Student Access to Online Interaction Technologies: The Impact on Grade Delta Variance and Student Satisfaction

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Abstract

Online learning has significantly changed the educational landscape in recent years, offering advantages to both schools as well as students. Despite the fact that some faculty members are not supportive of online learning, researchers have demonstrated that the quality of online learning to be as effective as classroom learning. It has been stated by researchers that there is a need to use metrics to assess the value achieved through the use of online learning. This study measured the impact that student access to interactive technologies (discussion boards, e-mail, chats, videoconferencing, etc.) played in an online course. By restricting these technologies would they have an impact on grade delta variance and the student's perceived satisfaction? The results of this study seem to indicate that in an online course student access to a variety of student-to-student collaborative technologies had no impact on five of the seven given student survey questions or on grade delta variance. In fact, lack of access to the interactive technologies only had an impact on two survey questions, namely "I have learned a lot in this course" and "My instructor treats me fairly." Students in the restricted class responded more positively on these two questions.

Literature Review

Definition Of Online Learning

Advances in technology and the Internet have changed the way in which individuals access and use information. This advanced technology can enhance education delivery and knowledge acquisition in the form of online learning where learners and faculty members are at a distance from one another but are connected through the Internet by a learning management system (LMS) like Blackboard or WebCT (Sava, 2005). Educational institutions across the world now offer classroom instruction through LMS (Dorado, Hernandez, Sani, Griffin, & Barnette, 2009). And this online learning is increasing at a rapid pace: a 2010 higher education study revealed that over 4.6 million students were taking at least one online course during the 2008-2009 Fall semesters, which reflected a 17 percent increase from the previous year. This growth far exceeded the 1.2 percent increase of the overall higher education student population (Allen & Seaman, 2010). Chawdhry, Paullet and Benjamin state that an increasing number of students are enrolling in online learning to complete their degrees, compete in today's job market, and advance in their careers (2011).

Advantages Of Online Learning

Online learning offers advantages to both schools as well as students. For schools online courses offer higher education institutions innovative ways to target adult learners wanting to continue their education but are constrained (Coppola, Hiltz, & Roxanne, 2002). Lessen and Sorensen identify these constraints as work schedule, family and time (2006). Additional constraints such as distance, cost, time, job requirements, and family demands, can preclude students from attending traditional classes. Online courses enable students to balance the demands of their daily lives by setting their own schedule for learning (Chawdhry, Paullet, & Benjamin, 2011). Due to the flexibility in online learning most schools are able to reach a larger student population, thus increasing their enrollments in times of decreasing financial support from external entities. One population segment that benefits from online learning is the adult learners who can engage in just-in-time skill acquisition without time and location constraints (Zhang, 2004).

Online learning also offers significant advantages to students. First, as previously noted, online courses provide opportunities for individuals who would otherwise not have opportunities for learning (Deal, 2002). One study indicated that students prefer online learning because this delivery mechanism allows them to balance their life demands while at the same time going to school. Almost 88 percent of students chose online learning because they had other commitments that prevented them from attending courses on campus in classrooms (Hannay & Newvine, 2006).

Second, students perceive online learning and its associated technology as a strategic advantage to them. Several researchers have reviewed an entire body of literature that reflects the importance students place on the Internet to their academic careers (Budden, Anthony, Budden, & Jones, 2007). Almost 72 percent of students reported a preference for interacting online instead of face-to-face (F2F) with admission counselors (Hayes, Ruschman, & Walker, 2009). The importance of technology, particularly social networking, is especially important to graduate students, who recognize the benefits to their career development (Benson, Filipaios, & Morgan, 2010).

Third, students view online courses as convenient and beneficial. An exploratory study of factors that influence a student's decision to take online courses was conducted in 2009 by examining four key elements: convenience, level of difficulty, effectiveness, and social

interaction. Convenience and effectiveness were both perceived by students as a positive influence in their decision to take online courses. Level of difficulty and social interaction were perceived by students as negative influences in their decision to take online courses. The study revealed that convenience was the major factor that influenced a student to take online courses (Dorado et al., 2009). Another study indicated that 59 percent of students surveyed reported that their grades were higher in online courses than in traditional courses, and overall 70 percent of students indicated that they preferred online courses. One interesting finding of this study was that 90 percent of students said that they read the textbooks associated with their online courses while only 60 percent of students in traditional classes read the textbooks (Hannay & Newvine, 2006).

Fourth, online courses are seen as enhancements to communications and interactions. A 2008 study of student perceptions of various components of the Blackboard LMS found an increased level of communications and interactions in online classrooms. Over 63 percent of students indicated increased learner-to-instructor interactions, almost 62 percent agreed that there was a significant increase in the overall volume of communications in the online classroom, and 52 percent said that the LMS fostered a sense of community in the course. The respondents also found online learning to be effective and accessible: 68 percent stated that the online discussions helped them to understand and assimilate the course content and while almost 80 percent preferred submitting assignments online. Students also liked the functionality of the online learning: almost 81 percent agreed that the LMS makes the classroom handouts readily available and accessible (Buzzetto-More, 2008).

Is Online Learning Viable?

Although many faculty members are supportive of online learning, some faculty members believe technology cannot improve teaching and learning (Cheng & Miller, 2009). In addition, they believe that online courses are inferior to classroom courses in terms of quality and learning outcomes (Anstine & Skidmore, 2005). Some faculty members note that the benefits of online learning may be outweighed by the disadvantages, such as the lack of peer interaction and less dynamic modes of instruction (Welsch, Wanberg, Brown, & Simmering, 2006).

Yet researchers demonstrate that the quality of online learning is as effective as F2F learning (Neuhauser, 2002). An analysis by the Department of Defense's Advanced Distributed Learning Initiative and the University of Tulsa found learning effectiveness of online courses comparable to that of classroom instruction (Sitzmann, Kraiger, Stewart, & Wisher, 2006).

There may be several reasons why some faculty members are resistant to online learning. The implementation of online courses should be done only through careful analysis of online learning environments and an analysis of the online student's characteristics (Singleton, Hill, & Koh, 2004). Without this analysis online courses can change the traditional student-teacher relationship from personalized attention to "just another number", with the result being that the efficiency of online instruction is less effective than the traditional classroom (Bressler, Bressler, & Bressler, 2011). Online instructors should understand that adults prefer to be actively engaged and involved in the learning process and come ready to learn what they need to know in order to cope effectively with their real-life situations (Knowles, 1980)

Constructivism And Collaborative Learning

One approach to online learning that is currently being promoted is called "constructivism". Carlson sates that constructivism has gained a foothold in education, including traditional higher education (2001). Constructivism says that for learning to occur it is necessary for learners to construct their own understandings of the world in which they live (Brooks & Brooks, 1993). Individuals "construct" new learning based on their past experiences, motives, and intentions. In short, learning is inherently personal, built sequentially upon a scaffold of experiences, and deepening in complexity as learners develop and gain new information and understandings. Education becomes a conceptual change, not just the acquisition of information (Biggs, 1999). Constructivism encourages faculty members to cultivate a learning environment by infusing students with a desire to engage in learning experiences that are self-directed, self-reflective, interactive, and collaborative. This self-paced and autonomous learning, which are key principles of constructivism, are enhanced in an online learning environment where students can engage in learning anytime, anywhere, and at their own pace (Bellefeuille, 2006). Faculty members can incorporate technology to elevate a student's cognitive level with modeling, support, and fading. Modeling provides students with adequate learning structures, leading students to the desired learning behavior. Supporting provides students with feedback so that students can independently perform tasks or assignments. Fading reduces the amount of support over time so that students can become confident and self-reliant (Bellefeuille, 2006). Using constructivism in online learning, the faculty members then reposition themselves as facilitators whose collaborative presence invites peer interaction and participation among learners in a virtual learning environment (Conrad, 2002). In addition, online faculty members foster a supportive collegial, collaborative, and interactive learning environment to enhance the sense of community by providing students with material and technology resources (De Simone, 2006).

Another approach to online learning is collaborative learning, which is a relationship among learners that requires response interdependence (a sense of sink or swim together), individual accountability (everyone has to contribute and learn), interpersonal skills (communication, trust, leadership, decision making, and conflict resolution), face-to-face promotive interaction, and processing (reflecting on how well the team is functioning and how to function even better) (Srinivas, 2010). Collaborative learning is different than cooperative learning, which states that people who help each other and who join forces to achieve a common goal will generally grow to feel more positively about each other and will be willing and able to interact constructively when performing a collective task? (Sharan, 1985). Collaborative learning develops higher level thinking skills, promotes learners-leader interaction and familiarity, builds self-esteem in learners, and promotes a positive attitude toward the subject matter (Srinivas, 2010). Collaborative learning helps to maximize student achievement through personalized learning and assessment while adhering to compliance and government regulations (Ogunlade, 2011).

Metrics To Assess Online Learning

Koch notes that it is important to use metrics such as student learning, reduced cost, user satisfaction, and other similar measurements to assess the value achieved through the use of online learning (2006). There is extensive research that attempts to understand and measure what

influences student satisfaction, attention and retention in an academic environment (Li, Finley, Pitts, & Guo, 2011). Studies have indicated that student engagement in college activities outside the classroom and interactions with other students and faculty tends to have a substantial impact in terms of student retention, academic performance, and overall satisfaction (Astin, 1999). Kuh found that participation in college activities, living on campus, and conversing frequently with other students and faculty positively influenced students' learning and personal development (1995).

The most common forms of communication used by faculty to facilitate interaction with students include the use of asynchronous (e.g., email and online discussion boards) and synchronous communication (e.g., chat or instant messaging) (Li et al., 2011). The majority of research related to the use of asynchronous communication in higher education has focused on online learning that use Web-based communication technologies to deliver course content virtually and involves extensive student-instructor communications (Dezhi, Bieber, & Hilz, 2009).

Study

Following Koch's statement regarding the need to use metrics to assess the value achieved through the use of online learning, this study measures the impact that student access to interactive technologies plays in an online course. Specifically the study looks at two metrics: grade delta variance and the student's perceived satisfaction of the course and instructor. In many online courses students use a variety of online interactive technologies to collaborate with other students. By restricting these technologies would they have an impact on grade delta variance and the student's perceived satisfaction?

The primary research hypothesis is as follows:

H0 – No significant difference exists between grade delta variance and satisfaction regarding the use of online interaction technologies.

H1 – Students who use interaction technologies demonstrate a higher grade delta variance and satisfaction.

Student participants in the study were undergraduate students at a mid-South public university enrolled in two separate online courses, "Database Systems II" and "Telecommunications II", over two consecutive semesters. Thus the study looked at students enrolled in a total of four classes. In the first semester students enrolled in these two courses had full access to a variety of student-to-student collaborative technologies through which they could interact with all other students on both a scheduled as well as ad-hoc basis. For example, multiple discussion boards were available for students to post personal information about them as well as ask questions and receive answers from other students. In addition, students had full access to e-mail, chat, and videoconferencing tools. These were called the "Open" sections. In the second semester students who enrolled in these two courses had no access to student-to-student collaborative technologies. All other activities were the same. These were called the "Closed" sections.

In each of the four courses students took a pre-assessment test at the beginning of the course and a final exam at the end of the course. These were used to measure grade delta variance. In addition, students completed a seven-question satisfaction survey of the course and instructor at the end of the course. Using a 5-point Lickert scale the survey examined student perceptions regarding the following seven statements:

1. My instructor displays a clear understanding of course topics
2. My instructor is well prepared for class
3. Performance measures (exams, assignments, etc.) are well constructed
4. My instructor provides helpful feedback
5. Overall, my instructor is effective
6. I have learned a lot in this course
7. My instructor treats me fairly

The purpose of this study was to measure the grade delta variance for final grades and student satisfaction responses comparing "Open" (full access to student-to-student collaborative technologies) and "Closed" (no access) courses.

Results

Initially, a series of descriptive statistics were conducted on these data. The same variables included in the independent-samples *t*-tests were included in these initial analyses, and consisted of delta grade (change in grade from the preassessment test to the final grade, using the final grade range), and survey questions 1 through 7. The Table 1 presents the results of these initial descriptive statistics, which consist of the valid and missing sample sizes for each measure, as well as the mean, median, standard deviation, and minimum and maximum scores.

Next, a series of tests were conducted in order to determine the extent of normality associated with these measures. While larger sample sizes do not require a perfectly normal distribution with regard to the *t*-test, and in fact, markedly non-normal data can be used without producing invalid results, it is ideal to initially determine the extent of the normality of any measures analyzed. The following table presents the results of a series of one-sample Kolmogorov-Smirnov tests of normality conducted on these data. This test of normality, when statistically significant, indicates significant non-normality, while a non-significant result indicates a normal distribution. As indicated in Table 2, change in grade was not found to achieve statistical significance, indicating normality. However, the remaining measures (i.e., all seven survey questions) were found to be significantly non-normal on the basis of this analysis.

Additionally, Table 3 presents the results of measures of skewness and kurtosis calculated in order to further explore the normality of these measures. Measures of skewness or kurtosis divided by their respective standard errors which are above the absolute value of 3 is generally accepted as indicating substantial skewness or kurtosis. As indicated in the following table, these measures are found to have substantial negative skewness as well as substantial positive kurtosis.

Furthermore, a series of histograms were also constructed in order to visually illustrate the distribution of these measures. These histograms are included in the appendix. Table 4 presents a series of descriptive statistics associated with the independent-samples *t*-tests conducted. As presented in the table, the sample size, mean, standard deviation, and standard error of the mean are reported for each of these measures separately on the basis of class. Change in grade was found to be lower with regard to the closed class, while scores on the seven survey questions were found to be higher in all cases with regard to the closed class as compared with the open class.

Finally, Table 5 presents the results of the independent-samples *t*-tests conducted. The results presented in this table consist of the results of Levene's test for the equality of variance, the independent-samples *t*-test, the mean difference and standard error of the difference between groups, as well as the 95% lower and upper confidence levels. Levene's test, if found to be statistically significant, would indicate that the results of the *t*-test in which equal variances was not assumed should be utilized, as this indicates that the assumption of the equality of variance has been violated. With regard to these analyses, significant differences between classes were found to be significant at the .10 alpha level with regard to survey questions 6 and 7. In both of these cases, the closed class had a significantly higher score on these measures as compared with the open class. None of the remaining independent-samples *t*-tests were found to achieve statistical significance.

In conclusion, the results of these analyses indicated that the closed class had a significantly higher score on survey questions 6 and 7 as compared with the open class. However, no other significant results were found. This indicates that with regard to the majority of the survey questions, as well as with regard to the change in grade from pretest and posttest scores, no significant differences were indicated between open and closed classes. Levene's test was found to be significant in many cases, indicating significant differences between classes with regard to the variation in scores on a number of the survey questions.

Conclusion And Future Study

The results from this study indicate that in an online course student access to a variety of student-to-student collaborative technologies—such as multiple discussion boards for students to post personal information about themselves as well as ask questions and receive answers from other students, e-mail, chat, and videoconferencing tools—had no impact on five of the seven survey questions or on grade delta variance. In fact, lack of access to the interactive technologies only had an impact on two survey questions, namely "I have learned a lot in this course" and "My instructor treats me fairly." Students in the closed class had a significantly higher score on these two questions. It is difficult to surmise precisely why students in the closed section had a higher score on these questions than students in the open section. To the casual observer it may be supposed that students in the open class, who had access to other students, would have indicated a higher score on learning since they had access to interaction with other students; however, that was not the case.

Further study in this area needed to examine why students in a closed section scored higher on the two survey questions than in the open section.

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Computer Information Systems, 44(3), 35-43

Table 1: Descriptive Statistics

Measure		*Delta Grade*	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*
N	Valid	59	46	46	46	46	46	46	46
	Missing	0	13	13	13	13	13	13	13
Mean		.310	4.70	4.70	4.26	4.52	4.50	4.30	4.72
Median		.335	5.00	5.00	4.00	5.00	5.00	5.00	5.00
Std. Deviation		.192	.591	.662	.929	.752	.782	.940	.584
Minimum		-.48	3	2	1	2	1	1	3
Maximum		.69	5	5	5	5	5	5	5

Table 2: Tests of Normality: One-Sample Kolmogorov-Smirnov Tests

Measure	*Test Statistic*	*p*
Delta Grade	.972	.301
Survey: Q1	3.103	<.001
Survey: Q2	3.118	<.001
Survey: Q3	1.798	.003
Survey: Q4	2.495	<.001
Survey: Q5	2.357	<.001
Survey: Q6	2.129	<.001
Survey: Q7	3.178	<.001

Table 3: Tests of Normality: Skewness and Kurtosis

Measure	*Delta Grade*	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*
N (Valid)	59	46	46	46	46	46	46	46
N (Missing)	0	13	13	13	13	13	13	13
Skewness	-1.939	-1.834	-2.453	-1.599	-1.877	-2.334	-1.500	-1.983
Std. Error of Skewness	.311	.350	.350	.350	.350	.350	.350	.350
Skewness/SE	-6.235	-5.240	-7.009	-4.569	-5.363	-6.669	-4.286	-5.666
Kurtosis	6.501	2.389	6.197	2.900	3.823	7.864	2.349	2.959
Std. Error of Kurtosis .688	.613	.688	.688	.688	.688	.688	.688	
Kurtosis/SE	10.605	3.472	9.007	4.215	5.557	11.430	3.414	4.301

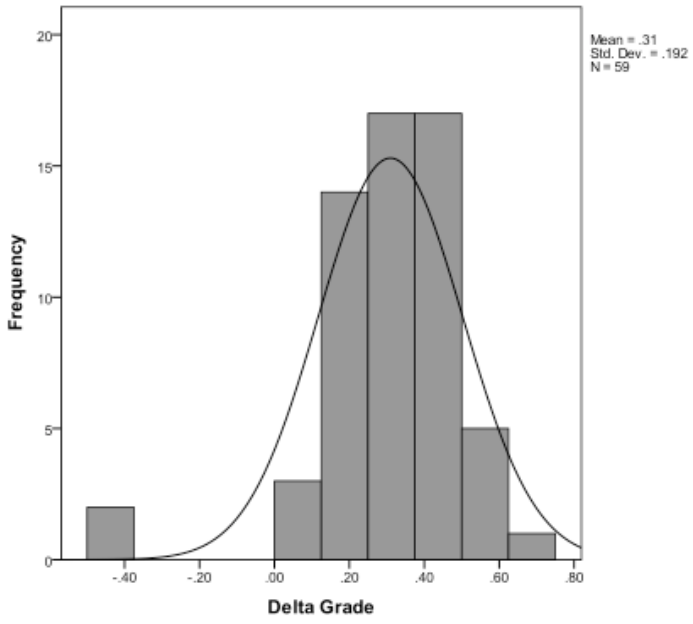
Table 4: Independent-Samples *t*-Tests: Descriptive Statistics

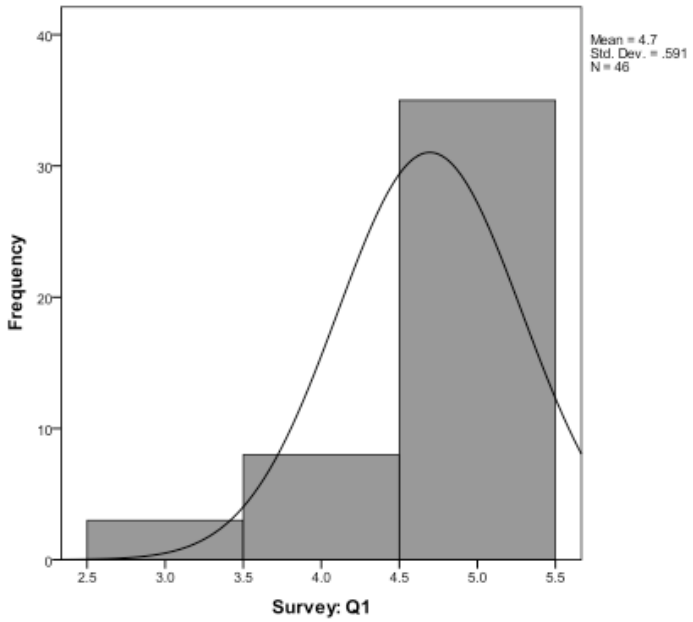
Measure	*Class*	*N*	*Mean*	*Std. Dev.*	*S.E. Mean*
Delta Grade	Open	28	.34	.244	.046
	Closed	31	.29	.130	.023
Survey: Q1	Open	18	4.56	.705	.166
	Closed	28	4.79	.499	.094
Survey: Q2	Open	18	4.50	.924	.218
	Closed	28	4.82	.390	.074
Survey: Q3	Open	18	4.17	1.150	.271
	Closed	28	4.32	.772	.146
Survey: Q4	Open	18	4.39	1.037	.244
	Closed	28	4.61	.497	.094
Survey: Q5	Open	18	4.39	1.037	.244
	Closed	28	4.57	.573	.108
Survey: Q6	Open	18	3.94	1.211	.286
	Closed	28	4.54	.637	.120
Survey: Q7	Open	18	4.50	.786	.185
	Closed	28	4.86	.356	.067

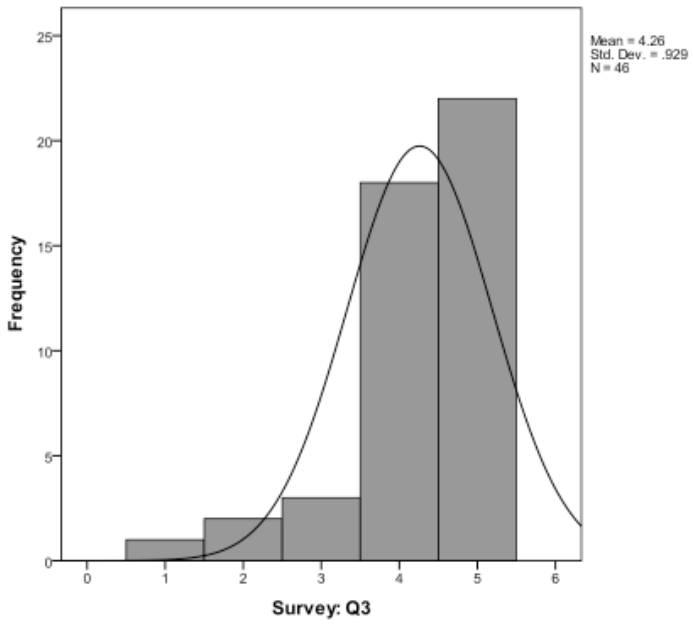
Table 5: Independent-Samples *t*-Tests

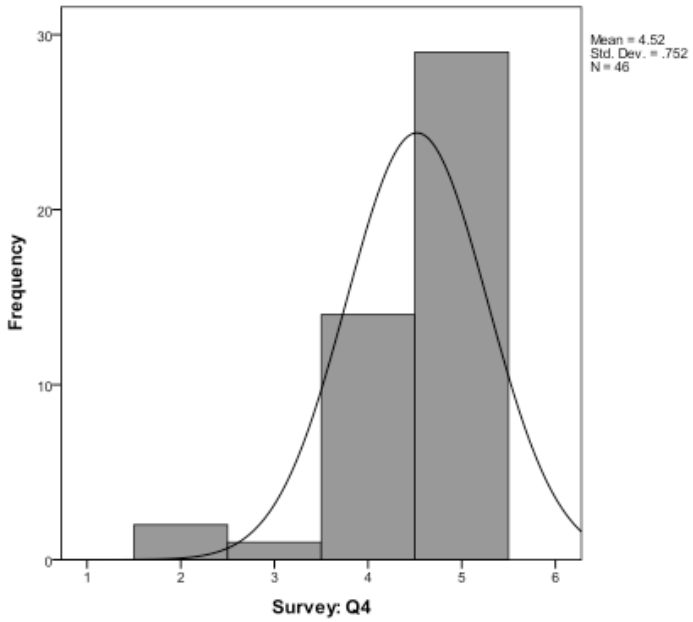
		Levene's Test		t-Test						
Measure	*Equal Variances*	*F*	*p*	*t*	*df*	*p*	*Mean Diff.*	*Std. E. Diff.*	*LCL*	*UCL*
Delta Grade	EV assumed	1.094	.300	.976	57	.333	.049	.050	-.051	.149
	EV not assumed			.948	40.199	.349	.049	.052	-.055	.153
Survey: Q1	EV assumed	5.197	.028	-1.298	44	.201	-.230	.177	-.588	.127
	EV not assumed			-1.205	27.885	.238	-.230	.191	-.621	.161
Survey: Q2	EV assumed	13.023	.001	-1.636	44	.109	-.321	.196	-.717	.075
	EV not assumed			-1.399	20.948	.177	-.321	.230	-.799	.157
Survey: Q3	EV assumed	1.328	.255	-.547	44	.587	-.155	.283	-.725	.416
	EV not assumed			-.503	26.859	.619	-.155	.308	-.787	.477
Survey: Q4	EV assumed	8.291	.006	-.959	44	.343	-.218	.228	-.677	.240
	EV not assumed			-.834	22.096	.413	-.218	.262	-.761	.325
Survey: Q5	EV assumed	2.601	.114	-.769	44	.446	-.183	.237	-.661	.296
	EV not assumed			-.683	23.748	.501	-.183	.267	-.735	.369
Survey: Q6	EV assumed	7.445	.009	-2.166	44	.036	-.591	.273	-1.141	-.041
	EV not assumed			-1.908	23.126	.069	-.591	.310	-1.232	.050
Survey: Q7	EV assumed	20.182	.000	-2.101	44	.041	-.357	.170	-.700	-.015
	EV not assumed			-1.812	21.554	.084	-.357	.197	-.766	.052

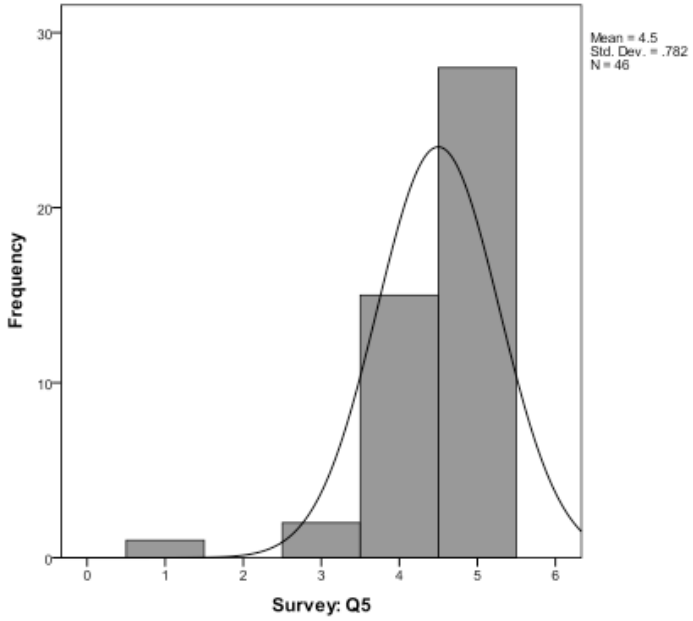
Appendix
Histograms

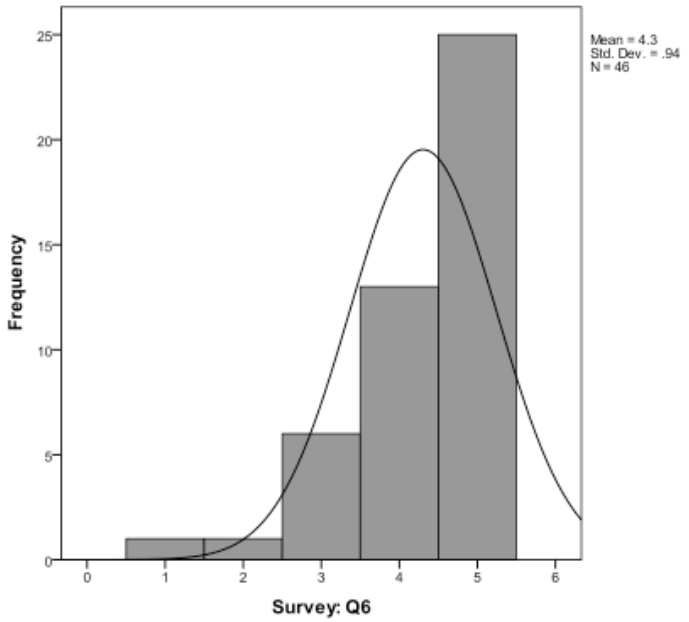


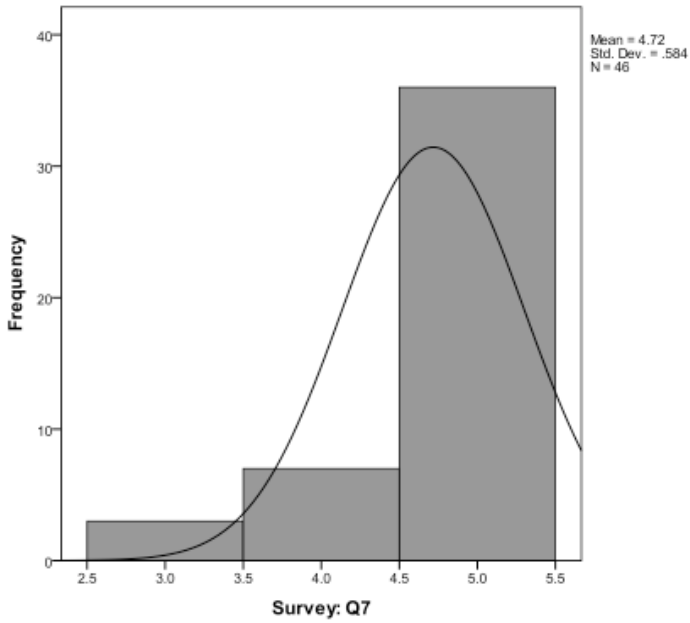

Mean = 4.7
Std. Dev. = .591
N = 46
Frequency
40
30
20
10
0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
Survey: Q1


Mean = 4.26
Std. Dev. = .929
N = 46
Frequency
25
20
15
10
5
0
0
1
2
3
4
5
6
Survey: Q3


Mean = 4.52
Std. Dev. = .752
N = 46
Frequency
Survey: Q4


Mean = 4.5
Std. Dev. = .782
N = 46
Frequency
Survey: Q5





Online Journal of Distance Learning Administration, Volume XV, Number V, Winter 2012
University of West Georgia, Distance Education Center
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