2010

Security Assessment Taxonomy

Winston Chong
Shandong University, China, wchong@shandong.edu.cn

Lee Shen
Shandong University, China, lshen@shandong.edu.cn

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Winston Chong
Shandong University
Jinan City, Shandong Province, China
wchong@shandong.edu.cn

Lee Shen
Shandong University
Jinan City, Shandong Province, China
lshen@shandong.edu.cn

Abstract:

Learning today has shifted from face-to-face curriculum to distance learning. Recent advances in distance learning bring major changes in education and educators take different roles in teaching courses. As technology offers a great potential for distance learning, many schools have been adopting this innovative approach. This paper explores a project undertaken by a large US university. We examine a security course that employs a distance learning environment and investigate how this environment affects learners and educators. Our findings indicate that distance learning is not considered a superior teaching method; on the contrary, in many cases, students reported on technical difficulties working with an on-line system. We conclude that further study and research of this method is warranted in order to determine the long-term benefits of using distance learning and to address its many challenges.

Keywords: Learning, Simulations, Pedagogy.

I. INTRODUCTION

The use of technology-driven method in the classroom is becoming very popular with students. Today, most university degrees in business or technology address technology in some way or other in their curricula. Given the dynamic nature of the content, continuously evolving business models and applications, technological and managerial challenges in technology transformation, ever-expanding knowledge in the interacting disciplines and, importantly, its multi-disciplinary focus, it is a challenge for business schools to design and redesign technology-driven courses that are relevant, 'current' and pedagogically effective. An earlier version of this paper discussed the notion of distance learning and its potential applications (Chong and Kasemanandan 2010). This paper discusses a model of technology-driven course curriculum and reports on its effectiveness.

The first part of the paper gives a detailed review of the literature and provides a background to the development initiatives from a business school perspective. It then describes a specific course, namely, a simulation game course, and its features, and presents a summary of the approach adopted in evaluating this method. The final section presents an analysis and findings of the empirical study and discusses its implications. We examine the application of technology in a game environment. We specifically interested in examining the technological issues related to the learning experience. Our focus is technology in the game and the learning experience. Organized in six sections, the next section explores technology education and games. Then we present different learning models we follow in this paper. Next, we state the methodology. We then present our results. Finally, we discuss the results, draw some conclusions and suggest recommendations for future study.

II. LITERATURE REVIEW

Technology learning is an innovative method that uses technology to enhance learning. It is usually being used remotely where the learner and the instructor are not present at the same place (Verduin and Clark, 1991; Chang and Cho, 2009). Many studies show that students consider the technology learning method as superior to the traditional teaching methods and therefore, it bears several benefits for the students as it enhances the learning experience (for example, see Boucher et al., 1999).

One important factor that makes technology learning so unique is that it allows learning to be an individual matter. That is, the learner learns in his or her own time, in his or her own pace, rather then following the instructor’s dictated pace (Kosmahl, 1994; Stephens & Doherty, 1992). As stated earlier, studies that explored technology learning show that this method is considered better than traditional methods because of the flexibility it allows to the learners. This outcome comes at lower costs to the students (all they need to have is a computer and a headset) and the institutions using the method, as they do not need to supply the students with campus services, such as classrooms (Russell, 1999; Clark, 1999).

However, an investigation of the literature reveals that over flexibility may deter students from learning. Unlike traditional teaching methods, the instructor usually cannot follow student participation in virtual classes, as those can be easily manipulated using the available technology (Webster & Hackley, 1997). Griffin et al. (1999) states that sometimes one may even find negative reaction to this method. This usually happens when the students are not technology savvy and have hard time operating in a virtual class.

In addition, in today’s environment it is only natural that we desire to see our students becoming more ethical. Many argue that higher education institutions should increase their emphasis on distance learning (e.g., Wu and Fang 2009). However, usually educators fail to help students thoughtfully assess what goals are worthy of professional (and personal) aspirations, and aid and abet physical, psychological, spiritual pain for our students, the organizations they work for, and the society at large (Giacalone, 2004). Koehn (2005) agrees that we are failing as professionals. He argues that what is needed is a radical change in peoples’ self conceptions and that it is our duty as teachers to bring about a positive change in our students.

The argument to increase pedagogical emphasis on distance learning is supported by the observation that young people are susceptible to attitude change (Fang and Chan 2009). Kohlberg (1984) suggests that young adults are more open to learning and better deal with ethical issues. In further support of the idea are studies showing that ethical attitudes change with academic exposure or training (e.g., Durget and Smith, 2009).

In addition, studies also show that some decision makers are unaware of the implications of their decisions and others seem to believe that other concerns, such as beliefs, should not even be applied to their decisions (Teach et al., 2005). This means that business decision makers are either unaware or unwilling to believe that that business decisions have consequences or real impact. Nevertheless, decision making has far more impact than the immediate result, and the long-term effect may be far larger than the short term result (Becker, 2010; Ben-Zvi, 2009; Fang, 2009). As a result, college students as future decision makers should be open to and capable of learning to incorporate different factors into their decision making . So it is fairly easy to argue that we ought to try to teach those skills.

When considering experiential learning, the main model was published more than 20 years ago; yet, Kolb’s theory (1984) on experiential learning is still considered a central theory in education. His model emphasizes the interaction between experience and learning by exploiting the subjective nature of the learning process and creating a transformation of experience that engenders knowledge (Mainemelis et al., 2002). Business games relate to experiential learning as they present a method that epitomizes experiential learning (Garris et al., 2002). They provide students the opportunity to become intimately involved in decisions faced by executives in real organizations, to test the understanding of theory, to connect theory with application, and to develop theoretical insights (Chang, 2010; Chen and Lin, 2009).

Kolb and Fry (1985) argue that the learning cycle can begin at any one of the four points. However, they suggest that the learning process should begin with a person carrying out a particular action and then seeing the effect of the action in a situation. Generalizing may involve actions over a range of circumstances to gain experience beyond the particular instance and suggest the general principle. Understanding the general principle is the ability to see a connection between the actions and effects over a range of circumstances.

This model represents a practical heuristic for exploring the interplay between teaching, learning, and ethical matters. Thus, we discuss ethics issues in a specific game course.

Adams et al. (2010) presented a model based on Kolb's model. That model consisted of four elements: concrete experience, observation and reflection, the formation of abstract concepts and testing in new situations. Other modifications of the Kolb model can be found in Geller and Smith (2009), Grisham and Smith (2009) and Lei and Chong (2009). The model is represented as a learning circle, depicted in Figure 1.

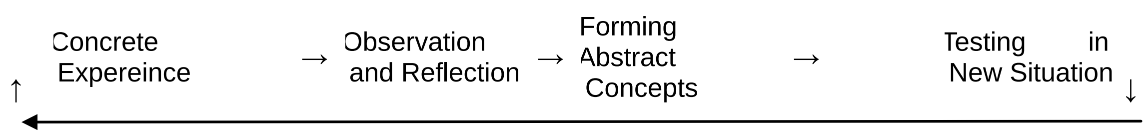

Figure 1. Kolb's (1984) Learning Model

III. DISTANCE LEARNING MODE

When developing a curriculum model, there are three areas of expertise in that are preferred by educators – technical, semi-technical and non-technical. Since business schools cannot incorporate all three areas in their curriculum equally, they have to decide whether they will emphasize technology or business in their courses. While students perceive the need for more concrete programming and technical skills in their courses, instructors appear to be looking for more generic skills in the areas of technology strategy and development. In fact, as observed by many researchers, students perceive their lack of specialized technical knowledge as an impediment. On the other hand, when leaving school, employers are looking for graduates with a better understanding of the processes, integration and technology across a business.

The nature of technology programs varies significantly from one business school to another. Some universities offer a major with technology management, while others have full-fledged masters or undergraduate programs in technology management. Some other universities have added this subject to their existing programs in many disciplines.

The majority of simulation games available at universities is offered by business schools and is taught from a non-technical perspective (Bodevin and Suttikul 2010). The field of simulation games touches every discipline in business schools, whether it is accounting, marketing, logistics, manufacturing or human resources. The disciplines offering these courses are also varied and many. For example, disciplines of marketing, business information systems, law, and international business have all started some simulation games-related courses, emphasizing their particular discipline focus and expertise. There are other schools where academic staff have actually tried to incorporate simulation games content into their traditional courses in accounting, marketing, finance, logistics, human resource management and information systems.

In this climate, where every discipline considers some aspect of simulation games relevant to their discipline. In addition, it has become a challenge for the discipline of business information systems within business schools to carve out a niche for themselves in the wider curriculum. While simulation games is mostly known as selling and buying and interacting (which is strongly linked to the various business disciplines), as discussed earlier, the technology part of it is related to the learning method. Thus, simulation games are fundamentally linked to the business information systems discipline whose focus is on application of information and communication technologies to business organizations.

Two models are generally recommended – an integrated interdisciplinary approach and a non-integrated approach (Smith, 2010). The first approach requires individual disciplines to teach basic technology content, complemented by the advanced specialty courses in simulations taught by individual disciplines, as well as by the business information systems discipline. This approach requires individual disciplines such as marketing, accounting, business information systems and others to include some technology content, together with traditional content, in their offerings. This way, all students will develop some understanding of technology principles within the context of their respective disciplines. Students, if they desire, will acquire additional knowledge and skills by enrolling in simulation courses offered either by the individual disciplines or by the information systems/technology discipline.

The non-integrated approach incorporates both technical and business content in a single course. Incorporating a problem-based learning approach, students are expected to develop a business concept, and operate a mock business in a simulated market environment. A variation of this approach is also used in several universities, depending upon the emphasis on technology or business aspects or equal emphasis on both the technological as well as business aspects. Factors such as the nature of the discipline offering the course, the student mix and their backgrounds, the school that is hosting the course, and the skill sets the potential employers of these graduates are expecting typically influence the emphases. When a simulation course is offered by the discipline of information systems located within the business school, it typically combines technology with business concepts in the curriculum. This approach is taken in this study and the specific details of the course are explained later.

IV. CURRENT TEACHING CHALLENGES

The need for curricula to be up-to-date with the knowledge of current practices, business models and applications is well recognized in the current dynamic environment. Responding to the challenge of meeting the ever moving target of 'being current' and 'relevant', academic institutions are involved in an on-going curriculum development effort. Developing and teaching a current and relevant curriculum is challenging and stimulating because of the topic's rapid evolution and its interfacing effect on every aspect of business. The dot com crash in 2001 undermined some of the foundational premises on which technology is taught in business schools. For example, the electronic marketplaces and application service providers (ASPs) that were predicted to create multi-billion dollar markets by 2004, rapidly faded out as several firms went out of business. Also, in Australia, the number of electronic marketplaces has declined significantly from around 150 in 2001 to less than three in 2006.

It is challenging to keep up-to-date and be on top of the changing nature of technology applications, teaching materials and the introduction and occasional disappearance of some new and interesting business models, software applications and environmental conditions. Because of the ever-changing nature of course content and case studies, it is very hard to develop a course that is stable on some theory and applications, and has some longevity. It is possible that a certain course which was considered successful in 2005 may be viewed as a significant failure by 2010. For example, an established brick-and-mortar retailer in Australia has acquired its strong online competitor, a successful online retailer of green groceries and simply merged it with its existing fledgling online retailing unit. With these dynamic changes occurring regularly, it is difficult to maintain a set of local case studies and examples and present them for analysis in the class. Taking into consideration these dynamic changes, simulation courses may simply consist of some interesting overseas case studies of successes and failures, and an explanation of current applications. Such courses simply lack the sufficient depth in content and process, and do not equip students with the conceptual frameworks and critical skills necessary to deal with the changing technology and business models in the workplace.

Rapid changes in the field make course development and maintenance extremely resource intensive. In addition to keeping abreast of the evolving and changing content, academic staff teaching these courses must also continuously learn constantly evolving software applications, hardware and networks. To be effective across the broader curriculum, teaching simulations requires bringing together a wide variety of skills from a number of academic disciplines. Because of its multi-disciplinary nature, simulations also include some traditional content from other disciplines such as finance, accounting and logistics. This requirement creates a need to integrate the offerings and content across different courses taught in the business schools.

The difficulties of delivering an effective and relevant course may be exacerbated if the classes are small. With increasing number of electives to choose from, this is often the case in many business schools. This together with the recent down turn of the demand for information technology/system based courses in general in many universities; the class sizes have typically become smaller. While small classes facilitate critical analysis of case studies and critical appraisal of the latest frameworks and technology, and learning by sharing and interacting, lecture-based teaching typical in large classes is considered inappropriate for such a subject.

Academic staff can achieve some stability in the curriculum if they ground their courses in mature principles such as system selection, IT investment evaluation, change management and security. The difficulties faced by curriculum developers are exacerbated by the trends towards the convergence of technologies that traditionally were grounded either in business or in software. In an attempt to bridge the divide between information technology and business, a variety of business-cum-technical courses have been developed.

Taking these challenges into consideration and adopting a non-integrative approach in curriculum design, a simulation course has been designed in this university business school. Targeting a mix of students from commerce and information technology degree programs majoring in accounting, marketing or information systems/technologies, this course was designed with a greater emphasis on business aspects rather than on technology aspects. Offered by the discipline of business information systems situated within the school of business, the curriculum design aimed to incorporate the ability to apply and integrate the concepts to business organizations and go beyond rote learning. Using some experiential learning principles, an e-business project is designed to deal with dynamic issues and to give practical hands-on training to students. This is an important part of the curriculum designed with an aim to facilitate integration of functional knowledge gained from previous units into this business project that involves developing a comprehensive business plan. In line with a number of non-traditional teaching approaches and tools designed and developed for undergraduate students in general and for teaching simulations in particular, this business project intends to reinforce the concepts of technology by incorporating the principle of ‘learning by doing’ in the course. By asking students to investigate a real business in the marketplace, this project is expected to maintain currency and relevancy to local business organizations and industry and help in designing new and evolving business models into the project. This is expected to help them learn about the latest developments in the context of a particular industry, competition, and associated internet business models, and ensures maintenance of currency and relevancy of technology. In this process, students are expected to learn much needed skills in business planning and develop an integrated view of business along with an international focus. While teaching is focused on the basic technological concepts, this project is expected to deal with some of the challenges of technology education by exposing students to real world applications and issues in conceptualizing and developing a proposal for an e-business. Instead of looking at the old case studies and text book material successes and failures that are typically two or three years old, students are forced to find out up-to-date information about the recent business models from the press and other published reports and literature.

V. RESULTS

After removing incomplete data, a total of 165 responses were available for analysis. 64% of respondents were male, 23% international students and 27% part-time students. About 68% of the students are from the information technology/science/ engineering faculties while the remaining are from the business faculty. About 75% of the respondents have claimed some work experience, while the remaining 25% have reported no experience.

While a significant majority reported good understanding of information technology, only about 34% reported understanding of how business works. There are, however, significant differences between IT students on this dimension. On the questions of knowledge of business planning process, writing project reports, and project management knowledge more than 27% of the participants reported positively, with another 34% reporting no knowledge/skills.

Background of the students is an important independent variable that has a significant influence on the pedagogical effectiveness and attitude towards major group project. It is expected that there could be significant differences between IT students and commerce students with regard to the perceived pedagogical effects, knowledge and perceived value/knowledge gained from the group project experience and the entire course because of their previous knowledge and experience on the several dimensions as mentioned below.

On dimensions such as understanding of how business works, knowledge of business processes and business terminology, experience in group work and writing reports, business/commerce students have a significantly higher level of past experience and knowledge than the IT students. This reflects relatively less emphasis on these generic skills in science and engineering schools and the increased push in business schools towards the attainment of generic graduate attributes. On aspects such as understanding of web tools, understanding of creating web sites, knowledge of e-commerce programming as expected IT students have higher perceived knowledge and skills than the commerce/business students. On dimensions such as understanding of business planning process, project management, project management tools such as MS Project, presenting project reports, knowledge of the industry in which their e-business plan is developed, online buying experience and knowledge of generic information systems, however, no significant differences were noted. This may be because of the subject specific nature of some of these dimensions, especially relating to the perceived understanding of business planning process. We specify the results in Table 1.

The above analysis highlights the inherent strengths and weaknesses of the IT/Computer science education and Business/Commerce education in universities in general and this university in particular. Even though industry and employers' groups are seeking improved generic skills and attributes in university graduates whether they are in IT/Computer science or in Business/Commerce fields, by the very inherent nature, Business/Commerce schools are able to provide better outcomes suitable to the industry in terms of generic skills. Consequent to this exercise and by a generic policy push to improve graduate generic attributes/skills such as analytical skills, project management and self-management skills by incorporating them into the learning outcomes and assessments, there is a significant increase in group projects and group assignments in the second and third year courses. All these policy initiatives appear to have some positive effect and contributed to these positive results for business students.

Table 1. A Comparison between the Technology-Driven Group and the Traditionally Taught Group

Factor	Technology-driven Method	Face-to-Face Meetings	t-value	p-value
Business	5.35	5.37	0.02	0.65

understanding				
Web tools understanding	6.32	4.68	1.42	0.05
Group work experience	3.45	6.10	-2.01	0.03

In addition to the above results, the perceived benefits of the technology-driven group were measured by using more factors. The construct validity and reliability analysis was carried out in order to test the psychometric properties of the scale designed. After removing four items that have less than 0.60 item total correlations, 126 items are retained for further analysis. Considering the categorization of these 26 items into five groups, the reliability coefficients of the scales is computed using Cronbach alpha for each of the factors identified in the study – subject specific knowledge, technical skills, business integration knowledge, learning value and generic skills. In general, an internal consistency (alpha values) of less than 0.6 is regarded as poor, while above 0.7 is acceptable and over 0.8 is considered a good measure of reliability of the scale. The resulting Cronbach alpha values demonstrate sound psychometric properties of the instrument. Table 2 presents the values for each of the factors and the standard deviation. The scores for each of the factors are good and are more than 0.80 as shown in the table. The range of the variance suggests a reasonable variance.

Table 2. Mean and Standard Deviation of Major Concepts in the Tech-Driven Group

	Mean	Std. deviation
Subject Knowledge	4.45	1.54
Technical Skills	4.95	2.30
Integrated Knowledge	5.39	1.81
Learning Evaluation	5.11	2.29

VI. DISCUSSION AND CONCLUSIONS

Many studied have examined the implications of a technology-driven environment. Our findings reveal that students did in fact look at this type of method to be superior to the face-to-face teaching method. Although students in the technology-driven group that we examined reported on several communication problems and technical difficulties in using the software, they were overall satisfied with the course. Our investigation reveals that those problems mainly relate to internet operating skills that the students need to develop, as this was not part of the instruction. We emphasize that although computer skills are important, classes should not highlight how to apply a certain teaching method but they should concentrate on the content itself, that is, the subject matter.

Overall, we can state that using the techniques presented in this study can improve learning. Indeed, the experience was different and therefore requires extensive training of potential instructors and a lot of preparation, including orientation sessions for the students, to teach them how to operate the system and the software, in order to achieve a productive learning environment. This study also suggests that such a learning model is possible and that is has some effect on the participants beyond the traditional benefits of those learning situations

We also discovered that in the traditionally-taught group the use of the game produced relatively weaker relationships between interaction during the game and course-related content. On the other hand, in the technology-driven group it appears the game was an important factor, and the difficulties the students experienced had a major impact on the rating of this method. We note that this study did not explore the computer fluency skills the students possessed. As we revealed that those skills play a major role in the technology-driven environment, we suggest an extensive study of this topic, as well as other learning effects produced by games and simulations.

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