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Comparing of Distance Education and Traditional Education

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Comparing of Distance Education and Traditional Education

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Abstract

With the development of computer and internet technology, online education has gained its popularity in recent decades. In this research paper, the researcher will introduce the history, current situation and development trend of distance education. The advantage and disadvantage of online education will be discussed as well. In addition, the researcher will evaluate the effectiveness of E-learning compared to the traditional education by collecting, analyzing and summarizing the data of the student performance of the same class on Statistics Quality Control in both classroom and online lecture.

Keywords: distance education, traditional education, effectiveness

Introduction

Distance education is education allowing students study not in a classroom (Andreas & Michael, 2016). Most of time, communications media, such as television or internet, is used as educational technology. It makes important challenges to traditional face-to-face education. Distance education ensures the student taking class anywhere at any time. One of the most important forms of distance education is online education. It refers in particular to educational instruction which is delivered via the internet to students (Monroe, 2015). Online education has attracted more and more students, especially who have family responsibilities or inflexible work schedule. In addition, distance education is relatively "covenant lite", and it requires much less cost than traditional education does (Nguyen, 2015).

There is a tendency for online education to substitute traditional education in some occasions because of its convenience. However, many problems could arise while students were enjoying the flexibility and convenience of distance education. It requires students who should have strong self-motivation and self-disciplined (Tomer, 2016). In addition, it is difficult to communicate with the professors face to face because of a fixed "office hour" so that the distance education student might not be able to get a prompt and proper answer when students ask question at the first time. Moreover, some researchers even question the equivalency of online class with respect to the traditional class. For example, a student gets a good grade (A or B) in an online class, he or she

may not learn as much knowledge as the student who takes a traditional class with the same grade. There are many evaluation approaches that could be implemented for online class, such as homework, quiz, exam, or research paper, however, it is still lack of restrictions to totally stop cheating behaviors, for examples, scanning textbook during the test, Googling the answer, discussing with the other student during the exam, or even worse, asking other people to take the online class for credit. The violation of academic ethics would hurt the rigor of the evaluation. As a result, the effectiveness of distance education might not be compatible to the effectiveness of traditional education, which means the student learning outcomes in online education could be less than the outcomes in traditional education (Xu & Jaggars, 2013).

This research paper will compare the teaching effectiveness between distance education and traditional education. Along with the literature review, several research questions are to be answered:

Research question 1: what is the history of distance education? What drives the changes in the mode of distance education?

Research question 2: In contrast with traditional education, what is the advantage and disadvantage/limitation of distance education, especially online education?

Research question 3: what is the challenges of online education for engineering or technology related courses?

Research question 4: How is the student performance under tradition

lecture environment comparing to the one under online lecture environment?

Literature Review

History of Distance Education

The history of distance education can be tracked to the eighteenth century. In 1728, there was an advertisement in The Boston Gazette to recruit students for cultivating the skill (Holmberg, 2005). A short-hand teacher called Caleb Phillips offered a weekly course by mailing in Boston (Bowers et al., 2013). At that time, mailing, as the only way to communicate over vast distances, was the carrier of distance education or so-called correspondence education. Another correspondence education pioneer is Sir Isaac Pitman in England in the 1840s. He was an English educator teaching shorthand via the new post system (Nasseh, 1997). In 1874, Illinois Wesleyan University made the first attempt to offer bachelor and graduate degrees with correspondence learning courses. Correspondence education, as the first generation of distance education, occurred from the mid-nineteenth century to the mid-twentieth century. Correspondence education provided an opportunity to people who cannot present in the school but willing to study, and it gains popularity, acceptance, and effectiveness (Nasseh, 1977).

The second generation of distance education is the distance learning based on multimedia instruction. As radio was invented in the 1920s, and television was invented in the 1940s, educators found new information delivery methods.

Until 1925, about one hundred student took broadcast course in the University of Iowa (Power & Gould, 2011). As Gunawardena and McIsaac (2003) stated, the teaching contents were spreading through long-distance voice and image technology.

In 1969, Open University was established in United Kingdom. It is a milestone in the history of distance education. It was the first attempt for educators to combine technology to traditional education (Gunawardena & McIsaac, 2003). There was no admission requirement to enroll in Open University. All the material was mailed to the students, and the lecture could be watched through radio or television. Nowadays, about ten percent of the students in the United Kingdom graduated from Open University. The Open University is not only open for Britain students, but open to the whole world. The model of Open University is used as reference in many other countries.

The common ground for the first and second generation of distance education was that the teaching was in the form of one-way communication. The students can only acquire knowledge passively. With the development of computer and internet, the third generation of distance education makes timely communication and feedback possible. Since the early 2000s, computer and internet has been in widespread use. The explosion of web-based distance education has a big impact on traditional education. In 2014, about 30% students enroll classes without physically presenting in the classroom, and about three million students choose to take all online classes (Allen & Seaman,

2015).

Education is essentially about the diffusion of knowledge, information and communication technology is the carrier of knowledge. The development of information and communication technology accelerates the changes in the mode of distance education from correspondence education, multimedia education to online education. On the contrary, technological innovation does not change traditional education as much as it does to distance education. In the foreseeable future, distance education will become more prevalent and popular. Maybe one day, distance education would replace the leading status of traditional education.

Similarities and Differences between Online and Traditional Education

Since online education is growing rapidly in educational circles, online education might become a substitute or backup of traditional education and other forms of distance education. The difference between online education and traditional education is not as simple as studying in front of a computer at home comparing to physically studying in a classroom. The key differences include learning environment, schedule, interaction, and student performance.

Teaching environment is one of the differences between online education and traditional education. It is suggested that the teaching environment affects the student outcomes (Ramsden & Entwisle, 1981; Ni, 2013). In a physical classroom, Students stay in a stressful environment, and the educator plays a

dominant role. The teacher tends to create a positive study environment and have students to understand the teaching content during the class time. In contrast, the environment of web-based distance education is more comfortable. Online students are free to attend class sessions, and they do not need to worry about concentrating on the teaching context in the physical classroom. For face-to-face education, the instructor and students are more like a community environment, and more chance of hierarchies may occur because of background and different levels about the knowledge. Traditional interaction makes more pressure and compelling than online interaction does (Warschauer, 1997; Ni, 2013).

Another difference between online education and traditional education is schedule of class. Even campus-based courses will be offered in different sections in some big university, attending class in a certain number of times every week will still force students, especially part-time students, to change work or daily-life schedule. On the other hand, online education offers flexibility to students. Online students are free to choose their convenience time to watch a lecture, finish homework or even take exams. It gives the students who have full-time work or time commitment with the families a chance to obtain education. Even for the traditional students, the flexibility of online course provides the possibility to take more course per semester without concerning of schedule conflicts.

Interaction between educator and other students is quite important for both

online and offline student. In a traditional class, the interaction tends to be synchronous. It is easier to get the teacher's timely responses. In contrast, online education could show both synchronous and asynchronous, with an emphasis on asynchronous. Even if real-time communication, such as video chat, is widely used all over the world, the major communication still relies on email and discussion board. The influence of online educator is weaker than the influence of traditional educator. It is quite necessary for online instructor to get communication and feedback in order to make sure that the students understand the learning subject clearly because of the lack of instruction control. Under the traditional education environment, students discuss in small groups within a certain time, and it only provides little time to make a communication during the meetings. The verbal discussion will be in a more common mode, but limited details will be discussed because of time constraints. The participation may not be equal for every student, and introverts might avoid leaving feedback (McConnell, 2000; Ni, 2013). On the other hand, a web-based course provides sufficient time to discuss the topic more in detail. Online instructor may require all the students to participate and provide textual feedback. Educators attempt to figure out the relationship between the participation of online discussion and the acquisition of knowledge. Davies and Graff (2005) stated that active discussion had nothing to do with the final grade, but people did not pass the exam tended to avoid taking part in discussion and left few feedback.

Ni (2013) summarized a comprehensive comparison of interaction between two different education formats, and she adapted the significantly distinctions between distance education and face-to-face education in Table 1.

Table 1 Comparison of Interaction between Online and Face-to-Face Settings (Ni, 2013)

	Online	Face-to-Face
Mode	Discussions through text only; Can be structured; Dense; permanent; limited; stark	Verbal discussions: a more common mode, but impermanent
Sense of Instructor Control	Less sense of instructor control; Easier for participants to ignore instructor	More sense of leadership from instructor; Not so easy to ignore instructor
Discussion	Group contact continually maintained; Depth of analysis often increased; Discussion often stops for periods of time, then is picked up and restarted; Level of reflection is high; Able to reshape conversation on basis of ongoing understandings and reflection	Little group contact between meetings; Analysis varies, dependent on time available; Discussions occur within a set of time frame; Often little time for reflection during meetings; Conversations are less likely being shaped during meeting
Group Dynamics	Less sense of anxiety; More equal participation; Less hierarchies; Dynamics are 'hidden' but traceable; No breaks, constantly in the meeting; Can be active listening without participation; Medium (technology) has an impact; Different expectation about participation; Slower, time delays in interactions or discussions	Anxiety at beginning/during meetings; Participation unequal; More chance of hierarchies; Dynamics evident but lost after the event; Breaks between meetings; Listening without participation may be frowned upon; Medium (room) may have less impact; Certain expectations about participation; Quicker, immediacy of interactions or discussions
Rejoining	High psychological/emotional stress of rejoining	Stress of rejoining not so high
Feedback	Feedback on each individual's piece of work very detailed and focused; Whole group can see and read each other's feedback; Textual feedback only; No one can "hide" and not give feedback; Permanent record of feedback obtained by all; Delayed reactions to feedback; Sometimes little discussion after feedback; Group looks at all participants' work at same time	Less likely to cover as much detail, often more general discussion; Group hears feedback; Verbal/visual feedback; Possible to "free-ride" and avoid giving feedback; No permanent record of feedback; Immediate reactions to feedback possible; Usually some discussion after feedback, looking at wider issues; Group looks at one participant's work at a time
Divergence /Choice Level	Loose-bound nature encourages divergent talk and adventitious learning; Medium frees the sender but may restrict the other participants (receivers) by increasing their uncertainty	More tightly bound, requiring adherence to accepted protocols; Uncertainty less likely due to common understandings about how to take part in discussions

Student outcomes are complicated, which includes finishing a class, usually practices/homework results, final grade, and building skills (Ni, 2013). Many educators attempt to find out if the student performance has significantly

difference among students under traditional environment and ones who take the same course with the same teaching contents in online form. Bowers et al. (2013) used a randomized controlled experiment to analyze if the student performance is different among different studying situations, studying in a face-to-face environment, watching a recording with a student audience, or watching a recording lecture without any audiences (students or instructors). Researchers choose three courses in different academic fields, CHEM135: Chemistry for Engineers, ECON200: Principles of Micro-economics, and CCJS105: Introduction to Criminology in the University of Maryland to make sure the experimental result is universally applicable. There are about a hundred students in each study format in each class to keep the experimental result valid. Using ANOVA analysis the research suggested that there were no significantly differences of student learning outcomes among three different education formats.

Advantage and Limitation of Distance Education.

Online education opens flexible educational opportunities for the students who cannot study because of time, geography, or family responsibility (Bourne, Harris & Mayadas, 2005). There are many academic degrees that are offered through online education. The online students are free to choose when and where to take online class. In addition, the cost of online education provides a big advantage against traditional education. Not mention to the saving rental,

board, transportation or other "amenities" budget, is tuition cost in an online school a small part of that at a traditional school, even some mass open online courses are freely open to the public. Moreover, the application of multimedia, especially internet technology, provides abundant and full-scale resources, and it helps online students acquire knowledge clearly.

However, online learning is not a panacea. There are still many disadvantages and limitations that restrict the development of online education. Students who take an online class must have self-discipline and self-motivation. Online students need to keep as much (even more) motivation as they have in a traditional class because of the lack of instructor's discipline. Another limitation for online education is the high requirement of writing skill. Most of time, there is no "office hour" in an online class. The only way to communicate with the instructor and classmates are email and discussion board. It is important to develop a good writing skill to clearly raise a question through email.

In some countries or societies, the value of an online degree may not be as much as the value of a traditional degree. For example, even if online education is considered as adult and continuing education, the acknowledgement of online education degree is less than the acknowledgement of the other higher education degree in China. For some extreme cases, the entrance examination and graduation test of the online education program is not as strict as a traditional program so that online students did not learn anything but still get a diploma. As a result, some employers refuse to recognize an online education

degree.

Challenges for Online Engineering/Technology Courses

It is easy to find tons of courses in a different field that are offered online, however, it is still a big challenge to offer online courses in some major, for instance, engineering, technology or nursing. These majors require a lot of analytical skills, logical thinking and hand-on practice. The lack of interactions among student peers and instructors has a negative influence on student performance in online courses (Kinney, Liu, & Thornton, 2012). It is hard to teach analytical skills and logical thinking through pure writing method. In addition, if the course requires specific tools or special equipment, online education seems powerless with existing information technologies. This call for a change in the future to get innovated technology to improve online education.

TECH 3142 Statistical Quality Control

The University of Northern Iowa (UNI) is one of the three public universities in the States of Iowa. UNI Continuing and Distance Education is an important part of UNI education methods to provide the students more chances to study by using different information communication technology. In UNI distance programs, most courses deliver knowledge via the internet, video or mixing study method. In 2016, it offers four undergraduate distance degree programs, twenty-four graduate distance degree programs, and twelve endorsements,

certificates, or professional developments. Many of the team are entirely distance program by using the eLearning system.

TECH 3142 Statistical Quality Control is a required technical course for technology-related bachelor program at UNI. It introduces the application of quality concepts to both industry and service environment using statistics, sampling techniques, probability, and control charts. TECH 3142 has more technical contents using math, statistics, and computer software skills. It is offered in traditional and web-based forms every spring and fall semesters. The instructor has many years' teaching experience of teaching. The teaching contents are the same and can be seen in the E-learning system for both traditional and online students who enroll this class. TECH 3142 online course interface at UNI eLearning system is shown as follow in Figure 1.

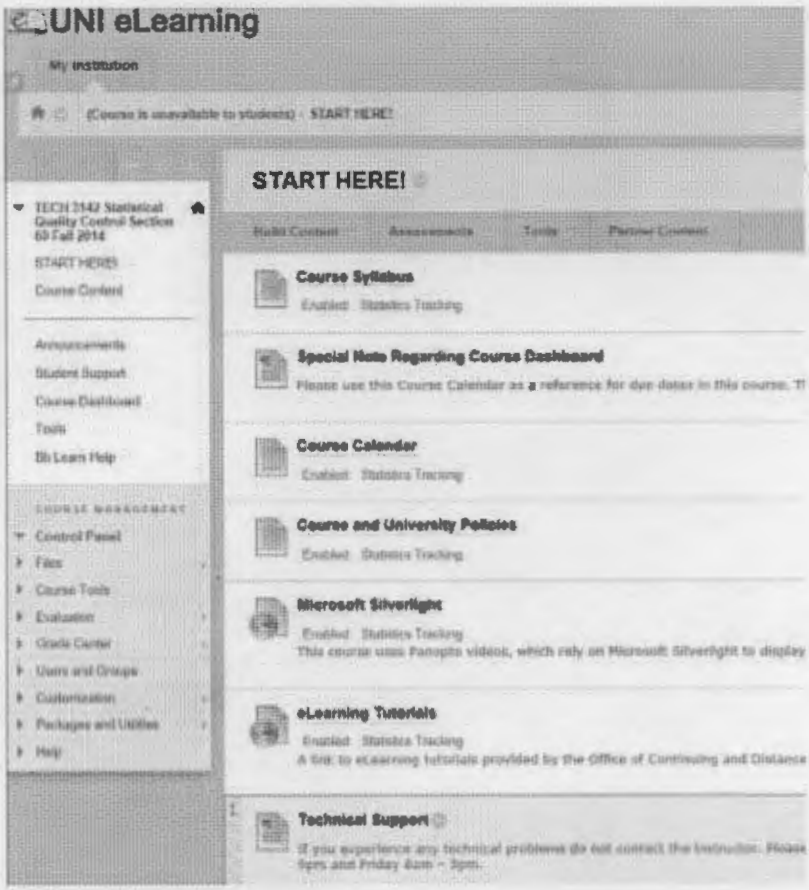


Figure 1 TECH 3142 online course interface

Since the teaching content of TECH 3142 includes a variety of calculation, math and statistics techniques, and computer software skills, the instructor uploaded both lecture video and lecture notes to the eLearning system for students to study and review complex method statistical analysis and data visualization. (Figure2). The assessment of the student's performance includes quiz, in-class practice, homework, and three exams. The weight scale of assignments and tests is as shown in Table 2.

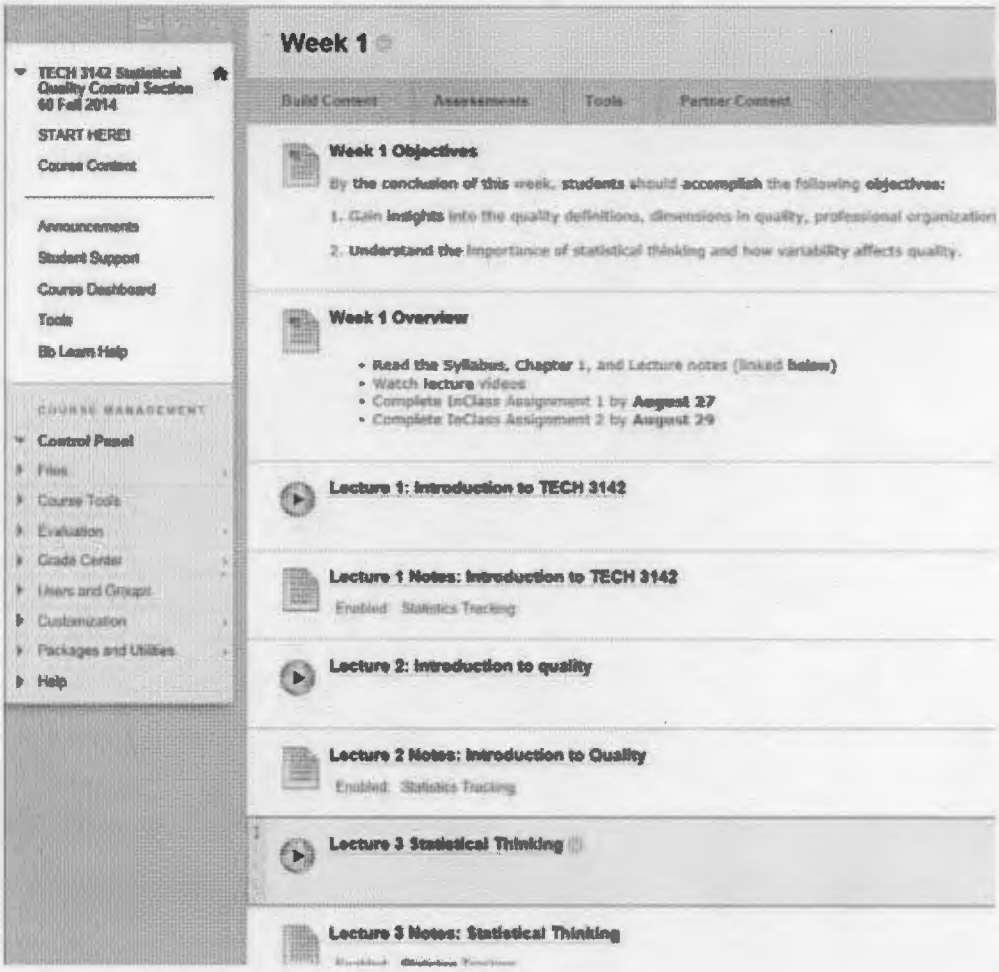


Figure 2 Lecture video and lecture notes

Table 2Weight scale of assignments and tests

Category	Weight
Quiz (3) & In-Class Practice (20)	15%
Homework (10)	20%
Exam 1	20%
Exam 2	20%
Final Exam	25%

Research Method

In order to compare the teaching effectiveness between traditional and online approach in TECH 3142, an experiment was designed to analyze the

student performance between two sampling groups, online students in fall 2014 and traditional students in fall 2015. As the instructor could not enroll students randomly into the two courses, a convenient sample method was used based on the class roster in the semester, 20 and 28 enrollments fall 2014 and fall 2015, respectively. Student background was investigated by using a questionnaire survey at the beginning of each semester. The questions included student academic status, math and statistical course experience, skill of using hand-held calculator et al. The student background information is shown in Table 3. As it can be seen, the percentage of junior and senior are nearly the same in each semester. The number of students who have taken other math courses and a number of student who are comfortable to use hand-held calculator in the face-to-face course in fall 2015 are notable higher than the number of online students in fall 2014.

Table 3 Student background information

	TECH 3142 online course in Fall 2014	**TECH 3142 face-to-face course in Fall 2015**
Enrollment	20	28
# of students completed the course	20	26
Sophomore and others	1	1
Junior	13	17
Senior	6	10
Percentage of junior and senior	95%	96%
# of students having taken Introduction to Statistics	17	16
# of students having taken other math course	3	10
# of students comfortable to use Excel	16	20
# of students comfortable to use hand-held calculator	20	28

For each of the five categories in Table 2, t-test is used to compare the

sample means in two groups. The hypothesis test will be,

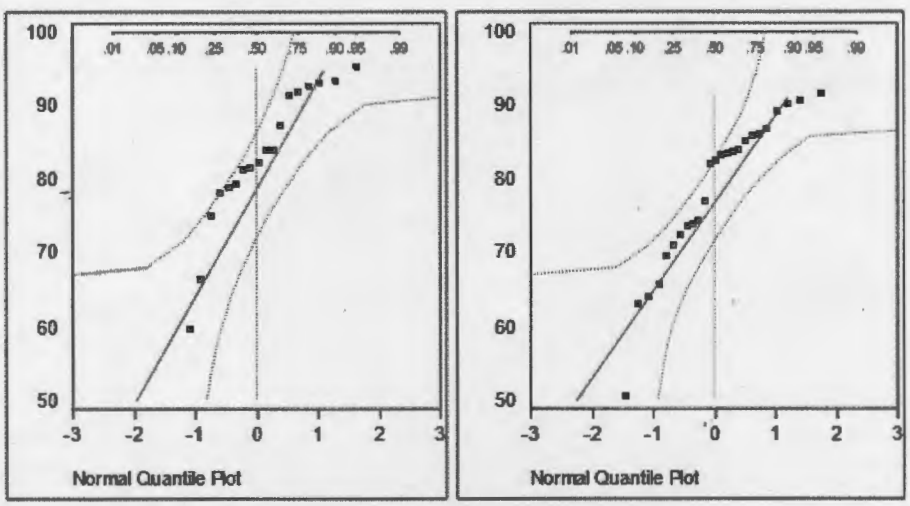
$$H_0: \mu_1 = \mu_2$$
$$H_A: \mu_1 \neq \mu_2$$

It assumes the equal variance for two sample means. The t-test results analysis by Excel is listed in Table 4. We choose α-level equals to 0.05. All the probability values in Table 4 are larger than the significant level 0.05. We are ninety-five percent confident that there are no statistically significant differences between the student outcomes of two groups. Referring to Table 3, it is noticed that variances for the two group sample data are within the range of $\frac{\text{Variance1}}{\text{Variance2}} \leq 2$ for Homework, Exam 1, Exam 2, Exam 3 and Total; but the variance ratio for Quiz & In-Class Practice violates this assumption ($\frac{\text{Variance1}}{\text{Variance2}} = \frac{5.66672}{0.784322} > 2$). Since the grade of In-class Practice is nearly the same for both traditional students and online students, plus the weight scale of quiz & In-class Practice is lower than the other four categories, the violation of Quiz & In-Class Practice is considered barely affecting the conclusion.

One of the assumptions of t-test is that the sample data follows normal distribution. A normal quantile plot for total scores of two groups are constructed, as shown in Figure 3. If the data perfectly follows normal distribution, it will show a diagonal straight line in a normal quantile plot. The two sample data do not follow a perfect straight line, but nearly all the data are within the boundary. We can still assume that data is in normality.

Table 4 T-test of student performance for the two teaching methods

Performance	Statistics	Fall 2014 online course	Fall 2015 face-to-face course
Quiz &In Class Practices	Mean	13.29973	13.36683
	Variance	5.66672	0.784322
	t Stat	-0.13264	
	P(T<=t) two-tail	0.8950	
Homework	Mean	15.55667	16.96859
	Variance	11.39472	7.358629
	t Stat	-1.57354	
	P(T<=t) two-tail	0.122758	
Exam 1	Mean	16.45	15.10907
	Variance	4.672807	8.431825
	t Stat	1.727824	
	P(T<=t) two-tail	0.091033	
Exam 2	Mean	14.6	13.60769
	Variance	21.32865	19.38821
	t Stat	0.966123	
	P(T<=t) two-tail	0.339563	
Exam 3	Mean	19.03125	18
	Variance	22.04914	13.985
	t Stat	0.829611	
	P(T<=t) two-tail	0.411237	
Total score	Mean	78.93765	76.75218
	Variance	217.5148	142.6849
	t Stat	0.555458	
	P(T<=t) two-tail	0.581395	



(a) Online course (b) Face-to-face course

Figure 3 Normal quantile plot chart for total score

There are still some limitations in this experiment. It is hard to prove that the scores exactly reflect the student performance and learning effectiveness. For examples, some students who take online course might finish homework and do the exam with other classmates or upperclassmen who took this course before. As a result, their grade will much over-reflect the student outcomes. In addition, the sample size is not very large to make an accurate deduction. It is suggested to improve the homework and exam discipline and collect more data within several years to analyze.

Conclusion

The study of TECH3142 Statistical Quality Control shows that the online student outcomes are not statistically significant different from the traditional student outcomes. Since TECH3142 is a course with a lot of analytical skills and applications of computer software, the case can be considered as a successful implementation of online education in a technology-related course because of following several reasons,

1. According to course syllabus, the instructor must make a response to student inquiries within 48 hours, and most of time, the instructor reply immediately.
2. Both emails and phone calls were used to explain the course related question. Students were welcome to office if the question is too complicated for students to understand by students through emails or

phone calls

3. The instructor update Panopto videos in the eLearning system for students to go over the learning contents.

All these reasons improve the interactions between instructor and students, and it affects the student performance in online technology-related course.

This paper reviews the development history of distance learning. Distance education could have both benefits and limitations. When it brings convenience, flexibility and affordable price to the students, the quality of education might lag behind traditional education. In contrast with traditional education, distance education, especially online education, is an emerging and developing rapidly educational mode. With the development of technology, distance education will be more widely used in any study field. As plenty researches proved, there is no strongly evidence to against that student performance of web-based education is not less than the student performance of traditional format (Nguyen, 2015).

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