differences were found among grade levels on the variables of Motivation, Technology, and Satisfaction, therefore, the null hypothesis was not rejected.

Table 6
Test Between Subjects Effects for Grade Levels

Effect		Value	F	df	p	η^2
Grade	Wilks' Lambda	.96	1.68	12, 1026	.07	.02

Note: Dependent Variables: Motivation, Technology, and Satisfaction; Independent Variable: Grade Levels

The following null hypothesis was quantitatively tested for specific clarification of data for research question 3:

H$_{03}$: There are no significant interactions between type of instruction and grades on the variables of Motivation, Technology, and Satisfaction while controlling the variables of age and gender in college algebra at a college in south Texas for the fall semester of 2013.

A One-Way Multivariate Analysis of Covariance (MANCOVA) was conducted for the third hypothesis. The results of MANCOVA for grade letters and method of instruction on the combined dependent variables, Motivation, Technology, and Satisfaction indicated that there was significant interaction between method of instruction and grade levels,: Wilks' Lambda = 0.94, F (12, 1101) = 1.80, p = .04; partial η^2 = .02 indicates the effect size is small where 2% of the dependent variables were explained by the grade level and method of instruction (Table 7). Based on Figure 1, there appeared to be an interaction among Grade letters (A, B, C, D, and F/W) and method of instruction (F2F and online) on the variables of Motivation, Technology, and Satisfaction while controlling the variables of age and gender.

Table 7

Test Between Subjects Effects for Grade Levels and Method of Instructions (Interaction)

Effect		Value	F	df	p	η^2
Grade*Method	Wilks' Lambda	0.938	1.799	12,1101	0.04	0.021

In conclusion, there was significant interaction between grade level and method of instruction on the dependent variables while controlling age and gender. Therefore, the null hypothesis was rejected.

In general the higher the students' grade, the higher the students' Motivation and Satisfaction regardless of method of instruction. However, online students who failed or withdrew scored the highest on motivational scale, which may indicate interaction among factors or empathy when students completed the survey. Online students with low technical skill still achieved the highest grade level of A. However, students with a C grade scored the same in technological skill regardless the method of instruction (Figure 1).
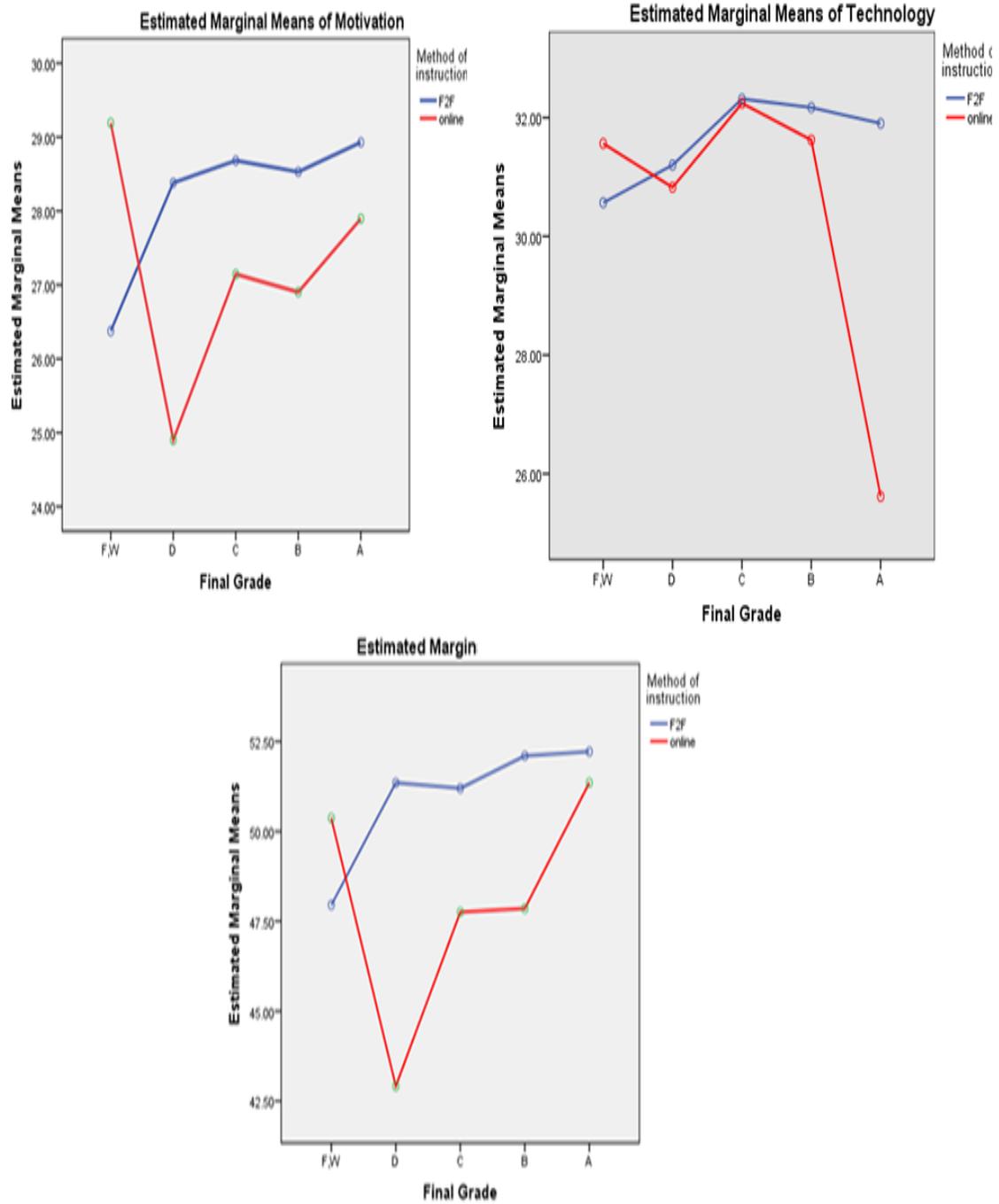
Figure 1: Interaction Effect between the Method of Instruction and Grade on the Variables of Motivation, Technology, and Satisfaction (Laerd Statistics, 2013)

Conclusion

Student success might be impacted by variables such as motivation and self-discipline. Gharibpanah and Zamani (2011); Hodge, Richardson, and York (2009); Mandernach et al. (2006); Waschull (2005), and Zeidenberg and Bailey (2010) concluded that self-discipline and motivation impacted students' performance in online courses. The finding of this research is supported by Sadera, Robertson, Song, and Midon (2009) who also indicated that motivation has no significant differences on online versus F2F.

Technology was another factor. The finding of this research found that technology has no effect on students' performance which supports the research of Bekele (2010) and Waschull (2005), but was inconsistent with Solimeno, Mebane, Tomai, and Francescato (2008); Mandernach et al. (2006), and Tekinarslan (2011).

Regarding satisfaction, a survey question of "Getting a good grade in this course is most satisfying thing . . ." has a (MD= 5.00) in this research. The finding supports the research of Bain, Fedynich, and Knight (2009); Hermans, Haytko, and Mott-Stenerson (2009), and Kupczynski et al. (2011). There was significant association between the level of student satisfaction and student achievement. Furthermore, the researcher concluded that online female participants ($M = 48.93$) were more satisfied than the male online participants ($M = 46.27$), which was consistent with the research of Coldwell et al. (2008) and Ryabova (2012). Finally, the researcher concluded that F2F students ($M = 50.93$) were more satisfied than online students ($M = 47.96$). The result agreed with the research of Summers, Waigandt, and Whittaker (2005).

Demand exists for higher quality education in both F2F settings and online settings. Post-secondary institutions are still investigating factors that might impact student achievement.

College administrations seek factors that increase student's performance which affect course completion which influences funding.

Recommendations for Research

The following recommendations are for future research:

1. Qualitative and quantitative research is needed to identify the reason satisfaction affects student achievement to be able to advise students to take the right course.

2. More investigations are needed in the demographic characteristics of the online students such as age and gender to discover why female online students performed better than female F2F students.

3. More research is needed on F2F settings to investigate the reason male students outperform female students.

4. More research is needed regarding the age group 18-20 and their high drop rate.

Recommendations for Practice

1. Satisfaction impacts student success; therefore, faculty need to be trained in satisfaction issues regarding courses and look at all factors that impact student achievement.

2. Workshops for student services and advisors are needed to increase supports to students that will assist in increasing overall satisfaction.

3. Faculty need to be made aware of factors such as age group and gender and whether any of these might impact student achievement.

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STUDENT INSTRUMENT

Dear Student,
South Texas College is conducting this survey to determine factors that predict the student's performance in college algebra in online and face-to-face courses. Your help and participation is appreciated. This information will only be used to evaluate survey results and will not be used to identify your participation in any way. Your responses and all data will remain confidential.

Acknowledgment of the survey for online student:

Please read the following disclaimer and the extended disclaimer on the homepage and click "yes" I accept," if you agree. If you don't, please close the survey window. You will not be included in the study. If you choose not to participate in the study, there will be no penalty.

Student Information

1. Student identification number _____

2. What is your age?
       1. 18-24
       2. 25-29
       3. 30-39
       4. 40-49,
       5.50 and above

3. What is your gender?
       1. Female
       2. Male

4. What is your ethnicity?
       1. African-American
       2. American Indian/Alaskan Native
       3. Asian
       4. Caucasian
       5. Hispanic
       6. International

Select one of the choices that you believe most reflect the way you feel. If the statement does not apply to you experience, choice undecided.

<u>Motivation</u>

5. It is my own fault if I don't learn the material in this course.
       1. Strongly disagree
       2. Disagree
       3. Undecided

4. Agree
5. Strongly Agree

6. I'm confident that I can learn the basic concepts taught in this course.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

7. I think the course material in this class is useful for me to learn.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

8. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

9. I want to do well in this class because it is important to show my ability to my family, friend, employer, or others.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

10. I prefer class work that is challenging so I can learn new things.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

11. I think I will be able to use what I learn in this course in other courses.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

Technology

You select an answer dealing with your knowledge of the computer. Strongly agree= very knowledgeable, and strongly disagree= not-knowledgeable

12. Word –processing (create .edit, save, print document)
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

13. Manage files and folders (find, copy, save, rename, delete, move a file or folder)
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

14. E-mail (compose, edit, send, receive)
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

15. Browsing and searching on the internet?
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

16. Entering a URL to access a website
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

17. Printing a website
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

18. Downloading (saving) Web material to a hard drive or disk
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

Satisfaction

19. The class syllabus is clearly presented.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

20. The class syllabus offers a tentative schedule for the semester.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

21. The class content is helpful in understanding the subject.
1. Strongly disagree
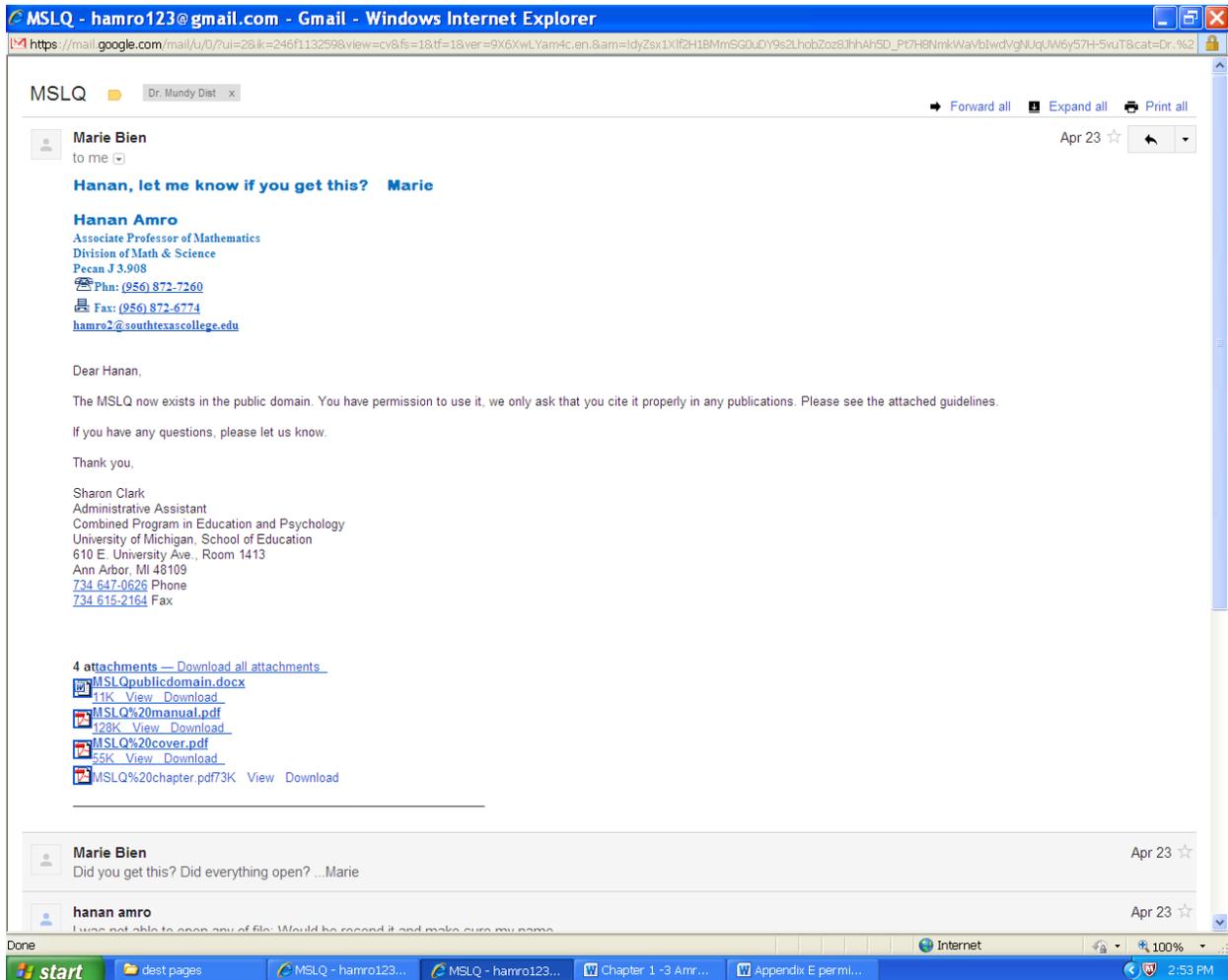2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

22. Getting a good grade in this course is most satisfying thing for me now.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

23. I'm certain I can master the skill being taught in this class.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

24. The class content is helpful in understanding the subject.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

25. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

26. I'm confident I can do an excellent job on the assignments and tests in this course.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

27. I like the subject matter of this course.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

28. The class content is helpful in understanding the subject.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

29. I'm certain I can master the skill being taught in this class.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

30. I believe I will receive an excellent grade in this class.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

Motivated Strategies for Learning Questionnaire, MSLQ

For motivation and part of satisfaction

The computer knowledge survey

Part of the Satisfaction Survey