The Effect of Student Background in E-Learning — Longitudinal Study

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Abstract

This study surveyed how students' backgrounds prepare them for online education. The study compared learning outcome between traditional and non-traditional (adult) undergraduate students in online and face-to-face sessions; the difference in learning over time; and the effect of prior online experience. Student learning measurements included: pre-test, final examination (post-test), and final letter grade.

Findings revealed that online education is as effective as F2F sessions and that learning has occurred. The study found a significant difference of learning outcomes over time. And that adult student with some prior online experience performed better than those with no prior experience.

Conclusions suggest that Adult students benefit more from taking online classes compared to traditional age students, and that computer competency helped improve performance in online classes over time. Additional analysis is needed to determine if there is a difference between the personality of students and their performance in online and F2F classes.

Keywords: Distance learning, Online education, learning outcomes, e-learning, Internet Based Learning. effectiveness of online education, f2f.

Introduction

Management philosopher Peter Drucker forecasted: "Universities won't survive. The future is outside the traditional campus. Distance learning is coming on fast."(Drucker, 1997)

Even though online education is being offered by many colleges and universities, the successes of such programs remain a challenge. Administrators recognized that "if we offer the class, students will sign up" is an untrue statement. They are in the process of re-assessing their online education. A number of online degrees and programs have been cancelled due to low enrollment, low retention rate, and high withdrawal rate (Bird, 2006). These and other factors have left businesses with suspicious views of the value of online education.

Hence, there is a need for a better understanding of online education. Both universities and employers are often doubtful of efficacy of online education. Many implementations (early as well as current ones) are developed by posting lecture notes and transparencies on the Web. Additionally, some implementations do not consider various learning theories resulting in online courses that post lecture material without considering the effects of the change in the communication channel (i.e., from Face-to-Face to Online).

"A working assumption throughout academic life that is almost never stated is that anyone with a Ph.D. can teach well enough for any college students he might be required to teach" (Buckley, 2002).

This paper differentiates between learning and teaching. Learning is often the result of student activities, while teaching is mainly the instructors' activities (Joyce, 2004). Learning is measured as a grade in: a final test, the difference between grades in the final test and grades in the pretest, and the final letter grade. The pre-test is administered at the start of the academic term. The final letter grade in the course includes additional course assignments and other activities. This paper does not investigate teaching effectiveness.

This study compares how students' backgrounds influence the learning outcomes in two delivery modalities -Online and Face to Face (F2F) education - in order to identify some of the factors that affect learning outcome. Students background include type of students - traditional and non-traditional (adult students who started working after high school and returned to get a college degree). Students enrolled in the class majored in Business Administration, Computer Science, and Organizational Management. Two sessions (online and Face to Face) of the same undergraduate class – Management of Information Systems – were offered over several academic terms. The F2F sessions of the course were typically offered either early afternoon twice a week for two hours or once a week at night for four hours. All F2F sessions were offered in a computer lab. The online sessions were offered "anytime, anywhere."

The next section describes prior research, followed by research design and methodology, findings, and lastly analysis of findings. The paper ends with a conclusions and future research.

Prior Research

Distance online education is defined as "a general term used to cover the broad range of teaching and learning events in which the student is separated (at a distance) from the instructor, or other fellow learners" (Hoyle, 2007). Relevant research consistently demonstrated three distinct generations in distance education. Historically, distance education started in the 1840, with the use of correspondence – students and instructors making use of the traditional United States Postal Service to communicate: assignments, homework, and examinations. The United States was the only country in the world that offered distance education via correspondence (Public Broadcasting System, 2005). The second was the use of video and audio – the American educators were fascinated with the new media and technology; which started with radio, followed by one-way audio, two-way audio, one-way video, two-way video, television, videoconferencing, and later, microcomputer. The third was the use of the Internet – based distance education (online) – the introduction of the Internet to the commercial sector in 1996 had a profound impact on distance education. The third generation is identified by the speed of technology, the use of personal computers, CD ROMs, and the online distance learning courses.

The effectiveness of online education is still an unanswered question. Many universities are opening new centers while others are closing their doors. Industries have adopted virtual learning to train their employees (Weekes, 2007). Some colleges are creating articulation agreements and partnership with industries to provide training to staff development programs (Bird, 2006). Administrators in colleges and universities are dedicating a major portion of their financial resources in the development and facilitation of anytime / anywhere virtual learning. Some researchers proved that F2F classroom modality was the best way to encourage and motivate students (Mentzer, Cryan, & Teclehaimanot, 2007). Some researchers demonstrated that blended hybrid learning was the least cost effective (Mackay & Stockport, 2006); students and faculty liked the benefits of time flexibility in blended courses however, they consider finding time to develop such courses was a challenge (Vaughan, 2007). There were other researchers who considered

that e-learning was the biggest growth in higher education (Rosenberg, 2001). Finally, there are some researchers who compared all three delivery modalities and found that all students acquire course content equally regardless of delivery mode (Tang, 2007).

Many faculty members feel that it is the 21st century, and offering courses via Internet is becoming a strategic necessity among competitive universities (Lee, Tseng, Liu, & Liu, 2007). They look at the opportunities that distance education may provide universities, such as, increased enrollment, extra grants from different foundations, and most of all, widening the student body by offering global access to courses (Papp, Aucott, & Aron, 2001). On the other hand, some faculty members perceive students in an online class have the tendency of cheating more compared to in class modality because they are not monitoring the students; they feel that institutions should address academic dishonesty (Grijalva, Nowell, & Kerkvliet, 2006). Others are still skeptical and resistant to change when it comes to distance online education. They examine the retention rates of online courses, with student dropout rates of thirty-two percent compared to a four percent dropout rate for students enrolled in a F2F classroom course (Liu, Gomez, Khan, & Yen, 2007), and remember the sixties era and the failures of distance education when they tried to offer correspondence courses using US postal services or offer courses using TVs and videos. As such, many faculty believe online education is another fad that will soon disappear.

Students, on the other hand have different needs and challenges. Empirical data identify some of the factors that influence student satisfaction toward online education such as: student control, instructor rapport, enthusiasm, group interaction just to name few (Lee, 2007). Researchers reveal that there are some concerns in student achievement and motivation, and that the level of interactivity plays a major factor in student motivation (Mahle, 2007).

Buckley states that there is a paradigm shift between F2F classrooms and online courses. He specifies that in the F2F classroom, responsibilities of course pace and material covered reside with the faculty member. The faculty decides the content of the course, how to deliver the course, and what kind of learning styles to use. In the case of Online learning courses, the responsibilities of learning fall on students. He recommends that students who recognize the paradigm shift and are willing to take that responsibility will favor online education more than F2F classroom learning. Moreover, he recommends that Colleges and Universities address the effective institutional transition by developing staff development programs to train their faculty (Buckley, 2002). He also indicates that half of the fourteen million students enrolled in higher education in the United States are nontraditional adult students over twenty-four years of age, who have families and full-time jobs. Research shows that nontraditional adult students achieved better grades than traditional undergraduate students. Therefore, this study examines whether online education is good only for a unique group of students or could it be one size fits all.

In modern days, there are few studies which use experimental design and no study was found comparing heterogeneous student types in the same course and setting. As such, there is a need for a study investigating the effect of student background on efficacy of the learning environment since the current trend in research is moving towards more rigorous design and identifying the critical success factors. These arguments and findings gave the birth to this experiment. This paper compares the effectiveness of online classes with face-to-face classes, and the effect of student background on their performance in each setting.

Research Design and Methodology

This is an ongoing longitudinal research experiment that started in Fall 2001. Two concurrent classes have been conducted twice a year, one Face-to-Face (F2F) in a classroom and the other Online. The F2F course was fifteen weeks in a semester base, whereas the online course was an

accelerated ten week term. Even though they started at different dates, they both ended on the same day. The average enrollment of each class was twenty-two students.

Even though there was a time difference in the duration of the course, students completed the same contents using the same timeline. In the F2F modality, students had breaks such as Spring break or Thanksgiving, whereas, in the online modality there were no breaks taken. However, all students had exactly the same assignments and duration to finish their assignments.

Sample Selection

The research was implemented in a small private institution located in Southern California. The university consists of four colleges – College of Arts and Sciences, College of Business, Education and Organizational Leadership, and Law. It has one main campus and several regional centers. The institution serves many first generation college students, and is recognized as one of the diverse universities in the United States.

All students in this study were undergraduate students seeking a Bachelors of Science degree. Most students were majoring in Computer Science, Business Administration, or Organizational Management and they had junior or senior status. The study compared three different types of students - Traditional Undergraduate, Campus Accelerated Program for Adults (CAPA), and Regional Campus Administration (RCA). Traditional students were 19 – 24 years old; who started attending the university right after they graduated from high school. Non-traditional (CAPA and RCA) students were considered adults over 25 years of age. Those students started working in industry right after they graduated from High school. CAPA students came to the main campus to attend courses, whereas RCA students attend classes in the off campus centers. The CAPA students benefited from the campus environment, whereas the RCA students did not have that benefit.

In this study, students who enrolled in the face-to-face classroom sessions were CAPA and traditional aged students. However, the University policy restricted traditional aged students from enrolling in the Online Distance Learning courses. Only good standing (not on academic probation) students were given the permission to enroll in the online course. This restriction may influence the generalization of the study.

Course Design

A team of five educators from Indiana University's Center for Research on Learning and Technology (CRLT) tested Chickering's seven principles of good practices in an online distance learning course which included: "1) encourage student-faculty contact, 2) encourage cooperation among students, 3) encourage active learning, 4) give prompt feedback, 5) emphasize time on task which allows students to complete their assignments at their own time, 6) communicate high expectations, 7) respect diverse talents and ways of learning" (Chickering, 1996). In addition to Chickering's seven principles, they added and emphasized the importance of Human Computer Interface (HCI) designs that included the organization and presentation of online materials. They identified four principles that are related to Human Computer Interface design that included: (a) consistency of web page layout and design, (b) clear organization and presentation of information, (c) consistent and easy to use website navigation, and (d) aesthetically pleasing design and graphics (Graham, 2001). All of the principles mentioned above were taken into consideration and were integrated during the course development stage.

Measurement of Learning

One issue that often pesters educational research is how to measure learning. Though many suggest that examination results may not be the best metric, it is one of the most commonly used

methods. In this research, student performance is measured using three grades: pre-test, post-test, and achieved grade. The pre-test was conducted the first day of class prior to the course. The post-test was the same test as the pre-test and was conducted at the end of the course. The achieved grade consisted of the following activities: nine weekly quizzes, facilitating one case study, participating in nine case study discussions, nine weekly homework assignments, nine weekly e-commerce assignments, research paper, midterm exam, and final exam. All quizzes and exams were on blackboard and can be accessed online.

Research Design

A quasi-experimental pre-test / post-test experiment was conducted with a sample of four hundred and eighty six students (see Table 1.0). The sample was divided into a control group and an experimental group. The instrument used was an end of semester course evaluation. The data was analyzed using a Chi squared, one-way ANOVA, an independent-sample t-test, a paired sample t-test, and regression analysis.

Table 1.0: Enrollment by Student and Class Type

Class Type / Student Type	F2F	Online	Total
CAPA	44	79	**123**
RCA	0	131	**131**
Traditional	193	35	**228**
(students did not respond)	0	4	**4**
Grand Total	**237**	**249**	**486**

The study had two independent variables and three dependent variables. The independent variables were: delivery modality (i.e., class type - F2F and Online) and student type (traditional undergraduate, CAPA, RCA). The dependent variables included: (1) pre-test, (2) post-test, (3) achieved grade. In addition, though not analyzed in the paper, the researcher investigated the student personality type and whether good principles of the classroom still applied to an online environment as well as a F2F classroom environment. Therefore, six extra dependent variables were added (1) faculty availability, (2) interaction among students, (3) satisfaction with course activities, (4) perceived quality of feedback, (5) flexibility of time, (6) consistency in design of human computer interface.

As suggested by Babbie (2007), the experiment consists of a control group and an experimental group. The F2F classroom session is the control group, which receives no treatment. The online session is the experimental group, which receives treatment. The effects of the treatment and no treatment on the dependent variables are measured by means of (1) a pre-test prior to the beginning of the class, (2) a post-test is administered after the completion of the treatment, and (3) a final course grade.

All students took the following surveys and exams:

1. "Fact Sheet" survey
2. Myers Briggs personality test
3. Pre-test exam before the class began
4. Midterm exam
5. Final exam, and
6. Assessment survey
7. Official Class Evaluation

The student assessment survey instrument was validated using an eight member expert panel before the beginning of the instructions. The panel recommended separating the student opinion survey from the course evaluation form. Therefore, students filled out the course evaluation and the student opinion survey separately. Data for the dependent variables were collected from the student opinion survey instrument, which was administered at the end of the semester. The researcher was careful in keeping the control and experimental students separate to avoid data contamination. The course used Blackboard as the virtual classroom in the distance learning session as well as the face-to-face classroom session. The same instructor taught both sessions to ensure internal reliability.

Hypotheses

Drawing upon the literature and based on the present research context, this research investigates the following hypothesis:

H1: ***There is no statistically significant difference in grade distribution between:***

- **a.** *Delivery modality (F2F, Online)*
- **b.** *Student Type (Traditional, CAPA, RCA)*

H2: ***There is no statistically significant difference in learning (as measured by the pre-, post- tests and difference between pre and post test grades) regardless of***

- **a.** *Delivery modality (F2F, Online)*
- **b.** *Student Type (Traditional, CAPA, RCA)*

H3: ***There is no difference over time in achieved grade regardless of***

- **a.** *Delivery modality (F2F, Online)*
- **b.** *Student Type (Traditional, CAPA, RCA)*

H4: ***There is no relation between average grade in online classes and the number of prior online classes taken by a student regardless of student type.***

Findings

Chi Squared was used to analyze the data to determine any significant difference and the effect of interaction among student type (CAPA, RCA, Traditional) and delivery modality (the F2F and the Online); a paired-sample t-test was used to analyze the pre-test versus the post-test to determine any significant difference between the two tests; and there were cases where an independent variable (student type or delivery modality) was held constant and an independent-sample t-test was used to analyze the data to determine any significant difference when the question addressed one independent variable. The data analysis was triangulated using two way ANOVA, one way ANOVA and t-test to confirm accuracy. Dependent variables were analyzed using the independent-samples t-test to confirm the direction of the significance.

H1: *There is no statistically significant difference in grade distribution between:*

- **a.** *Delivery modality (F2F, Online)*
- **b.** *Student Type (Traditional, CAPA, RCA)*

This hypothesis is further divided into two:

H1.1: There is no difference in grade distribution between Online and F2F classes. Subordinate hypotheses include no difference between the two delivery modality (online and F2F) for traditional and adult (CAPA and RCA) students. The study combined several grades in order to

avoid having many cells with less than five. As such, the Chi Squared test was conducted using the A, B, C, and D or less as grade categories instead of the A, A-, B+ …etc.

No significant difference was found in the grade distribution between delivery modality (Table 1.1.1) (F2F vs. Online) using Chi Squared tests (p = .2348). For traditional students (Table 1.1.2), no significant difference was found in the grade distribution between delivery modality (F2F vs. Online) using Chi Squared tests (p = 0.191028069). For CAPA adult students (Table 1.1.3), no significant difference was found in the grade distribution between delivery modality (F2F vs. Online) using Chi Squared tests (p = 0.108371771). No test was conducted the RCA students since they did not come to the main campus and did not enroll F2F classes.

Table 1.1.1: Difference in letter grade distribution between F2F and Online classes regardless of student types

Grade	F2F	Online	Grand Total
A	100	120	**220**
B	108	91	**199**
C	20	25	**45**
D or less	9	13	**22**
Chi Squared (p value)	0.23476483		

Table 1.1.2: Traditional Students Grade Distributions F2F versus Online

	F2F	Online	Totals
A	74	20	**94**
B	95	13	**108**
C	16	1	**17**
D or less	8	1	**9**
Totals	**193**	**35**	**228**
Chi Squared Test (p value)	0.191028069		

Table 1.1.3: CAPA Students Grade Distributions F2F versus Online

	F2F	Online	Totals
A	26	31	**57**
B	13	31	**44**
C	4	8	**12**
D or less	1	9	**10**
Totals	**44**	**79**	**123**
Chi Squared Test (p value)	0.108371771		

H1.2: There is no difference in grade distribution between students type (CAPA, RCA and traditional) regardless of class delivery modality. Subordinate hypotheses include no difference between adult students and traditional students in F2F and for online delivery modality.

No significant difference in letter grade distribution was found between CAPA and traditional students in F2F classes as shown in Table 1.2.1. Since no RCA students attended F2F classes on the main campus, Table 1.2.1 is limited to CAPA and traditional students only.

Table 1.2.1: F2F Grade Distributions CAPA versus Traditional			
Final Grade	**CAPA**	**Traditional**	**F2F Total**
A	26	74	**100**
B	13	95	**108**
C	4	16	**20**
D or less	1	8	**9**
Chi Squared (p value)	0.070056582		

However, there was a significant difference in letter grade distributions between CAPA/RCA and traditional students in online classes as shown in Tables 1.2.2 & 1.2.3.

Table 1.2.2: Online Grade Distributions All Student Types			
Final Grade	**CAPA**	**RCA**	**Traditional**
A	57	67	94
B	44	46	108
C	12	15	17
D or Less	10	3	9
Chi Squared (p value)	0.048875661		

Table 1.2.3: Online Grade Distributions CAPA versus Traditional			
Final Grade	**CAPA**	**Traditional**	**Total**
A	98	20	118
B	77	13	90
C	23	1	24
D or less	12	1	13
Chi squared (p value)	1.3006E-158		

H2: There is no statistically significant difference in learning (as measured by the pre, post tests and difference between pre and post test grades) regardless of delivery modality or type of students (see Table 2.1 for results)

Several t-tests were conducted to investigate student learning in various delivery modality (see Tables 2.2 – 2.4). These tests include comparisons of: (1) pre-test grades between traditional and CAPA students; (2) post test grades between the same student groups; and (3) difference between pre and post test grades for CAPA and traditional student groups.

The purpose of the pre-test was to determine the level of knowledge of students prior to taking the course. There was a significant difference between CAPA and traditional students in F2F and online classes. This may be explained by the work experience of the adult CAPA students which allows them to appreciate the value of information in organizations. No significant differences were found between traditional students in all modality or between CAPA students in all modality (see Table 2.2).

The post-test was the final exam and measured the level of learning reached at the end of the term. There was a significant difference in post-test between adult (CAPA) and traditional students in F2F modality. However, no significant difference was found in online modality. That implies the amount of learning of traditional students who were taking online course had learned more than traditional students who were taking F2F course, and have reached the same level of knowledge as CAPA students (see Table 2.3).

Table 2.1: Pre and Post Test Grades for Traditional and CAPA Students			
Type of Students	**F2F/Online**	**Data**	**Total**
Traditional	F2F	Average of Pre-Test	48.69
		Std. Dev. of Pre-Test	8.91
		Count	156.00
		Average of Difference	19.43
		Std. Dev of Difference	11.80
	Online	Average of Pre-Test	45.86
		Std. Dev. of Pre-Test	10.40
		Count	29.00
		Average of Difference	25.21
		Std. Dev. of Difference	12.14
Traditional Average of Pre-Test			48.25
Traditional Std. Dev of Pre-Test			9.19
Traditional Count			185.00
Traditional Average of Difference			20.34
Traditional Std. Dev. of Difference			12.01
CAPA	F2F	Average of Pre-Test	53.19
		Std. Dev. of Pre-Test	9.11
		Count	31.00
		Average of Difference	19.26
		Std. Dev. of Difference	7.95
	Online	Average of Pre-Test	57.00
		Std. Dev. of Pre-Test	18.02
		Count	10.00
		Average of Difference	18.00
		Std. Dev. of Difference	10.18
CAPA	ALL	Average of Pre-Test	54.12
		Std. Dev of Pre-Test	11.75
		Count	41.00
		Average of Difference	18.95
		Std. Dev. of Difference	8.42
F2F	ALL	Average of Pre-Test	49.44
		Std. Dev. of Pre-Test	9.08
		Count	187.00
		Average of Difference	19.40
		Std. Dev. of Difference	11.24
Online	ALL	Average of Pre-Test	48.72
		Std. Dev. of Pre-Test	13.45
		Count	39.00
		Average of Difference	23.36
		Std. Dev. of Difference	11.97

Total Average of Pre-Test	49.31
Total Std. Dev. of Pre-Test	9.94
Total Count	226.00
Total Average of Difference	20.08
Total Std. Dev. of Difference	11.44

Table 2.2: T test for Pre Test Grades For Traditional and CAPA Students in Online and F2F

		Pre Test	Std.Dev	count		t (equal variance)	t (unequal variance)	T Critical
All	**Traditional**	48.25	9.19	185		-3.51	-3.00	1.65
	CAPA	54.12	11.75	41				
All	**F2F**	49.44	9.08	185		0.42	0.33	1.65
	Online	48.72	13.45	41				
Traditional	**F2F**	48.69	8.91	156		1.53	1.37	1.653
	Online	45.86	10.4	29				
CAPA	**F2F**	53.19	9.11	31		-0.89	-0.64	1.684
	Online	57	18.02	10				
F2F	**Traditional**	48.69	8.91	156		-2.56	-2.52	1.653
	CAPA	53.19	9.11	31				
Online	**Traditional**	45.86	10.4	29		-2.40	-1.85	1.69
	CAPA	57	18.02	10				

Table 2.3: T test for Post Test (Final Exam) For Traditional and CAPA Students in Online and F2F

		Post test Final Exam	Std.Dev	count		t (equal variance)	t (unequal variance)	T Critical
All	**Traditional**	68.58	10.13	185		-2.47	-2.20	1.65
	CAPA	73.07	12.18	41				
ALL	**F2F**	68.84	10.27	187		-0.31	-0.30	1.65
	Online	69.4	10.64	39				
Traditional	**F2F**	68.12	9.94	156		-1.45	-1.36	1.653
	Online	71.07	10.9	29				
CAPA	**F2F**	72.45	11.3	31		-0.57	-0.49	1.684
	Online	75	15.1	10				
F2F	**Traditional**	68.12	9.94	156		-2.16	-1.99	1.653
	CAPA	72.45	11.29	31				
Online	**Trad**	71.07	10.9	29		-0.89	-0.76	1.69
	CAPA	75	15.1	10				

Table 2.4 tests the amount of knowledge acquired (as measured by difference = post-test – Pre-test) by student type and modality. Traditional students who took the course in an online modality learned more compared to F2F modality. Traditional students learned more than CAPA students

in the online modality while the same was not true in the F2F modality. There was no significant difference in the CAPA students taking online or F2F modalities.

Table 2.4: T test for Differences
For Traditional and CAPA Students in Online and F2F

		Differences	Std.Dev	count		t (equal variance)	t (un-equal variance)	T Criti-cal
ALL	**Traditional**	20.34	12.01	185		0.70	0.88	1.65
	CAPA	18.95	8.42	41				
ALL	**F2F**	19.4	11.23	187		-1.98	-1.89	1.65
	Online	23.35	11.97	39				
Traditional	**F2F**	19.43	11.8	156		-2.41	-2.36	1.653
	Online	25.21	12.14	29				
CAPA	**F2F**	19.26	7.95	31		0.41	0.36	1.684
	Online	18	10.18	10				
F2F	**Traditional**	19.43	11.8	156		0.08	0.10	1.653
	CAPA	19.26	7.95	31				
Online	**Traditional**	25.21	12.14	29		1.68	1.83	1.69
	CAPA	18	10.18	10				

H3: There is no difference over time in achieved grade. Subordinate hypotheses include that there is no relation between time and grade achieved by student type (traditional and adults) or delivery modality. See Table 3.1.

Table 3.1: Final Exam grade for all types of students and classes
Average of Final Exam for Online and F2F

			Traditional		CAPA		RCA	Grand
Year	**Semester**	**Term #**	**F2F**	**Online**	**F2F**	**Online**	**Online**	**Total**
2001	3-Fall	1	73.67	71.83	68.89	84.75		**73.23**
2002	1-Spring	2	67.70	70.87	59.00	58.71		**67.56**
	3-Fall	3	70.10	74.00	73.67	67.33	76.92	**73.27**
2003	1-Spring	4	68.11	64.00	80.50	77.00	74.14	**71.19**
	3-Fall	5	63.21	79.00	72.75	71.20	69.92	**68.11**
2004	1-Spring	6	59.40	69.00		73.70	74.00	**67.69**
	3-Fall	7	66.60		64.80	65.83	73.46	**68.82**
2005	1-Spring	8	75.88	66.50	83.00	71.75	76.44	**75.03**
	3-Fall	9	76.32		70.80	77.88	78.13	**76.56**
2006	1-Spring	10	64.04		58.00	84.15	85.33	**73.23**
	3-Fall	11	63.19			70.43	76.94	**68.71**
2007	1-Spring	12	72.88		71.78	82.29	80.22	**76.64**

A significant temporal relation was found in the following cases: All students; CAPA online; RCA online (Tables 3.2, 3.5 & 3.7). No significant temporal relation was with traditional students both in online and F2F environments; CAPA F2F (Tables 3.3, 3.4 & 3.6).

Table 3.2: Regression Analysis All Students
Final Exam Grade vs. Time
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.353956708
R Square	0.125285351
Adjusted R Square	0.037813887
Standard Error	3.369762594
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	16.2641925	16.26419	1.4323	0.258992
Residual	10	113.5529994	11.3553		
Total	11	129.8171919			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	69.47831814	2.07394551	33.50055	1.33E-11
X Variable 1	0.337247108	0.281793704	1.196787	0.258992

Table 3.3: Regression Analysis Traditional Online Students
Final Exam Grade vs. Time
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.265635625
R Square	0.070562286
Adjusted R Square	-0.115325257
Standard Error	5.218480791
Observations	7

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	10.33738118	10.33738118	0.379596634	0.564783392
Residual	5	136.1627088	27.23254177		
Total	6	146.50009			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	72.99937634	4.159249998	17.55109127	1.10102E-05
Term #	-0.544577097	0.88388995	-0.61611414	0.564783392

Table 3.4: Regression Analysis Traditional F2F Students
Final Exam Grade vs. Time
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.012537158
R Square	0.00015718
Adjusted R Square	-0.099827102
Standard Error	5.71876901
Observations	12

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.051412837	0.051412837	0.00157205	0.969153303
Residual	10	327.0431899	32.70431899		
Total	11	327.0946027			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	68.54754989	3.51965902	19.47562236	2.78215E-09
Term #	-0.018961285	0.478227489	-0.03964909	0.969153303

Table 3.5: Regression Analysis CAPA Online Students
Final Exam Grade vs. Time
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.311162581
R Square	0.096822152
Adjusted R Square	0.006504367
Standard Error	7.84337
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	65.94879428	65.94879428	1.072016462	0.324879384
Residual	10	615.1845296	61.51845296		
Total	11	681.1333239			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	69.33783994	4.827260538	14.36380725	5.29866E-08
Term #	0.679102628	0.655895549	1.035382278	0.324879384

Table 3.6: Regression Analysis CAPA F2F Students
Final Exam Grade vs. Time
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.001317997
R Square	1.73712E-06
Adjusted R Square	-0.124998046
Standard Error	8.63363777
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001035875	0.001035875	1.3897E-05	0.997116886
Residual	8	596.3176092	74.53970115		
Total	9	596.3186451			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	70.3004779	5.513204892	12.75129063	1.34791E-06
Term #	0.002927121	0.785200691	0.003727863	0.997116886

Table 3.7: Regression Analysis RCA Online Students
Final Exam Grade vs. Time
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.618128847
R Square	0.382083271
Adjusted R Square	0.30484368
Standard Error	3.506254926
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	60.81421	60.81421	4.946728	0.056815
Residual	8	98.35059	12.29382		
Total	9	159.1648			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	70.11203241	3.100248	22.61498	1.55E-08
Term	0.858569671	0.386026	2.224124	0.056815

H4: There is no relation between average grade in online classes and the number of prior online classes taken by a student regardless of student type.

Based on total sample (all students regardless on background-Table 4.1), no relation was found between the number of online classes and the grade achieved in the final test as shown in Table 4.2

Table 4.1: Average Grade in Online and Prior Online Class Taken by Student

Prior Online	Average of Final Exam	# of students
0	73.11	62
1	76.77	35
2	80.20	10
3	81.33	6
4	71.67	6
5	71.25	4
6	81.40	5
7	72.00	3
8	53.00	4
9	92.00	1
10	77.25	4
12	88.00	1

Table 4.2: Relation Between Number of Previously Taken Online Courses and Traditional Student Performance

Regression Statistics					
Multiple R	0.196627141				
R Square	0.038662232				
Adjusted R Square	-0.442006651				
Standard Error	11.45798166				
Observations	4				
ANOVA					
	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	10.55983578	10.55984	0.080434	0.803372859
Residual	2	262.5706876	131.2853		
Total	3	273.1305234			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	
Intercept	69.8173913	9.586435243	7.282936	0.018336	
No of Courses	1.45326087	5.124165177	0.283609	0.803373	

A more careful investigation of the sample size shows that a small number of students have taken more than 4 online classes (i.e. the sample is disoriented). Therefore, the data was aggregated and limited to 4 online courses. For adult (CAPA) students (Table 4.3), a strong linear relation

was found, with an average increase of 3.65 points per online course. For adult (RCA) students (Table 4.4), there was no linear relation between the number of online courses and the grade.

Table 4.3 Relation between Number of Previously Taken Online Courses (limited to four) and Adults (CAPA) Student Performance
SUMMARY OUTPUT (for a subset of CAPA – up to four online classes)

Regression Statistics	
Multiple R	0.989723
R Square	0.979552
Adjusted R Square	0.972736
Standard Error	0.961616
Observations	5

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	132.8934	132.8934	143.7143	0.001249
Residual	3	2.774116	0.924705		
Total	4	135.6675			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	73.18364	0.744865	98.25094	2.32E-06
No of Courses	3.645455	0.30409	11.98809	0.001249

Table 4.4 Relation between Number of Previously Taken Online Courses (limited to four) and Adults (RCA) Student Performance
Summary Output (Up to 4 classes)

Regression Statistics	
Multiple R	0.160332963
R Square	0.025706659
Adjusted R Square	-0.299057788
Standard Error	7.707026965
Observations	5

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4.701656671	4.701656671	0.079155	0.796735772
Residual	3	178.1947939	59.39826464		
Total	4	182.8964506			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	78.95039216	5.969837417	13.22488146	0.000934
No of Courses	-0.685686275	2.43717592	-0.281344596	0.796736

Analysis of Findings

The study found that learning was attained and that there is no difference in learning irrespective of delivery modality or student type. There was a statistically significant difference between the pre-test and the post-test for all students and all class types and there were no significant differences between post-test grades for F2F and online students. This is also true for the student type of Traditional, and non-traditional (CAPA, and RCA).

The investigation indicates that adult students start the class with a better understanding of how information systems are used in organizations. This is reflected in the significant difference in the grade scored in the pretest between adults and traditional students. This finding is reasonable since adult students work full time and are exposed to IT in organizations, while most traditional students utilize computers for academic or personal activities.

Another interesting finding is that in online classes, both traditional and adult students reach the same level of learning as indicated by the lack of statistically significant difference between traditional and adult students final examination grade, which in turn suggests that traditional students acquire more new information to reach the same level of adult students. However, in F2F classes adult students maintain a slight advantage over traditional students. This finding suggests that there are other aspects that may influence learning such as maturity, cognitive styles or other personality types.

Furthermore, a closer look at the differences in grades between the pre-test and the final examination scores (post-test) suggests that online traditional students improve their grade more than F2F traditional students. When this is combined with the observation that the letter grade distribution of online traditional students is skewed towards 'A', one may conclude that currently "better" traditional students enroll in online classes. This observation is not true in the case of CAPA students, (i.e., a wide spectrum of students enroll equally in both online and F2F classes).

Two additional findings are as follows: First, performance of adult students taking online courses improved over time (approx. 1 point per term), no such improvements were found for traditional age students. Second, no linear relation was found between the number of previously taken online courses and the performance in online classes for traditional students. However, a strong relation was found for CAPA students with a slope of 3.6 points improvements with each class. RCA students show some relation between the two variables, however, the improvement is less than one point. This suggests that familiarity with technology competence maybe more important than the number of online classes. This conclusion is based on the difference between the CAPA and RCA population, and on the fact that there was improvement overtime in online course grade. Considering that most CAPA students, who graduated from High schools when computers were not common, may have been apprehensive of computers, while traditional (younger) students, who used computers in school, apprehension (or lack of familiarity) may be a factor.

Conclusions and Future Research

In conclusion, it seems online education is more effective for adult students compared to traditional age students. This statement is based on the fact that adult students in online classes scored more than adult students in F2F classes. The same conclusion can't be made for traditional students since only select ones registered for online classes, while adult students covered a greater spectrum. Online education allows adult students the flexibility to accomplish their education and accommodate other life responsibilities. Such motivation might not exist for traditional aged students. Therefore, adult students benefit more from online education compared to traditional age students.

Familiarity with technology is an important factor in performance in online classes. Performance of adult students improves over time and based on number of previously taken online classes, while the same is not true for traditional students. One possible explanation is that in earlier years adult students were not familiar with technology especially those schools did not stress use of technology in the classroom. However, later years, schools have changed policy and commonality of computers have reduced the apprehensions that adults have towards the use of technology.

Since the both traditional and adult students reached the same level of knowledge at the end of the courses regardless of the method of delivery, one may conclude that online education is as effective as face-to-face. Online delivery is a new teaching environment that benefit students, which is supported by research that suggest that not all students learn in the same environment, nor can one student learn in all environments (Joyce, 2004). It seems that more motivated traditional students enroll in them, which is clear from the letter grade distribution. On the other hand, a wider spectrum of adult students enrolls in online classes. This benefit requires familiarity with computers and some experience with online classes, which is the learning curve. This learning curve may be facilitated by training for some students.

Future Research

Additional analysis is needed to determine if there is a difference between the personality of students and their performance in online and F2F classes. Especially that as more and more traditional students join online classes, less learning may take place. Future research will include student profile, student satisfaction with the classroom, student satisfaction with the instruction, student's satisfaction with the features in Blackboard, student satisfaction with the Human Computer Interface, student personality, and student learning style.

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