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MOOCs and the Online Delivery of Business Education: What's New? What's Not? What Now?

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Abstract

While the past two decades have produced much promise (and accompanying research) on the use of information technology (IT) in business school courses, it is not entirely clear whether IT has truly 'transformed' management education. There are compelling arguments on both sides. On one hand, advocates for the transformative role of IT can point to several success stories. On the other hand, skeptics on the role of IT in management education can also point to support for their view.

This lack of consensus has led researchers in *Academy of Management Learning and Education* to call for scholars to confront the bias against online education (Redpath, 2012) and engage in serious research on online education (Arbaugh, DeArmond, & Rau, 2013). In this work, we respond to these calls for research by using Adaptive Structuration Theory to develop a conceptual model of three factors that influence the use of IT in business education. We review prior research for each factor and use the conceptual model to identify implications for the design and delivery of business education. Based on the implications, we offer recommendations and recognize challenges for business schools and faculty related to the use of IT in business education.

INTRODUCTION

In 1997, Alavi and colleagues made an important observation in the *Academy of Management Journal* on the potential for information technology (IT)[1] to transform management education:

> *"The same factors that have motivated the formation of information-technology-enabled partnerships in business and industry now seem poised to transform management education. First, universities are under increased pressure to deliver to their students and other constituencies expanded services and greater value with reduced expenditure of capital and human resources. Second, the capabilities and economics of information and telecommunication technologies are rapidly improving…"* (Alavi, Yoo, & Vogel, 1997, p. 1311).

[1] Throughout the paper, we use the term 'information technology' (abbreviation IT) to refer to the overall domain or discipline, and we use the descriptive term 'technology' (or technology tools) to refer to the specific information technologies used in business education. Use of the descriptive term 'technology' is consistent with Adaptive Structuration Theory research on which the conceptual model in this paper is based (DeSanctis & Poole, 1994; Orlikowski, 1992).

Now, almost two decades later, it is not entirely clear whether IT has truly 'transformed' management education. There are compelling arguments on both sides. On one hand, advocates for the transformative role of IT can point to several success stories. For example, the number of college students who have taken at least one online course has increased every year since 2001, reaching 6.7 million in 2013 (almost one-third of college students) (Hartman, 2013). Kelley School of Business at Indiana University-Bloomington and Keenan-Flagler Business School at the University of North Carolina-Chapel Hill, two business schools regularly ranked as Top 20 MBA programs by *BusinessWeek* magazine, have more students enrolled in their online MBA programs than their traditional campus MBA programs (Clark, 2014).[2] Eighty-eight percent of public four-year degree-granting institutions offer college-level for-credit courses in online, hybrid or distance education formats (Parsad, Lewis, & Tice, 2008).[3] There has been significant recent experimentation with business-related courses in a massive open online course (MOOC) format, including Introduction to Finance taught at the University of Michigan, Introduction to Statistics taught at the University of California-Berkeley, Operations Management taught at the University of Pennsylvania, and Organizational Analysis taught at Stanford University (Jordan, 2014).

On the other hand, skeptics on the transformative role of IT in management education can also point to support for their view. Through the years, there have been a number of highly-heralded technology collaborations that started with initial fanfare and then fell flat. For example, UNext.com was founded during the late 1990s and billed itself as 'The Internet

[2] Kelley School of Business has 1,072 students enrolled in its online MBA program, more than double the number of students in its traditional campus program. Kelley School of Business charges tuition of $61,200 for the online program, and tuition of $93,000 for the traditional campus program. Keenan-Flagler Business School has 551 students enrolled in its MBA@UNC program, and charges tuition of $96,775 for the MBA@UNC program compared with $111,092 for the traditional campus MBA program (Clark, 2014).

[3] The comparable percentages for private for-profit and private not-for-profit four-year degree granting institutions are 70% and 53%, respectively (Parsad et al., 2008).

Education Company.' The roster of partner institutions included Carnegie Mellon University, University of Chicago, Columbia University, the London School of Economics, and Stanford University. While UNext raised $38 million in venture funding and had plans to offer online MBA degrees, these plans never materialized. More recently, the online education provider 2U assembled the Semester Online consortium as a platform for top-tier universities to offer online courses to paying students at participating universities. While initial members of the consortium included Duke University, Emory University and Vanderbilt University, multiple members backed out of the consortium before the first pilot in Fall 2013 and the consortium subsequently disbanded in Spring 2014 (Straumsheim, 2014). The dean of the College of Engineering at Georgia Institute of Technology, which has collaborated with AT&T to begin an online engineering master's program, observed that "The prospect of MOOCs replacing the physical college campus for undergraduates is dubious at best" (Guzdial, 2014). The director of communications for the Massachusetts Institute of Technology OpenCourseWare project said "It's going to be a long time before graduate school experience can be replicated online" (Long, 2013). There are even conflicting perspectives on the role of technology in education within the same institution. For example, while Stanford University's president has described online education as "a tsunami coming" (Mossberg, Hennessey, & Khan, 2012), Stanford University's vice provost for online learning takes a more methodical approach "What can we learn about teaching and learning through experimenting with different forms of technology? So I think we're going to treat this as an intellectual question and an academic investigation" (Weissmann, 2012).

This lack of consensus regarding the role of IT in business education has led researchers publishing in *Academy of Management Learning and Education* to call for scholars to confront

the bias against online education (Redpath, 2012) and engage in serious research on online education (Arbaugh et al., 2013). Herein, we respond to these calls by using Adaptive Structuration Theory (DeSanctis & Poole, 1994; Orlikowski, 1992) to develop a conceptual model of three factors that influence the use of IT in business education. We review prior research for each factor and we use the conceptual model to identify implications for the design and delivery of business education. As called for by Arbaugh and colleagues (2013), we also use the conceptual model to identify areas of future research concerned with the effects of IT on business education. Finally, we draw from theoretically-developed positions, recognize various challenges, and offer recommendations for business schools to take institutional-level actions and faculty to take individual-level actions related to the use of IT in business education.

USING IT TO DELIVER BUSINESS EDUCATION

Twenty years ago, research addressing the use of IT in business school courses was published in influential academic journals (e.g., Leidner & Jarvenpaa, 1993). At that time, the broad array of topics being considered included collaborative distance learning of students taking the same course from different locations. While the terminology was different, such as 'collaborative tele-learning' or 'technology-mediated distance education,' many of the underlying concepts examined in this earlier work such as audio, video and data links (Alavi, 1994) are similar to those MOOCs are using today.

In addition to describing the technologies, prior research discussed factors that influence how IT was used in business education (Alavi et al., 1997; Friga, Bettis, & Sullivan, 2003; Prosperio & Giola, 2007; Webster & Hackley, 1997). In this earlier work, researchers used a range of frameworks to discuss various factors. Instead of adding another framework to the list of those used to examine the effects of IT on business education, our approach consolidates

previously-used factors into a comprehensive conceptual model using Adaptive Structuration Theory (AST) (DeSanctis & Poole, 1994; Orlikowski, 1992). Our conceptual model enables us to integrate two decades of research in online education, and to connect this stream of research with a broader theoretical literature. As a result of these efforts, we are able to offer theoretically-grounded implications for business schools and areas for future research.

AST describes the interactions among IT, human factors and social structures, and explains how the impacts of IT on group outcomes depend on structural features of the technology, how group members appropriate technology into their tasks, and how new structures are formed over time (DeSanctis & Poole, 1994). We believe AST is an appropriate theoretical perspective for our conceptual model, because AST includes the technology artifact, use of the technology artifact, and the institutional context.[4] In the setting of online education, MOOC platforms and other software and hardware tools are the technology artifact, students and faculty are the technology users, and the institutional context includes universities and business schools.

AST was developed to answer questions such as 'What effects do technology tools have on group processes and outcomes?' and 'How does the process of using technology tools influence the effects on group processes and outcomes?' (DeSanctis et al., 2008). In the setting of online education, group processes include student learning and faculty teaching while group outcomes include student course performance and faculty teaching evaluations. AST argues that the effect of technology tools on group processes and outcomes depends on 1) the technology tools and 2) the emergent structures that form as group members interact with the technology tools over time (DeSanctis et al., 2008). Group members are a central aspect of AST, just as

[4] While we explain our rationale for AST, we do not argue that AST is the only relevant theory. While we believe that AST has the greatest amount of explanatory power relative to the issues we seek to examine, we recognize that other theoretical perspectives could be used to study online education. We thank an anonymous reviewer for making this helpful point.

students and faculty are a central aspect of online education. AST focuses on the manner in which group members form social structures as they use the technology tools (Orlikowski, 2000); in turn, these social structures impact organizational practices (DeSanctis & Poole, 1994).

We draw on an analogy from Shepherd and Martz (2006) to further explain AST. As technology tools are added to a process, they may restrict the flow of information from sender to receiver or otherwise cause the receiver to miss some information from the sender. The inherent characteristics of technology may serve as a filter that prevents all information from reaching the receiver. While the technology tools may be a constraint, AST proposes that the sender may be able to find alternative ways to send information and/or the receiver may be able to find alternative ways to decipher information based on what is allowed through the lens. Consistent with media richness theory, it might also be possible to enrich the technology so that it becomes more effective in transferring information from sender to receiver (Daft & Lengel, 1986).

This theoretical explanation is important because it directly supports the call for research on online education (Arbaugh et al., 2013). Using AST as the theoretical base, research questions on online teaching can be interpreted as 'how senders transmit information through the technology lens.' Research questions on online learning can be interpreted as 'how receivers interpret information through the technology lens,' and the development of online education tools can be interpreted as 'widening the technology lens.'

Table 1 shows a selection of prior research that has studied various aspects of online education. While the papers addressed different questions and researchers used different concepts to study the questions, the constructs in these studies can consistently be mapped to our conceptual model based on AST. This table reinforces the notion that AST is a valid theoretical basis for our work. Consistent with AST and prior research, the three factors that influence the

use of technology in business education are 1) characteristics of the technology and course design, 2) characteristics of student learning style and faculty teaching mode, and 3) internal and external institutional environment. Figure 1 provides a graphical representation of these factors. In the next section, we review prior research on each factor.

Insert Table 1 Here

Insert Figure 1 Here

Technology Tools and Course Design

We begin our review of prior research on technology tools and course design by discussing one of the first U.S. universities to develop and deploy advanced IT to support distance learning. The New Jersey Institute of Technology (NJIT) began the Virtual Classroom® project in 1986. The first version of software was programmed in FORTRAN, hosted on a minicomputer, and accessed through microcomputers in campus labs or from off campus through a modem (Hiltz, 1994). The text-based software enabled group discussion, individual messages, and the exchange of documents and diagrams. From 1994 to 1996, NJIT designed and offered entire undergraduate degree programs in Information Systems and Computer Science via Virtual Classroom® plus videotapes of lectures (Coppola, Hiltz, & Rotter, 2002). From 1997 to 2000, NJIT modified the software to an Internet-based version and began using it in other disciplines and graduate and certificate programs throughout the University.

As IT rapidly developed during the early 1990s, research described the manner in which technology tools could be applied in the classroom and for distance learning (e.g., Leidner & Jarvenpaa, 1995). In the classroom, faculty and students could use computers to automate certain steps of the instruction process. For distance learning, faculty could use communications technology to support synchronous exchange with students in remote locations, students could

use e-mail to support asynchronous communication with faculty, and students could use groupware to support synchronous and asynchronous collaboration with other students for assignments and projects.

By the mid-1990s, many of the technology tools described by Leidner and Jarvenpaa (1995) were deployable in the classroom for business school education. For example, Group Decision Support Software (GDSS) was used in teaching an MBA course (Alavi, 1994). The GDSS software featured tools to enrich student participation and learning in the course, including tools to generate alternative ideas, collect comments on ideas, categorize ideas, and evaluate alternative ideas using a variety of methodologies, such as ranking, scoring and voting.

For distance learning, faculty with different areas of expertise at the University of Maryland and University of Arizona applied technology tools to jointly teach an MBA course to students at the two universities (Alavi et al., 1997). The features of IT used in this effort bear a remarkable similarity to the 'new' distance-based technologies of today. For example, the faculty used videoconferencing to lead interactive discussions with students at both universities, and to bring in remote experts for specific segments of the course. The classrooms at both universities were equipped with a video wall that enabled a simultaneous display of remote presenters, visuals and student input. Students were able to ask questions verbally and electronically, and faculty could access the questions in the same manner. GDSS enabled students to discuss issues, organize information, and brainstorm ideas with students at the other university. Outside of class, students could use groupware to collaborate and communicate with each other (Alavi et al., 1997). Table 2 features a comparison of technology tools available in the 1990s with tools currently used in MOOCs.

Insert Table 2 Here

While these technologies were invented and available during the mid-1990s (Bilimoria, 1997), at that time they were deployed on a relatively limited scale to a small number of MBA and Executive MBA courses at large universities with the means to make the required investments in financial and human capital (Alavi & Gallupe, 2003). While the limited scale of deployment explains why these technologies did not lead to fundamental changes in teaching and learning at that time (Alavi et al., 1997), the expectation was that IT capabilities would continue to improve and standards would continue to consolidate, paving the way for distance education to become more effective and less expensive (Gilbert, 1996). This is precisely what occurred when the Internet was commercialized in the mid-to-late 1990s. The Internet's commercialization enabled education providers to offer the types of audio, video and data links described above to a broader audience at much lower cost than previous point-to-point linkages.

In 2001, Massachusetts Institute of Technology launched the OpenCourseWare initiative, with the aim to publish materials from all courses permanently on the Internet, including licenses to allow for use, modification and distribution of the course materials. Research noted the emergence of several startup companies to provide tools and services for technology-mediated learning (Alavi & Leidner, 2001), and developed frameworks to categorize technology tools based on their functionalities and capabilities (Alavi, Marakas, & Yoo, 2002). For example, one framework placed technology tools into four categories: 1) *staging tools* that provide the basic structure to manage and deliver courses online, 2) *course delivery tools* that enable the dissemination of course content, 3) *course collaboration tools* that facilitate interaction among students, groups and instructors, and 4) *assessment and learning tools* that gauge student learning against objectives and benchmarks (Singh, Mangalaraj, & Taneja, 2010). These

frameworks could then be applied to categorize and understand the application of technology tools to online education.

For example, one of the earliest MOOCs was the Stanford University course on Introduction to Artificial Intelligence. The faculty teaching this course used all four categories of technology tools described above, including *staging tools* (Moodle open source course management system), *course delivery tools* (Ustream video streaming, Pageflakes and Netvibes to aggregate RSS feeds, Twine semantic web service to collect and connect content), *course collaboration tools* (Elluminate synchronous web conferencing, Aiqus Q&A forums, Facebook discussion groups and Google+ virtual study sessions), and *assessment and learning tools* (ability to create computer code that can be instantly graded online, online quizzes at the end of most classes) (Rodriguez, 2012).

The most recent technology tools make progress on instruction-related tutoring and grading. For example, the online education firm Coursera employs a real-time search algorithm that can display related questions and potential answers even as a student types an inquiry, and enables students to vote and identify the most helpful answers (Waldrop, 2013). In a Stanford University online course on Human-Computer Interaction, each student submits his/her solution, the solutions from all students are combined to develop a global ranking, some solutions are graded by human experts, the graded solutions are embedded in the global ranking, and student grades are determined based on how their solutions compare with the expert-evaluated solutions (Cooper & Sahami, 2013). For qualitative writing, technology tools are increasingly able to evaluate key word use, rubrics and core concepts, evidenced by Massachusetts Institute of Technology machine grading software that matches the score of a human grader as accurately as a second human grader 85% of the time (Bonvillian & Singer, 2013). Not only do these most

recent technology tools bridge the gap between teaching and learning, they also open new possibilities for research on teaching and learning, as discussed further in the next section.

Student Learning Style and Faculty Teaching Mode

Research on student learning in online education falls into three broad categories: 1) ways in which technology tools can address student learning, 2) similarities and differences in learning outcomes between face-to-face, online and blended course formats, and 3) appropriateness of online education for various student types. The initial deployment of education-related IT during the 1990s was driven by research theories of student learning. Research describes the attributes of effective student learning processes, and the manner in which IT can be used to support each process (Alavi, 1994; Hiltz, 1994). In active learning, students construct knowledge and understanding by acquiring, structuring, analyzing and manipulating information (Schnell, 1986). Technology tools described in the previous section support active learning by increasing student involvement and facilitating the generation, exchange and analysis of information (Alavi, 1994). In problem-solving (learning by doing), students experience situations in which their mental models are tested, extended and refined until they are effective and reliable (Ansari & Simon, 1979). Students solve problems by developing knowledge about which actions lead to success and which actions lead to failure, and modifying their behaviors to include more successful actions and fewer problematic actions. Technology tools support problem-solving by exposing students to alternative perspectives and feedback from other students, which gives students an expanded knowledge base and enables them to evaluate and modify their mental models in a more timely and effective manner (Alavi, 1994). Cooperation and teamwork support learning by extending cognitive triggers beyond the individual student, and providing social support and encouragement for individual efforts (Glaser

& Bassock, 1989). Technology tools support cooperation and teamwork by facilitating information sharing and support for group processes (Alavi, 1994). For distance learning, desktop video conferencing supports collaboration and teamwork for students taking the same course on different campuses (Alavi, Wheeler, & Valacich, 1995). Subsequent developments in personal computing technology have further facilitated the dispersion of students, to the point where each student with a laptop or tablet computer and broadband Internet can be in any location and still be connected electronically to faculty and other students.

For the second category of research on student learning in online education, a recent paper in *Academy of Management Learning & Education* (Redpath, 2012) gives extensive coverage to research that compares outcomes for students who learn online compared with students who learn in the classroom. We note Redpath's observations that "Most comparative studies involving business courses support the argument that students learn just as effectively online as they do in the classroom…" (p. 128) and "Most researchers agree that there are likely to be minimal gains from additional studies to prove which mode of learning is better" (p. 130). We supplement these observations by noting research that finds benefits in blending in-class education with online education, to combine the advantages of face-to-face instruction where students can gain immediate verbal and non-verbal feedback from faculty with the advantages of online instruction where students can access content from any place at any time (Chou & Chou, 2011). Sixty-four percent of U.S. post-secondary institutions with more than 10,000 students offer blended learning courses, and a meta-analysis by the U.S. Department of Education notes that in some cases student outcomes were highest in blended instruction (Means, Toyama, Murphy, Bakia, & Jones, 2010; Parsad et al., 2008). For example, students in an Analog Circuits course at San Jose State University used Massachusetts Institute of Technology MOOC materials

for lectures and assignments, and used class time to work on lab and design problems with local faculty and teaching assistants (Fox, 2013). These students scored 5 percentage points higher on the first exam and 10 percentage points higher on the second exam than the previous cohort that used only traditional materials, and the pass rate (grade of C or better) increased from 59% to 91%. Related studies have included courses from multiple business disciplines such as marketing and international business, courses from multiple levels ranging from introduction to business to the business capstone course, multiple technology tools such as course management systems and wikis, and multiple content types such as factual questions and conceptual questions (Chou & Chou, 2011; Daspit & D'Souza, 2012; Klein, Noe, & Wang, 2006; Webb, Gill, & Poe, 2005). Such findings suggest further possibilities for online education to address the conveyance of information (first-order learning) and classroom education to focus on understanding and conceptual depth (second-order learning) (Bonvillian & Singer, 2013).

The third category of research on student learning in online education addresses the various types of students and the ways these students use technology tools in online education. Early research on technology in business education notes that some students learn best in an objectivist model in which they respond to stimulus, while other students learn best in a cooperative model where they interact with objects and other students (Leidner & Jarvenpaa, 1995). It should come as no surprise that there is a wide range of students in terms of motivation and ability, from students who are highly-motivated and self-directed to students who prefer greater structure and guidance (Siemens & Matheos, 2010). Because online education requires students to take more responsibility for their learning, a student's choice of course format may signal his/her motivation level (Klein et al., 2006). The range of students, matched with the range of online, in-class and blended class formats, suggests that some students may thrive in

online education while other students may be more suited to the traditional classroom (Nemanich, Banks, & Vera, 2009). Optimal learning occurs when the course format and faculty teaching style are aligned with the student learning style (Prosperio & Giola, 2007).

Research on faculty teaching in online education falls into two broad categories: 1) the manner in which technology tools support faculty teaching, and 2) the importance of faculty in online education. For the first category of research, technology tools support three roles of teaching for faculty (Coppola et al., 2002). The *cognitive* role of teaching deals with thinking, reasoning, analyzing and information storage. Technology tools, by capturing student questions in text form, enable faculty to be more reflective and deliberate in answering questions. Technology tools also facilitate a simultaneous response by all students to address a faculty question, enabling faculty to better understand and gauge student learning on a specific issue. The *affective* role of teaching deals with the faculty's relationship with students, and includes non-verbal communication. While technology tools lack some non-verbal cues found in face-to-face conversations, these gaps can be overcome through personal anecdotes, humor, shorthand and emoticons used in online environments (Redpath, 2012). The *managerial* role of teaching deals with the need for faculty to plan, organize, lead and control a course. The use of technology tools in online education requires faculty to make more of an initial effort, to organize materials and place them into a digital format, and prepare the artifacts for an online course. For the MBA@UNC program, each credit hour required about 100 hours of work for an instructor to create standardized lecture content (Byrne, 2012). While a cursory consideration may suggest the misleading view that some aspects of faculty teaching are supplanted by technology tools, the second category of research on faculty teaching in online education reinforces the critical importance of faculty. Research finds that effective online education

depends on qualified instructors and relevant content to the same extent as traditional classroom education (Nemanich et al., 2009). Given the range of student motivation and ability discussed above, online education requires faculty to intervene online and establish a digital presence in the form of discussion, encouragement and an understanding of individual student needs (Daniel, 2012). The less predictable and potentially more disruptive nature of online collaborative learning places a premium on careful instructional design and thoughtful supervision by the faculty (Baggaley, 2013).

Educators and researchers recognize that online education will provide an opportunity to extend theories of faculty teaching and student learning. When announcing the formation of edX, the president of Harvard University said: "We will not only make knowledge more available, but we will learn more about learning. We will refine proven teaching methods and develop new approaches that will take advantage of established and emerging technology" (Faust, 2012). Many MOOC platforms track every click students make as they use instructional resources, complete tests and other assessments, and engage in social interactions. The millions of students enrolled in these platforms provide significant potential to learn about learning. For example, the edX platform has enabled researchers to study "who the students were…, how they utilized course resources, what contributed to their persistence, and what advanced or hindered their achievement" (Breslow et al., 2013, p. 14). The knowledge gained from this research may enable faculty to better understand the individual needs of each student and apply adaptive technologies to meet those needs (Mazoue, 2013). The promise of greater personalization, along with changes in the institutional environment as discussed in the next section, are further motivating the adoption of technology tools in online education.

Institutional Environment

The institutional environment for universities is closely tied to the mission of teaching and learning, evidenced by Duke University's reflections on a partnership with the online education provider Coursera: "How well does the Coursera model…align with the University's distinctive strengths and strategic academic goals?...Would the partnership with Coursera generate new data that might improve teaching and learning?" (Lombardi, 2013, p. 240). The institutional environment for business schools includes cost, enrollment and funding pressures (Alavi et al., 1997; Friga et al., 2003). Over the past 30 years, university tuition costs have increased at a rapid pace. From 1981-82 to 2011-12, inflation-adjusted tuition and fees increased by 368 percent at public four-year college and universities and 281 percent at private four-year not-for-profit colleges and universities in the United States (College Board, 2011), while the inflation-adjusted median family income increased only 10 percent during a similar period (Butler, 2012). This has led to a corresponding increase in student borrowing, with over $1 trillion in outstanding student loans (Consumer Financial Protection Bureau, 2012), surpassing credit cards and auto loans as the second-largest component of U.S. household debt behind home mortgages.

Enrollment pressures are driven by demographic shifts and globalization – demographic shifts increase the volume of domestic students and globalization increases the volume of international students (Friga et al., 2003). From 2000 to 2010, total enrollment at degree-granting institutions in the United States increased 37% from 15.3 million to 21.0 million (U.S. Department of Education, 2012). Within this total, full-time enrollment increased by an even higher percentage (45%), from 9.0 million in 2000 to 13.1 million in 2010. While international students comprise a small portion of undergraduate students in the United States (0.3 million as

of 2010), the percentage of international students also increased significantly (32%) over the past 10 years (Institute of International Education, 2013). Exacerbating the challenge, the increase in enrollment is not evenly spread across institutions. Even as some institutions have struggled to deal with large increases in enrollment, other institutions have had difficulty attracting new students. For example, in the National Association of College Admissions Counseling 2014 College Openings Update, 470 colleges and universities self-identified as urgently seeking incoming freshmen or transfer students (Schifrin, 2014).

Even as U.S. universities have accommodated an overall increase in volume of domestic and international students over the past 10 years, the amount of funding states provided for public institutions declined from almost $8,000 per student in 2000 to $6,250 per student in 2010 (constant dollars) (Lederman, 2013). In fact, the 2010 state funding level of $6,250 per student is less than the 1985 state funding level of $7,250 per student (constant dollars). Universities have used a combination of debt and tuition increases to offset the decline in state funding per student, as long-term debt issuance increased from $7 billion in 2000 to $12 billion in 2012 and net tuition per student increased from $3,486 in 2000 to $5,189 in 2012 (constant dollars) (State Higher Education Executive Officers Organization, 2013).

The increase in enrollment combined with the decrease in state funding has forced many universities to shift their faculty composition toward part-time and non-tenure track positions. In the United States, the percentage of full-time faculty declined from almost 80% in 1970 to 51.3% in 2007, and the percentage of non-tenure track full-time faculty increased from 18.6% in 1975 to 37.2% in 2007 (Enhrenberg, 2012). Faculty composition impacts teaching and learning, as research shows that undergraduate persistence and graduation rates decrease when four-year academic institutions increase the use of full-time non-tenure track or part-time faculty

(Enhrenberg, 2012). Similar findings have been demonstrated in a business school context, as students who had a full-time faculty in their first principles of accounting course performed more highly in the subsequent finance course, enrolled more often in intermediate accounting courses, and chose more often to major in accounting, compared with students who had an adjunct faculty in their first accounting course (Kirk & Spector, 2009). In addition to a shift in faculty composition, some universities have responded to the dual pressures of increasing volume and reduced per-student funding levels by using online education to change their mission and scope, as we discuss further in the case analysis below. Table 3 provides a summary of prior research reviewed in this paper, organized according to the three factors in our conceptual model, and including selected references from our review.

Insert Table 3 Here

Analysis of Case Examples and New Ventures

The interaction of technology tools with theories of teaching and learning, accompanied by significant changes in the institutional environment, are leading to significant transformation in some education institutions. This premise is consistent with Adaptive Structuration Theory, which indicates that technologies are products of organizational context (institutional environment) and that new technologies must be blended with organizational practices (student learning style and faculty teaching mode) in order to lead to changes in group behavior and outcomes (DeSanctis & Poole, 1994; Orlikowski, 1992). Appendix 1 features the case facts for three educational institutions – Western Governors University, Brigham Young University-Idaho, and University of North Carolina-Chapel Hill (MBA@UNC) that have used technology

tools to change their mission and scope.[5] We use the conceptual model to draw three implications from these case examples.

First, the institutional environment was an integral part of each university's decision to deploy education-related technology tools. In the case of Western Governors University, the state governors had a public interest to simultaneously increase the access to education and reduce the cost for their constituents. The need to serve multiple geographies (19 states at the time, now nationwide) and the ability to share costs across different state budgets created momentum to invest in a new online institution rather than expanding existing physical facilities. In the case of Brigham Young University-Idaho, the Mormon Church had a 'zero standard' for growth, which meant that its educational institutions would need to serve a larger number of constituents without expanding existing physical facilities. The church also established the objectives to serve the educational needs of its worldwide members and to help high school students successfully transition to its college-level institutions; both of these objectives also supported Brigham Young University-Idaho's decision to incorporate online education. For MBA@UNC, University of North Carolina-Chapel Hill believed it had a market opportunity to expand its highly-ranked MBA program beyond the mid-Atlantic region, a viewpoint supported by the fact that only one other Business School ranked in the top 20 by *BusinessWeek* magazine (Kelley School of Business at Indiana University) offered an online MBA. This implication supports the conceptual model developed in this paper, by demonstrating the importance of institutional environment to the use of IT in business education.

[5] While Western Governors University, Brigham Young University-Idaho and MBA@UNC represent examples of institutions that have expanded or transformed their missions partly through the use of education-related technology tools, we do not claim a wide adoption for the use of IT to offer fully online business degrees. Even though the number of AACSB-accredited institutions offering an online BBA degree increased from four in 2001 to 39 in 2012, this means that less than five percent of not-for-profit universities offer an online undergraduate business degree.

The second implication from these cases is that universities may deploy technology tools to a different extent based on their objectives. In the case of Western Governors University, courses are exclusively delivered via technology tools at this entirely online university. Brigham Young University-Idaho uses a blend of online education with face-to-face instruction, as even on-campus students must take one online course per semester to help the university maximize student throughput of its existing facilities. While MBA@UNC delivers most of its curriculum using technology tools, the program does involve two in-person sessions in North Carolina to strengthen the sense of community and help students form personal relationships with each other and with faculty and staff. The third implication, reinforcing the interaction of technology tools, student learning and faculty teaching, and institutional environment, is the critical role of faculty to implement online education initiatives. In the case of Brigham Young University-Idaho, the University completely redesigned faculty roles and compensation to focus exclusively on teaching and pedagogical research during the entire year, with no tenure and renewable contracts. In the case of MBA@UNC, getting the program off the ground was a substantial undertaking for University of North Carolina-Chapel Hill faculty, requiring roughly 100 hours per credit hour for an instructor to create standardized lecture content.

In addition to the deployment of IT at individual universities, other significant changes are occurring through new ventures that are not individual universities**.** In Appendix 2, we provide details on two examples (edX and Coursera) to illustrate the type and range of ventures; here we discuss implications of new ventures based on the conceptual model in this paper. The first implication, building on the institutional component of our conceptual model, is to recognize that not all new ventures will succeed or even survive. In the introduction section, we discussed the examples of Semester Online and UNext, which disbanded or never materialized

after being founded with great fanfare by leading universities. Blackboard, the education technology company that emerged during the dot.com era and produced software that is now used at many universities, was one of the only enduring ventures out of many startup companies during that time (Alavi & Leidner, 2001). Udacity, a for-profit venture that began when two Stanford University faculty offered their Introduction to Artificial Intelligence course online and 160,000 students in 190 countries enrolled, has already announced a shift in its strategy from college education to professional training. Coursera, which had announced Coursera Career Services to help students find companies that match their interests, skills and knowledge, has already discontinued that effort.

While we are not able to predict the success of any individual venture, we believe these examples illustrate that new ventures will emerge from and generate further developments for the use of IT in business education.[6] Some of these ventures will be founded directly by large research universities as non-profit organizations (such as edX) or indirectly by their faculty as for-profit institutions (such as Udacity) while others will be collaborations between universities and for-profit institutions (such as Coursera or MBA@UNC). The second implication, building on the technology component of our conceptual model, is to note the strong computer science foundation for many of these new ventures. A significant proportion of courses offered on edX and Coursera are computer science and technical courses. Just as the Massachusetts Institute of Technology OpenCourseWare initiative was one of the first MOOC projects in the early 2000s, the continuing presence of computer science and technical courses in online education today reinforces the importance of incorporating technology tools and a systems perspective into

[6] Our expectation for emerging ventures in higher education is based on the experience with electronic commerce ventures during the mid-1990s. While not all electronic commerce ventures developed successful business models, the subset of ventures that did significantly changed their industry segments. For example, Amazon.com significantly impacted online retailing and Google significantly impacted search-based advertising.

considerations of online education. The implications from our analysis of case examples and new ventures are summarized in the second column of Table 4.

Insert Table 4 Here

FINDINGS AND RESEARCH OPPORTUNITIES

As discussed above, research recently published in *Academy of Management Learning and Education* encourages scholars to confront the bias against online education (Redpath, 2012) and engage in serious research concerned with online management instruction and instructors (Arbaugh et al., 2013). In this paper we use Adaptive Structuration Theory (AST) to develop a three-factor conceptual model (technology tools, student learning and faculty teaching, and institutional environment) that generates additional findings to complement the recommendations of Redpath (2012) and Arbaugh and colleagues (2013). In this section we state and provide additional support for each finding, and then we provide recommendations and recognize challenges for business schools and faculty.

Consistent with prior research that demonstrates a variety in student motivation and abilities, the first finding based on AST and our conceptual model is that *the same technology tool may be used in different ways by different students, and the same student may use different technology tools in different ways.* A multi-disciplinary research team from Harvard University and Massachusetts Institute of Technology analyzed 230 million student interactions with technology tools in the edX course on Circuits and Electronics. There was significant variation in the extent to which students used the technology tools. Seven percent of course participants earned a certificate in the course, and these participants averaged 100 hours and accounted for 60% of total time spent online for the course (Seaton, Bergner, Chuang, Mitros, & Pritchard, 2014). At the same time, 76% of participants merely browsed some materials and accounted for

only 8% of total time spent online for the course. Even among the more homogenous group of students who earned a certificate, half of certificate earners accessed less than half of the lecture videos and questions (Seaton et al., 2014). When considering the full range of certificate and non-certificate earners, the variability in use of technology tools becomes even more pronounced. In a University of Pennsylvania Principles of Microeconomics course, only 41% of registered participants accessed any lecture content, only 9% of registered participants remained engaged halfway through the course, and only 6% of registered participants completed the course. While these percentages may be slightly higher due to the zero-price nature of early-stage MOOCs (i.e., it might be less likely for a paying student to abandon a course), this trend persisted across a range of subjects and a large number of students. A University of Pennsylvania Graduate School of Education report involving 1 million students found that only 4% of registered students completed MOOCs and that half of registered students never even viewed a lecture (Cusumano, 2014). This variability across students also occurs across technology tools. While early MOOC courses involve many technology tools, 75% of respondents in one study indicated that three tools alone (daily e-mail newsletter, course management system, and wiki collaboration document) were sufficient to understand what a course intended (Rodriguez, 2012). While universities and faculty have a range of technology tools at their disposal for online education, additional work is required to understand how various types of students will use the technology tools, which technology tools are more likely to be used compared with other tools, and which technology tools are more likely to be effective compared with other tools, which leads directly to our second finding.

The second finding of our conceptual model, also consistent with AST and based on the interaction of users with technology tools, is that *technology tools have differential impacts on*

student learning and faculty teaching. For example, technology tools can be categorized as level 1 (messaging capabilities) versus level 2 (task structuring and information manipulation). Research has found that groups using only level 1 technology tools can actually underperform groups that use manual processes (DeSanctis et al., 2008) and that level 1 tools such as discussion boards may not deepen analytical and evaluative learning (Revere & Kovach, 2011). These are important insights in that scholars may use encompassing terms such as 'online education' without recognizing that the different technology tools and applications in online education may have vastly different impacts for student learning. Research also suggests that the various types of technology tools may have vastly different impacts for faculty teaching. For example, many common technology tools such as online library materials, electronic submission of assignments, and course management systems are non-disruptive and allow faculty to teach in the same way they have taught throughout their careers (Siemens & Matheos, 2010). Going back to the *Academy of Management Journal* research we quoted at the beginning of this paper, Alavi and colleagues (1997) reported that early automation efforts did not lead to fundamental changes in teaching and learning: "Instead, in many instances computers and communications technologies have replaced or augmented blackboard and chalk for instructors and paper and pencils for students" (p. 1312). We have not moved completely past this point even with advancements in IT over the past two decades. Watson and colleagues (2008) note that we will only fully realize the power of technology tools when they enable new and more productive roles in teaching and learning and new organizational structures, which leads to our third finding.

The third finding, based on the institutional component of our conceptual model, is that *different types of institutions will deploy technology tools to meet different objectives*. For example, many of the founders and partners for edX and Coursera are large research universities.

Over time, these large universities have typically had sufficient financial resources to engage in online education to enhance their enterprise and grow their brands, even if the online initiatives do not directly increase their revenue (Enhrenberg, 2012). Georgia Institute of Technology articulated the strategy that MOOC courses "allow us to reach a wider audience – including millions of people in India and China" (gatech.edu). Duke University's reflections on its partnership with Coursera illustrate the thinking of large research universities: "What will the college experience be from now on…?...[A partnership with Coursera could enable Duke to] produce a library of multi-disciplinary assets that faculty could recombine, remix, and repurpose to build new and different learning experiences" (Lombardi, 2013, p. 239, 240). On the other hand, regional universities may need to use online education to more directly generate tuition revenue while using a reasonable cost structure. For example, the Academic Partnerships program that works with 20 U.S. regional public universities has been able to recruit up to 30% of enrollment for their partner universities (Daniel, 2012). Five state-branded Western Governors University (WGU) subsidiary programs have now been established – WGU Indiana (established 2010), WGU Missouri (2013), WGU Tennessee (2013), WGU Texas (2011), and WGU Washington (2011). WGU Indiana graduates accounted for 10% of the 2010-11 increase in new bachelor's degrees awarded by public universities in Indiana. If the number of WGU Indiana graduates grows at its current rate, it will account for over half the growth in new bachelor's degrees in three years without any direct funding from the state of Indiana (Mendenhall, 2012). Because of the differences across institutions, each university will need to understand the fundamental qualities of its educational offerings, how it will communicate and differentiate that value from alternatives, and how it can use online education to substitute for existing activities in ways that will strengthen the university (Marshall, 2013). To address these

types of issues from a research standpoint may require large-scale studies across multiple institutions or campuses (Shea, 2007). In terms of the financial differences between large research universities and regional universities, it would be useful to develop models of how different types of institutions can generate the appropriate economic returns from their online education activities (Dellarocas & Van Alstyne, 2013).

The fourth finding may extend our model to its furthest point, with the *need to consider other stakeholders beyond students, faculty and university institutions*. For example, will online education be viewed by industry as a viable alternative to traditional education, and what degree of enthusiasm and commitment will employers have when it comes to opportunities to hire graduates from online institutions? While some initial research suggests that recruiters may be willing to consider graduates from online institutions (Tabatabaei & Gardiner, 2012), more work is necessary in this area. On an even broader level, if online education significantly lowers the cost of a college education and increases the supply of college graduates relative to available jobs, what will be the implications for society, the economy and wages?[7] Is there a possibility that increasing the supply of college graduates (all else equal) could reduce the lifetime value of a college degree? Again, these are significant questions that invite research contributions beyond the scope of what occurs in any single classroom or at any single institution. We summarize the four findings discussed in this section in the third column of Table 4.

Recommendations and Challenges

Based on our research and the theoretical insights on which it is based, we offer three recommendations for business schools and faculty to respond to these developments in online education. All three recommendations include parallels at the business school level and individual faculty level. Our first recommendation, for business schools that are not yet

[7] We thank an anonymous reviewer for broadening our thinking to include this finding.

undertaking such effort, is to initiate some actions for the purpose of gaining knowledge about and experience with online education. We cannot imagine any circumstance where it would be possible for a business school to navigate the future landscape without some primary knowledge of developments in online education. There are many ways to gain such knowledge and experience – by offering one or a small number of online courses, by having faculty take one or a small number of online courses, by having faculty, staff and/or administrators attend one of the increasing number of conferences on this topic, participating in consortia or academic working groups, etc. We believe that business school faculty can play a leadership role in these efforts, because the underlying challenges are grounded in business-related disciplines and because business school faculty have close industry relationships, through teaching and research partnerships and participation in recruitment and alumni activities. Many business schools have advisory councils that include executives and managers across a range of firms and industries. Business school faculty and administrators can leverage these partnerships to stay close to the marketplace and translate the knowledge acquired through these interactions for the benefit of their universities. The business community can provide insights on desired qualities for graduates as well as timely feedback on whether these qualities are being achieved as institutions refine their mission and strategy. From an implementation perspective, many business faculty and administrators are knowledgeable about and comfortable with the types of frameworks used to formulate actions based on mission and strategy (Boyer, 1990; Ray, Baker, & Plowman, 2011). At the individual level, each faculty member will need to engage in a sustained program of reflection, experimentation and refinement to identify the set of online education methods and technology tools that will work best for their courses. Given the range of disciplines in business schools, the different types of knowledge taught in introductory courses compared with specialty

electives, and the tremendous variability in student learning styles and faculty teaching modes, there will be no single best answer for all business schools or all faculty. Each business school and each faculty will need to find what works best in their unique context.

Our second recommendation is for individual business schools to carefully examine their mission and strategy as a foundation to select the most appropriate role for online education. Educational institutions have different missions, causing them to serve different stakeholders and provide different outcomes. Accordingly, we expect developments in online business education described above to have differential effects on various types of universities. Prior research has used a typology to generate propositions for how universities might adapt their strategies based on developments in distance education (Fornaciari, Forte, & Mathews, 1999). For example, universities can be classified according to multiple dimensions such as large versus small, national versus regional, public versus private, and low cost versus high cost. While institutional classification can inform mission and strategy, mission and strategy are not solely restricted by classification. Brigham Young University-Idaho and Western Governors University provide examples of institutions that carefully selected their mission and strategy and then implemented online education to fit their mission and strategy. At the individual level, faculty will want to align themselves with universities where their career objectives and individual strengths are consistent with the institution's mission and strategy. We do not propose that every faculty needs to learn to teach MOOCs; rather, we simply argue that just as every business school must have some knowledge and familiarity with online education so they can respond through their institutional mission and strategy, individual faculty should also understand the manner in which technology changes, institutional environment and phenomena such as winner-take-all markets may affect the roles of business school faculty.

Our third recommendation is based on our review of prior research that is concerned with online education.[8] During the 1980s and 1990s, large research universities such as the New Jersey Institute of Technology and the University of Maryland made significant financial investments in facilities and equipment for online education. Just as important as the investment of financial capital was the tremendous investment of human capital for faculty and doctoral students to study and publish research on online education. This investment continues to pay dividends, in that the research produced by faculty at large research universities during the 1990s and early 2000s forms the foundation for what we know about online education. While a number of individual scholars have moved forward the discussion of online education in *Academy of Management Learning and Education* and other important journals, we believe it is time for large research universities to collectively resume their past leadership in this domain. Large research universities have played an active role in forming online ventures such as edX and Coursera, they are gaining valuable experience by teaching many courses on these platforms, and they have the volume of faculty and doctoral student resources to have a significant impact on the research and practice of teaching. The next step is for large research universities to combine their experience with their resources to produce research that will drive the next generation of online education, for the benefit of students, faculty, institutions and society in general. Our recommendations are summarized in the fourth column of Table 4.

We acknowledge at least two challenges that universities will face as they consider our recommendations to make progress in online education. First, as faculty-governed institutions, universities are less able to have external partners execute the changes in the same way that private-sector institutions can engage consultants for enterprise-wide change initiatives. Faculty must remain responsible for the core activities of teaching, research and service, even as they

[8] We thank an anonymous reviewer for helping us to develop this recommendation.

work with administrators to re-examine and re-invent the mission and strategy of their institutions. And faculty must teach current subjects to current students, even as they develop new courses, new formats and new programming. Limitations of faculty time will pose one challenge as universities re-position themselves for the future of education. A second challenge is that by their very nature, universities are enduring institutions with stable principles, and have been (to this point) less susceptible to change than other private- or public-sector institutions. It would not be wise or responsible to drastically change in response to every marketplace challenge or to adopt every new management practice. However, as discussed above, the confluence of economic and technological factors is leading to significant change in business education, and we believe developments will unfold rapidly. These developments may lead to serious organizational conflict as in the highly-publicized presidential leadership crisis at the University of Virginia (Kiley, 2012; Marklein, 2012), and other instances where faculty from large research universities such as Duke University (Heller, 2013) to regional universities such as San Jose State University (Lewin, 2013) have pushed back at the intrusion of MOOCs on their campuses (Davidson, 2013). At Harvard University, several dozen Arts and Science professors signed a letter to their dean asking for formal oversight of the courses offered by the university through edX, referring to the university's brand within the edX platform and expressing concern about the program's cost and consequences (Kolowich, 2013).

Significant issues also remain in the institutional environment within universities, such as the promotion and tenure system or faculty reaction to developments in online education (Coppola et al., 2002; Ives & Jarvenpaa, 1996). While the promotion and tenure system was designed to ensure academic freedom, the tenure system involves an incentive structure that is not conducive to change. The resistance to potential changes stemming from online education

has been reflected in prior research, including when faculty at the University of Hawaii went on strike to protect intellectual property rights for materials in distance courses and when faculty at the University of Washington signed an open letter opposing the governor's initiative to use virtual universities to lessen the need for more physical campuses. Business school faculty are well aware of firms and industries that have experienced sudden and significant changes that are caused by the same economic and technological factors now facing business education. Many faculty have researched firms and industries that have been displaced by sudden and severe economic and technological changes or have used these examples to teach students why organizations must be responsive and proactive. Let us be mindful of these lessons for our 'industry' of business education, for our universities, and for our own faculty careers.

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Figure 1

Factors that influence the use of IT to deliver business education

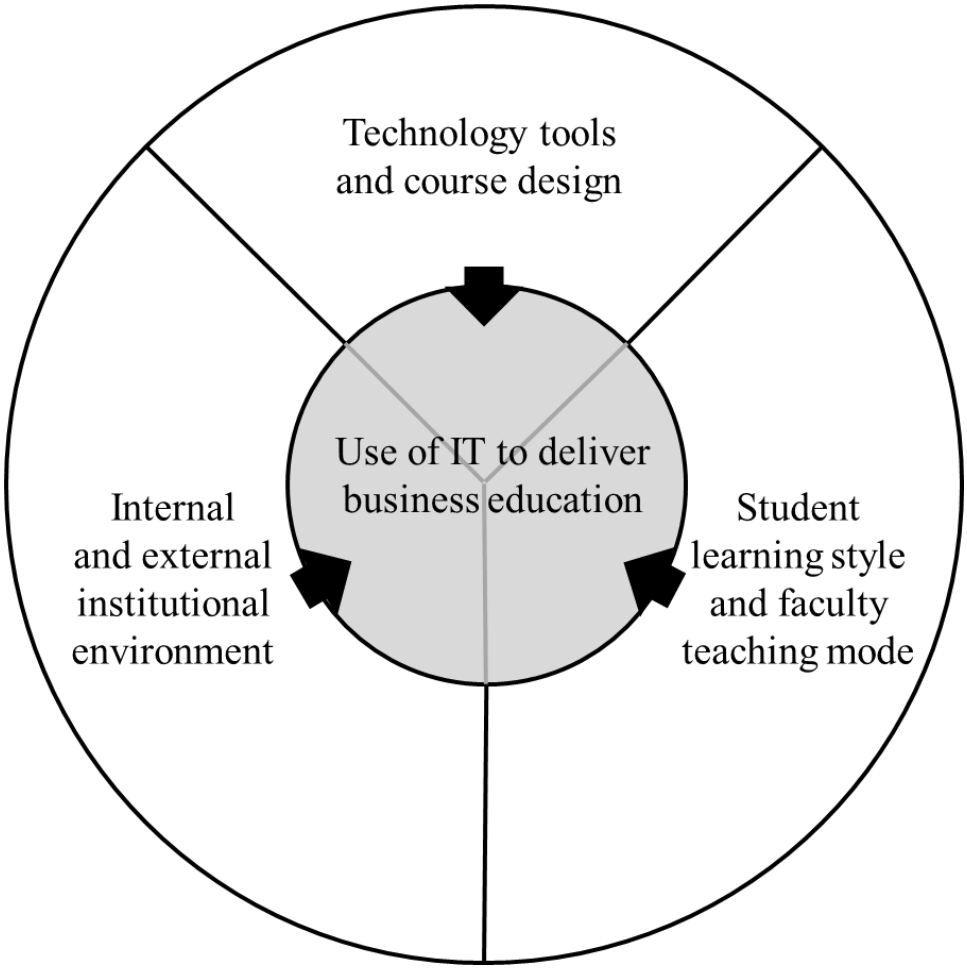

Table 1

Constructs in research on online education

This table lists constructs in selected online education research, and illustrates how these constructs can be mapped into our conceptual model based on Adaptive Structuration Theory.

	Reference, topic and constructs				
Conceptual model factors in this paper	(Alavi & Leidner, 2001) Call for research on technology-mediated learning	(Ivancevich, Gilbert, & Konopaske, 2009) Dialogue in online management courses	(Lee & Choi, 2011) Factors leading to online education dropout	(Wan, Fang, & Nuefeld, 2007) Role of IT in technology-mediated learning	(Webster & Hackley, 1997) Outcomes in technology-mediated distance learning
Technology tools and course design	• Information technology • Instructional strategy	• Technological characteristics • Dialogue resources	• Course/program factors	• Technology • Instructional design	• Technology characteristics • Course characteristics
Student learning style and faculty teaching mode	• Psychological learning processes • Learning outcomes	• Student characteristics • Instructor characteristics • Student-technology interface variables • Dialogue • Perception of dialogue • Learning outcomes	• Student factors	• Primary participants (student, instructor) • Learning processes • Learning outcomes	• Student characteristics • Instructor characteristics
Internal and external institutional environment	• Program level • Organizational level	• Organizational characteristics	• Environment factors		

Table 2

Comparison of technology tools: 1990s vs. current MOOCs

	1990s technology tools	Current MOOCs[9]
Interactive class discussion by video	Yes	Yes
Interactive class discussion by text-based message	Yes	Yes
Student-to-faculty individual messages	Yes	Yes
Archived lectures	Yes (*video tapes*)	Yes
Student access from computer in campus lab	Yes	Yes
Student access from computer off campus	Yes (*modem required*)	Yes
Student online collaboration for group projects	Yes	Yes
Document storage and retrieval	Yes	Yes
Interactive quizzes with automated grading	No	Yes
Connectivity	Site-to-site (*among one or small number of campuses*)	Global
Reliability	Reported some software bugs or facilities/maintenance limitations	High
Cost	Upfront capital investments required for connectivity	Limited incremental investment
Extent of penetration	Limited to universities with large capital budgets	*to be determined*
References and examples	(Alavi, 1994) (Alavi et al., 1997) (Alavi & Gallupe, 2003) (Hiltz, 1994) (Leidner & Jarvenpaa, 1995)	Coursera.org edX.org Udacity.org

[9] MOOC functionality assumes internet access.

Table 3

Prior research on online education

This table summarizes the themes of research reviewed in this paper, categorized by the three factors in our conceptual model. For full details and references, see the paper section 'Using IT to Deliver Business Education.'

Factor	Themes and selected references
Technology tools and course design	• Early deployment of advanced IT to support distance learning (Coppola et al., 2002; Hiltz, 1994) • Manner in which technology tools could be applied in classroom and for distance learning (Alavi, 1994; Alavi et al., 1997; Leidner & Jarvenpaa, 1995) • Commercialization of Internet technologies related to online education (Alavi & Leidner, 2001; Alavi et al., 2002; Singh et al., 2010) • Massive open online course (MOOC) technologies (Bonvillian & Singer, 2013; Cooper & Sahami, 2013; Rodriguez, 2012; Waldrop, 2013)
Student learning style and faculty teaching mode	Student learning style • Ways in which technology can address student learning (Alavi, 1994; Alavi et al., 1995; Hiltz, 1994) • Similarities and differences in learning outcomes between in-class, online and blended learning formats (Chou & Chou, 2011; Klein et al., 2006; Redpath, 2012) • Appropriateness of online education for various learning types (Leidner & Jarvenpaa, 1995; Nemanich et al., 2009; Prosperio & Giola, 2007) Faculty teaching mode • Manner in which technology tools support faculty teaching (Coppola et al., 2002; Redpath, 2012) • Importance of faculty in online education (Baggaley, 2013; Daniel, 2012; Nemanich et al., 2009)
Internal and external institutional environment	• Cost, enrollment and funding pressures for universities (College Board, 2011; Friga et al., 2003; U.S. Department of Education, 2012) • Shift in composition of faculty toward non-tenure track and part-time (Enhrenberg, 2012; Kirk & Spector, 2009)

Table 4

Summary of analysis, findings and recommendations

This table relates the analysis, findings and recommendations in this paper to the three factors in our conceptual model. For full details, see the paper sections 'Analysis of Case Examples and New Ventures' and 'Findings and Opportunities.'

		Technology tools and course design	Student learning style and faculty teaching mode	Internal and external institutional environment
Analysis of case examples and new ventures	• Institutional environment is an integral part of each university's decision to deploy education-related technology tools.	X		X
	• Different universities deploy education-related technology tools to a different extent, based on their objectives.	X		X
	• Faculty play a critical role in implementation of online education initiatives.		X	
	• Similar to electronic commerce in the 1990s, not all new online education ventures will succeed or even survive.			X
	• Many new online education ventures have a strong computer science foundation.			X
Findings based on prior research and conceptual model	• Same technology tool may be used in different ways by different students, and the same student may use different technology tools in different ways.	X	X	
	• Technology tools have differential impacts on student learning and faculty teaching.	X	X	
	• Different types of institutions will deploy technology tools to meet different objectives.	X		X
	• Need to consider other stakeholders beyond students, faculty and university institutions.			X
Recommendations for business schools and faculty	• Each university institution will need to make some effort to gain knowledge and experience with online education.			X
	• Faculty will need to engage in a careful process to find what online education tools are best suited for their courses.	X	X	
	• Individual business schools will need to carefully examine their mission and strategy, and select the role for online education that best fits their mission and strategy.			X
	• Faculty will want to align themselves with institutions where their career objectives and individual strengths are consistent with the institution's mission and strategy.		X	X
	• Large research universities should resume their leadership role in the research of online education.			X

Appendix 1
Case facts for institutional transformation using education IT

This table provides case facts for three institutions that used IT to transform their educational mission and scope. Analysis for these cases in the paper section 'Case Analysis.'

Case 1: Western Governors University

This case describes an entirely online university that uses IT to reach a lesser-served segment of students at low cost.

Overview and background: Western Governors University was established in 1997 by the governors of 19 U.S. states, as an entirely online university. The Western Governors University College of Business offers the BBA degree in accounting, marketing, management, IT, sales and HR, and the MBA degree with a general focus or a specialty in IT or health care management. While Western Governors University's business programs are not accredited by the AACSB, the university is accredited by four regional accrediting agencies (the only university to be accredited by four due to its geographic reach). Western Governors University receives financial support from many major corporations, including AT&T, Dell, Google, Hospital Corporation of America, HP, and Microsoft.

Technology use and outcomes: Western Governors University has used its online platform to reach a large body of students (over 50,000 students enrolled from all 50 states as of October 2014, and over 10,000 students graduating each year), in a lesser-served segment (student average age 36 years old, 68% work full time), at a low cost (tuition for most undergraduate programs including business is a flat rate of $2,890 per six-month term, and MBA tuition is $3,250). Western Governors University has combined entirely online instruction together with a competency-based progression and dedicated student and course-level mentoring and support (Ray et al., 2011) to achieve a graduation rate 14–28 percentage points higher than peers in other institutions at every age range, except entering students less than 20 years old. Since awarding its first degree in December 2000, the number of graduates has grown by more than 50% per year and Western Governors University recently awarded its 25,000th degree. Western Governors University reports that "98% of employers rate WGU graduates equal to or above their counterparts who graduated from other colleges and universities" and "97% rate WGU graduates' ability to analyze or solve problems at or above their counterparts" (wgu.edu). Western Governors University was ranked #28 in *Fast Company* magazine's 2013 ranking of the world's most innovative companies.

Case 2: Brigham Young University-Idaho

This case describes a traditional university that uses IT to expand its mission at a reduced cost.

Overview and background: In 1997, Ricks College had 8,600 students, intercollegiate athletic programs and performing arts were among the best of any two-year colleges, and the institution was operating in a cost-efficient manner. The major institutional challenge was how to serve more students to meet applicant demand and better serve the Mormon Church, while meeting the church board's 'zero-standard' for growth, which capped the number of faculty positions and building square footage at their universities and colleges (Christensen & Eyering, 2011). In June 2000, Ricks College announced that it would become the four-year Brigham Young University-Idaho. Key components in the plan included serving more students using IT, operating the school year-round through innovative scheduling, focusing on key academic disciplines and activities, phasing out intercollegiate athletics, not offering graduate degrees, and not including faculty rank as part of the academic structure (Christensen & Eyering, 2011).

Technology use and outcomes: In spring 2013, Brigham Young University-Idaho served 14,045 undergraduates on the Rexburg campus and another 6,852 through four online associate and nine online bachelor's degree programs, an increase of approximately 80% in online enrollments over the prior spring semester. Brigham Young University -Idaho is using online education to expand its capacity, and to serve its students at a relatively low cost. For example, the Online Concurrent Enrollment program enables high-school juniors and seniors to earn Brigham Young University-Idaho credit while still in high school ($30 per credit for fall 2013); and the Pathway program enables students in 10 countries to begin with Academic Start classes and then advance into degree programs including Professional Certificates, Associate's Degrees or Bachelor's Degrees (bachelor's degree cost about $8,000, with a lower price for students outside the United States).

Appendix 1 *(continued)*

Case facts for institutional transformation using education IT

Case 3: MBA@UNC

This case describes a top-ranked university that used IT to create a new business education program in which the focus is high quality not low cost.

Overview and background: Kenan-Flagler School of Business at University of North Carolina-Chapel Hill (ranked by *BusinessWeek* magazine as the #10 undergraduate business program and #17 MBA program in the U.S., as of June 2014) collaborated with the for-profit startup 2U to offer the online MBA@UNC beginning in fall 2011. At the time, MBA@UNC was one of only two programs offered online by a business school regularly ranked in the top 20 (Kelley School of Business at University of Indiana-Bloomington first offered an online MBA in 1999). 2U had $68 million in venture funding, and invested $10 million in MBA@UNC. Students starting July 2014-June 2015 can expect to pay at least $96,775 for the entire program, which generally takes 24-36 months to complete.

Technology use and outcomes: Students normally take two live (synchronous) 90-minute online classes each week. They are expected to spend another six to eight hours per week on asynchronous learning (video-recorded lectures and cases) and a further six to eight hours per week on group projects, readings and homework. Students are reported as devoting 20-25 hours each week to the program (Byrne, 2012). Nineteen students were in the inaugural class and 551 students were enrolled as of June 2014, a larger number of students than are enrolled in University of North Carolina-Chapel Hill's traditional MBA program. After 'attending' a class session, one business journalist said the "virtual classroom...is more intimate than 90% of the seminars I've taught in or taken" (Cohen, 2012).

Appendix 2

Case facts for new institutions using education IT

This table provides case facts for two new institutions that are bringing changes in online education. Analysis of these cases in the paper section 'New ventures.'

Case 1: edX *This case describes a relatively new partnership of existing not-for-profit universities.*
Overview and background: edX was announced by Harvard University and Massachusetts Institute of Technology in May 2012, offered its first course in fall 2012, and is scheduled to offer 397 classes as of December 2014. Forty-seven of these courses are listed in the categories of business and management or economics and finance. Harvard University and Massachusetts Institute of Technology each contributed $30 million to the venture (Crotty, 2012), making edX one of the better-financed educational start-ups. Harvard Business School has launched an online learning initiative, which is expected to offer business courses through edX starting in 2014 (Lavelle & Zlomek, 2013). The edX consortium currently includes 37 charter colleges and universities and 17 other member universities (edX.org). **Offerings and business model:** edX offers certificates of mastery under the name of the partner university to indicate that a student has completed the course. While certificates of mastery have been free thus far, "this may change in the future to help cover our costs" (edX.org). A proctored certificate can also be awarded to students who pay a fee and pass an exam in a proctored facility, in addition to completing the coursework. edX reports that its "students have used certificates of mastery on university or job applications, or with their employers to showcase their abilities" (edX.org).
Case 2: Coursera *This case describes a partnership of not-for-profit universities and a relatively new for-profit institution.*
Overview and background: Coursera was founded by two Stanford University computer science faculty with total venture funding of $22 million (Adams, 2012), and recently raised an additional $43 million (Anders, 2013). As of December 2014, the Coursera website lists 892 courses in 25 categories including business and management, economics and finance, and statistics and data analysis. Courses are provided by 117 partners that are primarily large research universities. Coursera plans to adapt the most highly-regarded parts of each partner university's curriculum (Kolowich, 2012), and reports that more than 10.7 million students have signed up for at least one course. Coursera has now begun to work with ten U.S. state university systems to use MOOC technology and content to improve the access, quality, and completion to higher education, across the universities' combined enrollment of 1.25 million students and Coursera's own network of students (coursera.org). *Fast Company* magazine ranked Coursera #40 on its 2013 list of the world's most innovative companies. **Offerings and business model:** While Coursera currently offers courses for a certificate of completion and not for academic credit, the American Council on Education (ACE) recommends degree credit for five courses offered by Coursera from University of California-Irvine, Duke University, and University of Pennsylvania (Chea, 2013). ACE recommendations are generally accepted by over 2,000 colleges and universities. While the courses are free, students seeking credit will pay $100-$190 to verify their identities, take exams monitored by webcam, and receive transcripts with the ACE credit recommendations (Chea, 2013). Offering certificates for Coursera courses is another approach some universities are considering as a means of generating revenue (Young, 2012).