Contributing Factors on the Effectiveness of Delivering Business Technology Courses: On-Ground Versus Online

John Tan (Corresponding author)

Dept. of Accounting and Finance, California State University East Bay

Hayward, California, United States

E-mail: john.tan@csueastbay.edu

Hongwei Du

Dept. of Management, California State University East Bay

Hayward, California, United States

Ching-Lih Jan

Dept. of Accounting and Finance, California State University East Bay

Hayward, California, United States

Robert Lin

Dept. of Accounting and Finance, California State University East Bay

Hayward, California, United States

Abstract

Enrollment in online college courses in the United States has grown by about 5% from 2012 to 2016. This paper examines course design and student performance data to research

whether instructors can delivery on-ground and online sections of a business technology course with the same effectiveness. Authors address this paper's research question by analyzing five pairs of on-ground and online sections of business technology courses. Each of the five pairs of business technology course, has data analytics projects as part of the course content, is taught by the same instructor with the same details of course contents in the same quarter. Overall results of this paper suggest that, with proper training and support of technology, an instructor can deliver both the on-ground and online sections of a business technology course with the same effectiveness as measured by students' grade points. Further analysis shows that this result applies to female and male students, respectively. Female (male) students learn equally well in on-ground and online. This paper contributes to the literature by discussing some contributing factors on the effectiveness of delivering online business technology courses. Authors suggest that other than technology such as LockDown Browser or Respondus Monitor, continuous placement of the same instructor with Quality Matters training to teach both the on-ground and online sections of a course is crucial to success. Results of this paper consequently provide practical implications to instructors, academic advisers, and administrators of universities.

Keywords: Online, On-ground, Information technology management, Accounting information systems, LockDown Browser, Respondus Monitor

1. Introduction

U.S. News reports "Enrollment in online courses rose at a faster pace between fall 2015 and 2016 compared with the previous three years, yet students are increasingly choosing local online degree programs, according to the "Grade Increase" report released today by the Babson Survey Research Group." (U.S. News, January 11, 2018). Seaman et al. (2018) actually find that between 2012 to 2016 overall enrolment in the US higher education system has slowly declined by almost 4% but online enrolment has grown by about 5% over the same period. It is now a norm for students to take online courses.

Prior literature suggests many reasons why do students take online courses, for example, Hannay and Newvine (2006) find that students prefer online courses because online delivery mode allows students to balance their other commitments more easily. In addition, prior studies also provide evidence that there are differences between students who prefer to take online courses versus on-ground, and vice versa. For example, Ashby et al. (2011) find that older students and female students in general are more likely to enroll in online course sections, while minorities are more likely to enroll in on-ground course sections.

Atchley et al. (2013) briefly describe how Texas public universities receive funding based on a formula that includes input variables such as completed semester credit hours and course completion rates. University administrators have been trying to figure out the reasons why undergraduate students are not graduating from public universities in four years. With limited resources on hand, administrators need to allocate resources to the best mode of instruction delivery of a course namely, on-ground or online. However, the effectiveness of online education is still under scrutiny by the public and the academic world.

Prior education literature is characterized by an ongoing debate on the effectiveness of online versus on-ground mode of instruction delivery of a course. Empirical studies have both supported (McLaren 2004; Summers et al. 2005; Larson and Sung 2009; Chen et al. 2013; Ni 2013; Cavanaugh and Jacquemin 2015) and refuted (Ashby et al. 2011; Atchley et al. 2013; Xu and Jaggers 2013; Hart et al. 2018) the notion that online mode of delivery can achieve the same effectiveness compared to on-ground learning environment.

Xu and Jaggers (2013, p. 46) highlight that "both two-year and four-year colleges may wish to focus on evaluating and improving the quality of online coursework before engaging in further expansions of online learning." Unfortunately, prior studies often use a single undergraduate subject, for example introductory management information systems, to research whether online mode of instruction delivery can achieve the same effectiveness as measured by student performance, compared to on-ground learning environment. Because of this, the authors of this paper conduct research on the effectiveness of online mode of instruction delivery of five pairs of upper-division undergraduate business technology courses.

Compare to other business courses (lower-division or upper-division), business technology courses have hands-on projects that normally require students to learn and use a software to complete a task. Data analytics is the talk of the town in the business world because data analytics helps to improve a business's bottom line. For example, Dabbs of Ernest and Young Australia describes how to improve the business with an environmental, health and safety (EHS) data analytics strategy (Dabbs, 2018). Accordingly, many business schools have incorporated data analytics concepts like data mining or visualization tools like Tableau into the contents of business technology courses: information technology management (ITM) courses and accounting information systems (AIS) courses, respectively.

Course contents of business technology courses now often include hands-on group or individual projects of data analytics on top of regular homework assignments, case studies, quizzes and examinations. Instructors of AIS courses teach students how to use Tableau software to complete certain visualization tasks. On the other hand, instructors of ITM courses teach students how to use a particular programming language to complete certain programming tasks. Instructors of business technology courses, AIS or ITM, face immense challenges when delivering the course through online mode. Unlike on-ground learning environment, instructors of an online business technology course cannot stand in front of the students physically to guide them how to use the Tableau software to complete a certain visualization task, step by step. Instructors of an online business technology course have to rely even more on educational technology to achieve the learning objectives of the course.

On the other hand, prior literature also shows that both instructors and students face many challenges when teaching or taking online courses, respectively. Kebritchi et al. (2017) conduct a review of literature to examine issues in delivering online courses and identify three major categories of challenges related to online learners, instructors, and content development. Kerbitichi et al. (2017) highlight challenges in online education that include instructional strategies in content development and integration of multimedia in content.

The motivation of this paper is to research on the question of whether an instructor can teach both the on-ground section and the online section of a business technology course with the same effectiveness in the same quarter.

While course contents of upper-division business technology courses become more insightful with more varieties of student activities, online instructors especially benefit from the advancement in online teaching tools. Assessment tools for learning systems, such as LockDown Browser or Respondus Monitor, help instructors to deter online students from cheating.

With proper training and support of technology, an instructor can teach both the on-ground and online sections of a business technology course with the same effectiveness in a quarter. This paper measures effectiveness by students' grade points in a business technology course. If an instructor is effective, grade points between on-ground students and online students of the same business technology course in the same quarter will not differ significantly.

Prior literature, for example Rovai and Baker (2005), Slater et al. (2007), Sullivan (2001), and Wehrwein et al. (2007), has extensive discussion about how male and female learn differently. Massoudi et al. (2017) also report that gender is one of the many factors related to the better examination performance of introductory financial accounting students. It is not the intention of this paper to further discuss how male and female learn differently. Instead, this paper researches on the question of whether within a group of female (male) students, will mode of instruction delivery (on-ground or online) cause a difference in grade points. If instruction is effective, female (male) students taking either on-ground or online section of a business technology course taught by the same instructor in the same quarter will perform equally well in terms of grade points.

This paper has three hypotheses:

Hypothesis 1: There is no significant difference in students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

Hypothesis 2: There is no significant difference in female students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

Hypothesis 3: There is no significant difference in male students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

This paper draw samples from the business technology courses of a state school located in the west coast of the United States. Each of the five pairs of business technology courses offered in the college of business and economics had the same instructor with the same details of course design, contents, questions in each quiz or examination, and grade points policy. The five pairs of on-ground and online business technology courses are ITM 4278 (Spring 2017), ACCT 3170 (Spring 2017), ITM 4272 (Fall 2017), ITM 4273 (Winter 2018), and ACCT 3170

(Spring 2018).

This paper uses five pairs of on-ground and online business technology courses to test for hypotheses one to three. A pairwise independent-samples t-test was conducted to compare students' grade points of the on-ground section and the online section for a specific course offered in the same quarter, for example ITM 4278 (Spring 2017). Similar independent-samples t-tests were conducted in the other four samples pairs of business technology courses, separately.

This paper reports to readers the following results:

Hypothesis 1: Results suggest that there is no significant difference in students' grade points between on-ground section and online section in all five-sample pairs of business technology courses.

Hypothesis 2: Results suggest that there is no significant difference in female students' grade points between on-ground section and online section in all five-sample pairs of business technology courses.

Hypothesis 3: Results suggest that there is no significant difference in male students' grade points between on-ground section and online section in all five-sample pairs of business technology courses.

Overall results of this paper suggest that with proper training and support of technology, an instructor can simultaneously teach both the on-ground and online sections of a business technology course with the same effectiveness in the same quarter. Female (male) students learn equally well in either on-ground or online mode of instruction delivery.

This paper differs from prior studies on on-ground versus online teaching, such as Larson and Sung (2009) and Driscoll et al. (2012), in several ways. First, instead of a basic undergraduate introductory course, this paper uses upper-division business courses as test samples. Second, this paper uses business technology courses with data analytics content to test for the differences in teaching effectiveness between on-ground and online mode of instruction delivery. Third, all online samples in this paper had deployed test assistance tools for the learning platform, such as LockDown Browser or Respondus Monitor. Fourth, this paper studies whether there is a difference in grade points for female (male) students taking a business technology course either through on-ground or online mode of instruction delivery.

This paper contributes to the literature in several ways. First, this paper contributes to the literature by using upper-division business technology courses to research about the effectiveness of online education. Second, results of this paper demonstrate that with proper training and support of technology, an instructor can effectively teach both the on-ground and online sections of a business technology class in the same quarter. Third, this paper demonstrates to readers that female (male) students can learn equally well in either on-ground or online delivery of an effectively taught business technology course. Fourth, this paper contributes to the literature by discussing some contributing factors on the effectiveness of delivering online business technology courses.

This paper also contributes to the existing literature by providing practical implications to help academic advisors to answer a common question of students: whether I should take on-ground or online delivery of a business course. The results of this paper suggest that, regardless female or male, students can take either online or on-ground section of an effectively taught business technology course as they can learn equally well in either on-ground or online mode of instruction delivery.

Another practice implication from our test results is for university administrators in deciding whether they should allocate more resources for the development of online courses. This paper's results suggest that administrator should allocate resources to develop online education. With proper training and support of technology, an instructor can effectively teach both the on-ground and online sections of a business technology class in the same quarter.

Readers should take notice that even if an instructor teaches both the on-ground or online sections of a business technology course effectively, there is always room for improvement. In 2013, the Association to Advance Collegiate Schools of Business (AACSB) issued the AACSB Assurance of Learning Standards: An Interpretation AACSB White Paper No. 3 (AACSB, 2013). Assurance of learning at the program level aims at continuous improvement of student learning across the curriculum and not confined to learning within any single subject-focused course.

The next section is literature review. The third section discusses theory and hypotheses. The fourth section describes the samples. The fifth and the sixth section discuss research methodology and results. The seventh section is discussion of test results. The final and last section consists of the conclusion.

2. Literature Review

The education literature is characterized by an ongoing debate on the effectiveness of online versus on-ground mode of instruction delivery of a course. Empirical studies have both supported (McLaren 2004; Summers et al. 2005; Larson and Sung 2009; Chen et al. 2013; Ni 2013; Cavanaugh and Jacquemin 2015) and refuted (Ashby et al. 2011; Atchley et al. 2013; Xu and Jaggers 2013; Hart et al. 2018) the notion that online delivery mode can achieve the same effectiveness compared to on-ground delivery mode.

The following paragraphs describe prior studies that find no significant difference in the effectiveness for a variety of courses between modes of instruction delivery: online and on-ground.

For undergraduate business statistics course, McLaren (2004) finds that grades of students in an undergraduate business statistics course were not significantly different between students completing the course online compared to on-ground course delivery mode. Summers et al. (2005) compare students' final grades of an introductory undergraduate statistics course between online and on-ground mode of instruction delivery and find that there was no significant difference in grades between the online and on-ground mode of instruction delivery.

Larson and Sung (2009) perform a three-way comparison of delivery modes (online, blended, and on-ground) for an undergraduate introductory management information systems course to determine if there existed a difference in student success among the delivery modes. Larson and Sung (2009) find that there was no significant difference among the three delivery modes in terms of student success. Driscoll et al. (2012) also find that both online and on-ground modes of instruction delivery provide equally effective learning environments for an undergraduate introductory-level sociology course.

Chen et al. (2013) survey accounting students of introductory and advanced accounting courses about students' perception of the effectiveness of online accounting education. Based on their survey results, Chen et. al (2013) report that accounting students favor traditional classrooms environments than online when learning advanced financial accounting courses. The survey result of Chen et al. suggest, "the course level is important when assessing whether it is advisable to offer online accounting courses (Chen et al., 2013 p.1)."

For a graduate level class, Ni (2013) finds that there is no difference in student performance as measured by grade between students taking the online section and the on-ground section of a graduate public administration research methods course. In a comprehensive study, Cavanaugh and Jacquemin (2015) analyze 5,000 courses taught by over 100 faculty members over a period of ten academic terms at a large, public, four-year University. Cavanaugh and Jacquemin (2015) find that there is no difference in grade based student performance between online and on-ground instructional modes for courses.

The following paragraphs describe prior studies that find significant differences in the effectiveness between modes of instruction delivery: on-line and on-ground.

Ashby et al. (2011) compare student success in a community college's developmental mathematic course offered in three different learning environments: online, blended, and on-ground. Ashby et al (2011) find that on-ground students performed most poorly in terms of student success compared to students taking online and blended developmental mathematic course.

Using a sample of around five thousand students, from a variety of academic disciplines at a small public university between fall 2004 and spring 2009, Atchley et al. (2013) find that there was a statistically significant difference in the student performance (final grade) between online and on-ground traditional courses.

Xu and Jaggers (2013) identify twenty-two thousand students "who initially enrolled in one of the Washington State's 34 two year public community or technical colleges during the fall term of 2004 (Xu and Jaggers, 2013, p. 48)." Xu and Jaggers (2013) track the academic performance of the twenty-two thousand students, mentioned above, for approximately five years from fall term 2004 to summer 2009. Contrary to the notion that there is no significant difference between online and on-ground student learning outcomes, Xu and Jaggers (2013) find that community college students taking courses through online delivery mode not only performed inferior but also dropped out more compared to students taking the same course through on-ground delivery mode. Xu and Jaggers (2013) highlight "both two-year and

four-year colleges may wish to focus on evaluating and improving the quality of online coursework before engaging in further expansions of online learning (Xu and Jaggers, 2013, p.46)."

Hart et al. (2018) use "fixed effects analyses to estimate differences in student performance under online versus face-to-face course delivery formats in the California Community College system (Hart et al. 2018, p.42)." Hart et al. (2018) report that "On average, students have poorer outcomes in online courses in terms of the likelihood of course completion, course completion with a passing grade, and receiving an A or B (Hart et al. 2018, p.42)."

If students taking course online perform worse than those taking on-ground, there must be reasons. This paper is therefore motivated to research on whether online mode of delivery can achieve the same effectiveness compared to face-to-face learning environment in a four-year public university, and why.

There is also a practical reason to continue researching about the effectiveness of online education from the administrators' points of view. Atchley et al. (2013) briefly describe how Texas public universities receive funding based on a formula that includes input variables like completed semester credit hours and course completion rates. Administrators are asking the questions why undergraduate students are not graduating from public universities in four years. With limited resources on hand, administrators must allocate resources to the best mode of instruction delivery of a course namely: on-ground or online delivery mode.

Prior studies often use a single academic subject to research whether online mode of delivery can achieve the same effectiveness as measured by student performance compared to on-ground learning environment. The mentioned above single academic subject of prior studies include the following undergraduate courses: business statistics, introductory statistics, introductory-level sociology, introductory management information systems, introductory and advanced accounting courses and a graduate public administration research methods course.

Other than Chen et al. (2013), it seems that most of the prior studies use introductory undergraduate courses to research on the effectiveness of online education. Further, Chen et al. (2013) use survey method instead of actually comparing student performances between online and on-ground mode of instruction delivery of advanced accounting. This motivates the authors to research on the effectiveness of online mode of delivery of upper-division undergraduate business technology courses. In general, course contents of upper-division business technology courses often include hands-on group or individual projects on top of regular homework assignments, case studies, quizzes and exanimation. Compared to introductory course, it is more challenging for instructors to teach upper-division business technology courses in terms of learning objectives and course contents. This paper contributes to the literature by using upper-division business technology courses to research about the effectiveness of online education.

Prior literature, for example Rovai and Baker (2005), Slater et al. (2007), Sullivan (2001), and Wehrwein et al. (2007), has extensive discussion about how male and female learn

differently. Ashby et al. (2011) suggest that older students and female students in general are more likely to enroll in online course sections, while minorities are more likely to enroll in on-ground course sections. Massoudi et al. (2017) also report that gender is one of the many factors related to the better examination performance of introductory financial accounting students.

It is not the intention of this paper to further discuss how male and female learn differently. Instead, this paper researches on the question of whether within a group of female (male) students, will mode of instruction delivery (on-ground or online) cause a difference in grade points. This paper also contributes to the literature by providing empirical results to help academic advisors to answer a common question of students: whether I should take on-ground or online delivery of a business course.

The following paragraphs explain why this paper selects business technology courses to research on the effectiveness of online education.

Publishers have developed well-designed online homework systems. Often publishers' online homework system can fully integrate into a higher education institution's learning management system such as Blackboard. Prior literature, such as Braun and Sellers (2012) and Dillard-Eggars et al. (2008), describes the incremental benefits of using publishers' online homework systems. Philips and Johnson (2011) suggest that publishers' intelligent tutoring system not only provides feedback to the accuracy of students' answers but also provides explicit step-by-step instruction on the process needed to reach solutions of algorithmically generated homework problems.

Massoudi et al. (2017) find that introductory financial accounting students can improve their examination performance by actively using the available online learning resource. Educators also benefit from other technology like the whiteboard voice-over (WBVO) video technology. Lento (2017) discusses about the benefits of adopting the whiteboard voice-over (WBVO) video technology as a supplemental resource in both traditional classrooms and online environment.

On the contrary, there are some prior studies actually show that online homework systems and intelligent tutoring systems do not necessarily improve students learning. Hahn et al. (2013) report that introductory financial accounting students who are using both the online homework manager and the intelligent tutoring system do not have learning advantage over comparable students who do not use the above mentioned online learning tools. Solsma et al. (2018) suggest that knowledge retention is greater for accounting students that use a paper/pencil method of completing homework than for accounting students that use an online homework systems method of completing homework.

It seems that technology in education does not guarantee incremental benefit in student performance. It is therefore interesting to study whether technology in education can actually help instructor to teach technology related subjects in upper-division business technology courses.

Compare to other business courses (lower-division or upper-division), business technology courses have hands-on-projects that normally require students to learn and use a software to complete a task. Instructors of accounting information systems (AIS) courses teach students how to use Tableau software to complete certain visualization tasks. Instructors of information technology management (ITM) courses teach students how to use a particular programming language to complete certain programming tasks.

Instructors of business technology courses, AIS or ITM, face immense challenges when delivering the course through online mode. Unlike on-ground learning environment, instructors of an online business technology course cannot stand in front of the students physically to explain which buttons to click in the Tableau software to complete a certain visualization task. Instructors of an online business technology course has to rely even more on educational technology to achieve the learning objectives of the course. The next couple of paragraphs briefly describe the latest educational technology available to instructors.

Kerbitichi et al. (2017) suggest that online instructors need to integrate multimedia when developing content of an online course. Kerbitichi et al. (2017) call for higher education institutions to provide professional development for online instructors and to provide technical support for content development. There are many online teaching tools available to instructors, ranging from online homework systems, lecture capture, virtual office to assessment tools for learning systems.

Online instructors have been struggling on how to prevent online students from cheating during quizzes and examinations. Assessment tools for learning systems, such as LockDown Browser or Respondus Monitor, can now help online instructors to deter online students from cheating.

According to Respondus, Inc., "LockDown Browser is a custom browser that locks down the testing environment within a learning management system. LockDown Browser is a custom browser that locks down the testing environment within online course. Students are unable to print, copy, or access other websites and applications (Respondus, 2019a)."

According to Respondus, Inc., "Respondus Monitor builds upon the power of LockDown Browser®, and uses a student's webcam and industry-leading video analytics to prevent cheating during non-proctored exams. It's the most cost-effective, scalable, and student-friendly system for online proctoring (Respondus, 2019b)."

The instructors for the courses studied in the paper not only integrate publishers' online homework systems into Blackboard but also deploy either LockDown Browser or Respondus Monitor for online quizzes and examinations. For on-ground students, instructors have the opportunity to proctor when students take quizzes and examination in a physical classroom.

Online instructors can also deploy many other online teaching tools to develop and integrate content. For example, online instructors can use software such as Camtasia to video capture lecture. Online instructors can also use software such as Zoom to conduct virtual office hours and virtual in-class discussion.

Readers should take notice that some online teaching tools are not freely available to online instructors. The higher education institutions must provide resources to (1) purchase teaching tools and software, (2) train the online instructors to use the purchased teaching tools, (3) to provide technical support for integration of multimedia in the content area, (4) to assist online instructors to meet the accessibility requirements.

This paper further contributes to the literature by providing empirical results to help administrators to decide whether they should allocate more resources for the development of online courses.

3. Theory and Hypotheses

Hannay and Newvine (2006) report that online students do not believe that they sacrifice a quality education for the convenience of utilizing distance learning. By providing resources to purchase online teaching tools, to provide training and technical support, higher education institutions' administers will certainly wish all instructors could teach both the on-ground and online sections of a business technology course with equal effectiveness. This paper provides an example of how a higher education institution provides professional development for online instructors and technical support for content development as suggested by Kerbitichi et al. (2017).

The College of Business and Economics (CBE), where the authors are affiliated with, is part of a regionally accredited university accredited by the Western Association for Schools and Colleges (WASC) Senior College and University Commission (WSCUC). Since 1973, the Association to Advance Collegiate Schools of Business (AACSB) has been accrediting the CBE. CBE has six AACSB accredited degree programs including the undergraduate program, the Bachelor of Science in Business Administration (BSBA). Undergraduate business students can complete their BSBA program either through on-ground or online mode of instruction delivery. The online BSBA undergraduate program only accepts transfer students who have completed all general education and pre-requisite courses for upper division business education. Students enroll into the online (on-ground) BSBA undergraduate program cannot enroll into on-ground (online) courses. Within a quarter, an instructor often teaches both the on-ground and online sections of a business technology course.

At the University level, where the authors work, there is an office of the online campus. The mission of the office of the online campus is to provide quality innovative support, technology, and infrastructure that inspire effective teaching and learning for online or hybrid courses and programs. The office of the online campus provides assistances to online instructors in the following ways:

(1) Purchase online teaching tools and software such as Camtasia for lecture capture, or assessment tools for learning systems (LockDown Browser or Respondus Monitor).

(2) Provide training to online instructors on how to integrate various online teaching tools into Blackboard. Instructors often integrate publishers' online homework systems into Blackboard. Through Blackboard, instructors deploy either LockDown Browser or Respondus Monitor.

(3) Provide training called *Quality Matters* (QM) for all instructors teaching online courses. Sener (2006) explains the purpose of *Quality Matters* is to provide a model to assess, assure, and improve the quality of online courses. Many online instructors have successfully completed their QM training and have become QM course reviewers. Most important of all, many online courses have attained the status of certified quality online course.

(4) Provide continuous round the clock technical support.

With proper training and support of technology, this paper proposes that an instructor can simultaneously teach both the on-ground and online sections of a business technology course with the same effectiveness in a quarter. This paper measures effectiveness by students' grade points in a business technology course. If an instructor is effective, grade points between on-ground students and online students of the same business technology course in a quarter will not differ significantly.

If an instructor is effective in teaching both the on-ground and online sections of a business technology course, mode of instruction delivery does not matter within the female (male) group of students. Female (male) students taking online section of a business technology course should learn equally well, compared to female (male) students taking the on ground section of the same course taught by the same instructor.

Based on the above discussion, this paper proposes three hypotheses:

Hypothesis 1: There is no significant difference in students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

Hypothesis 2: There is no significant difference in female students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

Hypothesis 3: There is no significant difference in male students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

4. Data Description

This paper draw sample data from the business technology courses in the College of Business and Economics (CBE) where the authors are affiliated. Each of the five pairs of business technology courses had the same instructor with the same details of course design, contents and grading policy. The five pairs of on-ground and online business technology courses are ITM 4278 (Spring 2017), ACCT 3170 (Spring 2017), ITM 4272 (Fall 2017), ITM 4273 (Winter 2018), and ACCT 3170 (Spring 2018).The following paragraphs briefly describe each of the five pairs of business technology courses.

4.1 E-business Systems Development (ITM 4278) Spring 2017

ITM 4278 is an overview of the basic knowledge of e-commerce technologies. Primary emphasis is on developing skills in implementing business-oriented systems for electronic

commerce using Internet technologies. ITM 4278 includes the following topics: Internet technology components, world wide web, databases, programming, security standards, web authorizing tools, integration with enterprise systems.

During Spring 2017, the course content of ITM 4278 (on-ground and online) had class participation activities, homework assignments, a group project, two individual case studies, quizzes, midterm examination and final examination. Students are formed into groups to study the website design of a company and to write a report on how to improve the selected company's website. In addition, each student had to read and comment on two individual Harvard Business Review cases.

ITM 4278 Spring 2017 had a maximum weighted total grade points of 100. The instructor required LockDown Browser for all online students while taking quizzes, midterm and final examination. On-ground students took all quizzes, midterm and final examination in paper format inside a classroom, proctored by the instructor.

4.2 Information Technology and Telecommunication Systems (ITM 4272) Fall 2017

ITM 4272 discusses theory and practice of computer networking and data communication management in a business environment. ITM 4272 includes topics like network-related technology, standards, protocols, security and design. Primary emphasis of ITM 4272 is on how network and data communication technology integrate with existing corporation architecture and how to identify network solutions to support business objectives.

During Spring 2017, the course content of ITM 4272 (on-ground and online) had class participation activities, homework assignments, a group project on computer networking, three individual projects on computer networking, midterm examination and final examination.

ITM 4272 Spring 2017 had a maximum weighted total grade points of 100. The instructor required LockDown Browser for all online students while taking midterm and final examination. On-ground students took both midterm and final examination in paper format inside a classroom, proctored by the instructor.

4.3 Business Intelligence Systems ITM 4273 (Winter 2018)

ITM 4273 discusses computerized support for decision-making and business intelligence systems. ITM 4273 includes topics like major tools and techniques of managerial decision support, the essentials of business intelligence, data warehousing definitions and architectures, data integration, data visualization, data mining concepts and applications.

During Winter 2018, the course content of ITM 4278 (on-ground and online) had class participation activities, homework assignments, a group project, an individual project, quizzes, midterm examination and final examination. Student formed into groups to learn an artificial intelligent technology and report on how a company could improve the application of the selected artificial intelligent technology.

ITM 4273 Winter 2018 had a maximum weighted total grade points of 100. The instructor required LockDown Browser for all online students while taking quizzes, midterm and final

examination. On-ground students took all quizzes, midterm and final examination in paper format inside a classroom, proctored by the instructor.

4.4 Accounting Information Systems ACCT 3170 (Spring 2017) (Spring 2018)

ACCT 3170 discusses the roles and responsibilities of business information systems within the IT function. ACCT 3170 covers the following concepts: hardware, software, operating systems, database management systems, systems operation, disaster recovery, business continuity, electronic commerce and information systems controls.

Readers should take notice that ACCT 3170 had different course contents in Spring 2017 and Spring 2018. The instructor, who taught ACCT 3170 regularly, incorporated data analytics activities into the course content of ACCT 3170 Spring 2018.

During Spring 2017, the course content of ACCT 3170 (on-ground and online) had homework assignments, an individual Excel project, quizzes, two midterm examinations and a final examination. During Spring 2018, the course content of ACCT 3170 (on-ground and online) had homework assignments, an individual Excel project, three data analytics exercises, quizzes, two midterm examinations and a final examination.

ACCT 3170 Spring 2017 and Spring 2018 had a maximum grade points of 500 which is a summation of all the class activities. The instructor required Respondus Monitor for all online students while taking quizzes, midterm and final examinations. On-ground students took all quizzes, midterm and final examination in a computer laboratory through Blackboard but without LockDown Browser or Respondus Monitor. The instructor walked around the computer laboratory while on-ground students took their quizzes and examination.

4.5 Descriptive Statistics of Samples.

Table 1. Descriptive statistics of the samples: five pairs of business technology courses

Course	Term	Mode of Delivery	Number of Students	Mean of Grade Points	Minimum Grade Points	Maximum Grade Points
ITM 4278	Spring 2017	On-ground	55	83.50	58.90	94.95
ITM 4278	Spring 2017	Online	42	85.58	61.30	98.40
ITM 4272	Fall 2017	On-ground	30	72.71	50.20	89.93
ITM 4272	Fall 2017	Online	43	74.15	49.65	90.61
ITM 4273	Winter 2018	On-ground	55	85.70	*2.85*	*97.65*

ITM 4273	Winter 2018	Online	*45*	*84.18*	*2.92*	*95.40*
ACCT 3170	Spring 2017	On-ground	45	403.57	317.00	461.00
ACCT 3170	Spring 2017	Online	29	416.31	310.00	470.00
ACCT 3170	Spring 2018	On-ground	22	399.63	235.00	458.00
ACCT 3170	Spring 2018	Online	21	407.66	356.00	467.00

Table 1 reports the mean of grade points and range of grade points for both the on-ground and online sections of each of the five pairs of business technology courses selected as samples.

5. Research Method

This paper uses five pairs of on-ground and online business technology courses to test for hypotheses one to three. An independent-samples t-test was conducted to compare students' grade points of the on-ground section and the online section for each of the five pairs of business technology courses, respectively.

To test for the hypothesis 1, an independent-samples t-test was conducted to compare students' grade points of the on-ground section and the online section for each of the five pairs of business technology courses, respectively.

To test for the hypothesis 2 and 3 respectively, an independent-samples t-test was conducted to compare female (male) students' grade points of the on-ground section and the online section for each of the five pairs of business technology courses, respectively.

The next section reports results of the independent-samples t-tests.

6. Results

6.1 Results of Hypothesis One

Table 2. Results of independent-samples t-tests of hypotheses 1

Course	Term	Mean of On-Ground Grade Points	Mean of Online Grade Points	Results of Independent-samples t-tests (2-tailed)
ITM 4278	Spring 2017	83.50	85.58	[t(86) = -1.2158, p = 0.2273]
ITM 4272	Fall 2017	72.71	74.15	[t(67) = -0.6091, p = 0.5444]

ITM 4273	Winter 2018	85.70	84.18	[t(90) = 0.5394, p = 0.5909]
ACCT 3170	Spring 2017	403.57	416.31	[t(56) = -1.5157, p = 0.1352]
ACCT 3170	Spring 2018	399.63	407.66	[t(37) = -0.69493, p = 0.4914]

An independent-sample t-tests was conducted to compare students' grade points of on-ground section and online section of a business technology course in the same quarter. Table 2 reports results of independent-samples t-tests (2-tailed) for each of the five pairs of sample courses.

The results in Table 2 show that there was not a significant difference in students' grade points of on-ground section and online section of a business technology course. This result cannot reject Hypothesis 1: there is no significant difference in students' grade points between on-ground section and online section in all five-sample pairs of business technology courses.

6.2 Results of Hypothesis Two

Table 3. Results of independent-samples t-tests of hypotheses 2

Course	Term	Mean of On-Ground Grade Points (Female)	Mean of Online Grade Points (Female)	Results of Independent-samples t-tests (2-tailed)
ITM 4278	Spring 2017	85.56	82.44	[t(38) = 0.7679, p = 0.4472]
ITM 4272	Fall 2017	69.62	72.63	[t(23) = -0.9138, p = 0.3702]
ITM 4273	Winter 2018	88.99	87.15	[t(31) = 0.7993, p = 0.4301]
ACCT 3170	Spring 2017	407.04	419.95	[t(41) = -1.3675, p = 0.1789]
ACCT 3170	Spring 2018	405.53	403.50	[t(29) = 0.2061, p = 0.8381]

An independent-sample t-tests was conducted to compare female students' grade points of

on-ground section and online section of a business technology course in the same quarter. Table 3 reports results of independent-samples t-tests (2-tailed) for each of the five pairs of sample courses.

The results in Table 3 show that there was not a significant difference in female students' grade points of on-ground section and online section of a business technology course. This result cannot reject Hypothesis 2: there is no significant difference in female students' grade points between on-ground section and online section in all five-sample pairs of business technology courses.

6.3 Results of Hypothesis Three

An independent-sample t-test was conducted to compare male students' grade points of on-ground section and online section of a business technology course in the same quarter. Table 4 reports results of independent-samples t-tests (2-tailed) for each of the five pairs of sample courses.

The results in Table 4 show that there was not a significant difference in male students' grade points of on-ground section and online section of a business technology course. These results cannot reject Hypothesis 3: there is no significant difference in male students' grade points between on-ground section and online section in all five-sample pairs of business technology courses.

Table 4. Results of independent-samples t-tests of hypotheses 3

Course	Term	Mean of On-Ground Grade Points (Male)	Mean of Online Grade Points (Male)	Results of Independent-samples t-tests (2-tailed)
ITM 4278	Spring 2017	82.41	85.53	$[t(29) = -1.2996, p = 0.2039]$
ITM 4272	Fall 2017	74.03	75.60	$[t(41) = -0.4972, p = 0.6216]$
ITM 4273	Winter 2018	84.58	82.00	$[t(46) = 0.6088, p = 0.5456]$
ACCT 3170	Spring 2017	399.61	408.22	$[t(12) = -0.4807, p = 0.6393]$
ACCT 3170	Spring 2018	387.00	421.00	$[t(9) = -1.106, p = 0.2970]$

7. Discussion

Overall, results of this paper suggest that with proper training and support of technology, an instructor can teach both the on-ground and online sections of a business technology course with the same effectiveness in the same quarter. Female (male) students learn equally well in either on-ground or online mode of instruction delivery.

After lengthy discussion with the online instructors of the five business technology courses (samples of this paper), the authors would like to suggest some contributing factors on the effectiveness of delivering online business technology course as follows

(1) Online instructor should have extensive teaching experiences in business technology course. Online instructor lacks interactions with students as in a traditional classroom setting. Unlike on-ground classroom environment, online instructor cannot response to students' questions in real time. Business technology course has the characteristic of multiple projects. Experienced instructors know how to select projects or cases that are suitable for the online environment to achieve the learning objectives. Instead of verbal explanation, experienced instructors know how to provide equivalent written guidelines and hints for online students to complete assignments and projects.

(2) Continuous placement of the same faculty to teach both the on-ground and online sections. Tan et al. (2018) demonstrate the benefit of continuously assigning the same faculty to teach the two introductory accounting courses of the BSBA program. Administrators should avoid assigning many different instructors to teach a business courses.

(3) Online instructors should deploy LockDown Browser or Respondus Monitor to prevent online students from cheating. LockDown Browser and Respondus Monitor act as deterrent to students' cheating. Instructors should certainly walk round the classroom during on-ground examination.

(4) Administrators must provide funding to buy online teaching tools, to train online instructors, and to provide technology support. Online instructors often need to ask for help from instructional specialist regarding integration of multimedia in course content.

(5) Online instructors should complete the QM training and certification. QM training helps instructors to align the institution learning objectives, program-learning objective and course learning objectives together. It is highly recommended to have all online courses achieving the status of certified online course.

8. Conclusion

This paper conducts tests to examine whether there is significant difference in grade points between on-ground students and online students of the same business technology course in the same quarter. Overall, results of this paper suggest that with proper training and support of technology, an instructor can simultaneously teach both the on-ground and online sections of a business technology course effectively.

Results suggest that there is no significant difference in students' grade points between

on-ground section and online section in all five-sample pairs of business technology courses. Results also suggest that there is no significant difference in female (male) students' grade points between on-ground section and online section of a business technology course taught by the same instructor in the same quarter.

This paper contributes to the literature by using upper-division business technology courses to research about the effectiveness of online education. This paper also contributes to the literature by demonstrating that proper training and support of technology contributing to the effectiveness of an instructor when teaching both the on-ground and online sections of a business technology course simultaneously. This paper further contributes to the literature by discussing some contributing factors on the effectiveness of delivering online business technology courses. This paper's results have two practical implications.

Results of this paper help academic advisors to address a common question of students: whether I should take on-ground or online delivery of a business course. This paper's results suggest that female (male) students can learn equally well in either on-ground or online delivery of an effectively taught business technology course. Further, this paper's results help administrators to decide whether they should allocate more resources for the development of online courses. Results of this paper suggest that administrator should allocate resources to develop online education because an instructor can effectively teach both the on-ground and online sections of a business technology class in the same quarter with proper training and technology support.

However, authors would like to acknowledge several limitations of this paper. This paper uses only business technology course as samples. This paper has only five pairs of samples to conduct the analysis. Readers should take notice that there is a limited number of business courses taught by the same instructor for both on-ground and online sections in a quarter. Nevertheless, there are ample opportunities of future research about the effectiveness of online teaching.

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