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Full Length Research Paper

Using ICT to enhance academic learning: Pedagogy and practice

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The explosion of new information and communication technologies (ICTs) has created immense opportunities to enhance the educational process at all levels, but especially in university and professional curricula such as architecture. Using the new tools effectively will require that teachers become comfortable with existing new technologies, but more importantly, with the innovations that appear with increasing rapidity. In short, they must learn to collaborate with technological professionals and in so doing collaborate across many disciplinary fields to learn and enable their students to learn more effectively.

Key words: ICT, pedagogy, educational technology, collaborative learning, teaching and learning.

INTRODUCTION AND GENERAL RESEARCH PROBLEM

In its review of the educational system to train engineers, the National Academy of Engineering, 2005 posits: "It is evident that the exploding body of knowledge in the fields of science and engineering cannot be accommodated within the context of the traditional four-year baccalaureate degree….(Pg. 25) Other writer such as Martin et al. (2005) further argue that university programs fail to expose students to "current professional knowledge and information and communication technologies (ICTs) relevant to labour market requirements".

Much research supports these assertions (Ferguson, 2006; Lucena, 2006; Haghighi, 2005; Zuga, 2004). A study of employment experiences among university graduates in business and engineering demonstrated that a possible mismatch exists between educational opportunities and the job market (Sageev and Romanowski, 2001). Such mismatches may be the reason for poor job performance among graduates (Jones and Oberst, 2003). As a result of these examinations are predictive of performance (Mummolo, 2007), the World Bank (2004) has consistently advised educational systems throughout the world to structure themselves to meet the needs of market economies, enabling learners to acquire high-level information-processing and problem-solving skills to prepare for entry into a rapidly changing and highly competitive marketplace (Lucena, 2006).

A review of current higher education curricula in a variety of disciplines indicates a lack of focus on the teaching and learning issues (Ferguson, 2006) con-fronted by students and workers in the information era (Gorard et al., 2003). There is little or no focus on developing the teachers' abilities to select strategies that maximize student learning outcomes (Forman et al., 2002). Observing the current educational system in Taiwan, it is obvious that education only emphasizes the knowledge of the final result. It ignores the need to educate the students to look at the entire process of how knowledge is acquired. Today's university students will be the backbone of tomorrow's society, and university education should be committed to the lofty ideals of seeking knowledge, fostering creative understanding, and nurturing the whole personality. Educators must cultivate humanity in students. Students should leave the university with senses of ethical responsibility and the aesthetic and qualitative standards they will need to contribute to society and enjoy meaningful lives. In short, education should be an agent for social change and growth.

This brings us to the central research problem for this research paper: Does learning need to be embedded in a specific social or technological context in order for it to be effective? The paper examines different domains for ICTs regarding teaching and learning, how ICTs affect pedagogy in higher education, collaborative study of learning and teaching works, and how they apply to employment

in the profession. This paper argues that major changes in pedagogy are needed for higher education to take full advantage of the potential of ICTs for teaching and learning.

Domains for ICTs regarding teaching and learning

The following describes briefly how teaching and learning activities are intertwined with collaboration in this transformation. This knowledge is needed to facilitate dialogue and exchange between the learners. Teaching involves multiple types of knowledge transformation that separate into different domains such as cognition, cooperation, coordination, and collaboration. Learning involves measurable, transferable skills that underlie performance across a spectrum of disciplines (Dewey, 1966). Skill development, like subject matter mastery, can be planned, cultivated, and assessed (Anderson and Krathwohl, 2001). It is best to focus on a small skill set at one time. The many different domains for the comparison may lead to pedagogical changes, which will improve the efficiency of the educational systems.

Cognition

The use of ICTs requires an understanding of how they are used in the classroom and what learning goals are held by the educators involved. Also needed is knowledge about the type of assessments used to evaluate improvements in student achievement and an awareness of the complex nature of change in the school environment (Christensen and Knezek, 2006). The processes of cognition to achieve a common goal among the learners are shared. It is also inseparable from the collaboration that they support. Evidence indicates that when used effectively, "technology applications can support higher-order thinking by engaging students in authentic, complex tasks within collaborative learning contexts" (Jefferies, 2003).

Stahl (2003, 2006) labels this collective cognition “group cognition” since learning skills primarily relate to mental (thinking) processes. When educators use the accumulating knowledge regarding the circumstances under which technology supports the broad definition of student achievement, they will be able to make informed choices about what technologies will best meet the particular needs of education.

Cooperation

Some researches confirmed an effective cooperative learning processes depends on a combination of students' goal preferences and the appropriate learning context. With respect to students' goal preferences, task-relevant engagement to depend on a combination of social goals and mastery goals needs to pursue notably (Christensen and Knezek, 2006). The difference between effective and ineffective cooperative learning teams lies precisely in the combination of these goals. Cooperative learning is an intermediate learning technique that requires positive interdependence, individual accountability, and interpersonal skills related to interpersonal interaction. It can be broadly refer to team learning (Panait and Luke, 2003) involves a single learner to carry out the learning behaviors of all the agents (Zuga, 2004). Often Cooperative learning methods involve hands-on tasks, in which students can develop their professional skills. In cooperative learning settings students depend on each other for learning and the conditions may encourage them to attend school regularly. It encourages student achievement, improves relations among ethnic groups, and offers students with learning disabilities opportunities to participate in mainstream educational programs. It is easy to implement without a special curriculum. Learning takes place through meaningful human activities. Understanding and application of knowledge are necessarily intertwined (Linnenbrink, 2006). Individuals learn differently, and teachers’ roles include providing scaffolding within which learning can take place (Zuga, 2004). The teaching and learning philosophy adopted in this educational environment recommends that students search and share resources and information. Thus learning becomes collaborative.

Coordination

Coordination allows those with similar motivations regarding performance and assessment to share their personal goals related to emotional and value development. Allowing enough time for individual work is of great importance to ensure that the partners can bring their individual domain knowledge to bear. It requests students to coordinate and agree on their activities and task strategies to solve the learning task at hand. Students will discover critical reflections in this learning and teaching transition environment. Students may believe that they will become better able to relate theory and practice about teaching and learning as a result of these reflections. It will also help them become more aware of their limitations as partners.

Learning in such surroundings is relevant and most meaningful when it is contextualized and based upon experiences—their own experiences—and interaction (Linnenbrink, 2006). They want to be able to continue doing what they are doing but also learn from it—learn from their own trials and problems, mistakes, and successes. It utilizes critical reflection in a collaborative environment to facilitate a practice-based learning opportunity for students. Clearly the students cherish the opportunity offered by this type of learning setting, for it will allow for advanced study in the domain.

Collaboration

There is a growing tendency to stimulate students to

learn actively, independently, in a self-directed way and in collaboration with others. Success of the group is paramount and all individuals must contribute to that success. The central idea in the theme of "Collaborating to Learn" and "Learning to collaborate" (McCormick, 2004) revolves around that participation in technological activity. Such activity is collaborative, and learning to participate is an important feature of learning. New technologies provide promising opportunities to make this new kind of learning possible and guide the learner in these new ways of learning. However, there is an on-going debate as to whether teachers' roles are becoming redundant as a consequence of the use of ICTs or whether learning is just put into air.

Teachers are expected to upgrade their knowledge and acquire new skills in terms of pedagogical improvement. Communication is fundamental to collaboration (Debevec and Shih, 2006) which involves compromising (Kvan, 2000). Or, students have to coordinate their learning activities with the social processes of collaboration. They have to create and maintain a positive collaborative climate in which they feel safely able to contribute and can take responsibility for shared tasks. Thus, they can take full advantage of the potential of ICTs to enhance their learning. Collaborating to learn is a teaching method wherein the collaboration process aids learning. A central idea is that participation in technological activity is collaborative—and learning to collaborate follows learning to participate (McCormick, 2004).

As levels of learning and its measurement increase among teachers in pedagogical change, learning will become more effective and efficient. Problem-solving capacity can increase as teachers utilize the appropriate problems at the appropriate time during student development. Overall it would suggest that technology cannot only be used to support the different domains of learning but that is can also be used to facilitate new opportunities for social interaction.

How ICTs affect pedagogy in higher education

Tertiary institutions that want to be more productive and meet societal needs must be more sensitive and adaptive to changing educational needs. Traditional architecture schools did not prepare architects to market their businesses. Some might view that as a good thing, but architecture graduates needing help with marketing are mostly left alone and find they are unprepared for the task on their own (Senyapılı and Karakaya, 2005). The need to market services is fairly new in this newly open society and economy, and the challenges are amplified by economic swings from boom to recession and back.

How architects approach change in this transitional society will be important to their careers and prospects for success. Their training should help students deal with rapid social transition and technological advances, the competitive pressures of globalization, and major demographic and societal shifts (Vaira, 2004). The educators who meet these challenges will be open to breakthroughs, plan with vision and foresight, and help their students and the nation open new frontiers. Professional education in architecture must facilitate advances in technology related to the discipline (Ahern, 2007). Educational programming that most effectively accomplishes that will take into account the special qualities of technologies in architecture (Senyapılı and Karakaya, 2005), which utilize both high-tech design processes and scientific developments from many other disciplines. Developments in information and communication techno-logy (ICT) often result in reducing the time and space requirements of projects and greater cost efficiency (Vaira, 2004). Using information and communication technologies to developing and present curricula in architectural education would be among the most produc-tive uses of those technologies (Dirckinck-Holmfeld and Lorentsen, 2003).

The effects of new information and communication technologies span many disciplines, and this reach makes that discipline rather a special case (Christensen and Knezek, 2006). The challenge for professional education in architecture is to harvest the full potential of the new technologies in curricula. Institutions themselves should explicitly recognize the potential benefits of melding the new technologies (Ahern, 2007) with architectural education. In no other area is the potential impact on the goal of creating a sustainable economy and environment more evident (Somekh, 2005). To take full advantage of the opportunity to utilize resources effecttively and change society in beneficial ways, institutions should promote partnerships (Fullan, 2007) and interacttions between educators and other professionals. By doing so, they will be helping to lead Taiwan to a position of leadership in science and technology (MOE, 2006).

Therefore, educators have been rethinking pedagogy and reflecting on new methods to help tertiary institutions produce marketable graduates (Watson, 2001). Problem-based and learner-focused educational models are beginning to flourish (Pearson, 2006; Pekrun et al., 2002), and educators are implementing new curricular tools that focus on shifting from teacher-cantered, traditional classroom teaching environments to student-focused and problem-based learning enhanced with ICTs (Karakaya and Senyapth, 2007; Trinidad et al., 2004). The successful integration of ICTs in education should result in substantial improvements in teaching and learning (Senyapılı and Karakaya, 2005) since teaching and practice in architecture is often mirrored in the development of society itself, encouraging integrated social and economic development.

How they apply to employment in the profession

ICT-based learning is a particularly dynamic means of providing instructional tools to deliver the subject matter

already in the curricula (Ferguson, 2006). Using technology to create an increasingly flexible learning experience: Institutions should adopt bylaws that define the circumstances in which study may be suspended for a time, perhaps to provide opportunities for work. They should also recognize courses and subjects undertaken at other institutions both at home and abroad. Recent developments in communication technology have increaseed the pace and intensity of interaction among academic institutions and expanded scholarly exchanges among nations. Ideally, it will become "a catalyst for educational diversity, freedom to learn, and equality of opportunity" (Forman et al., 2002). To abet truly effective teaching and learning, ICT experts and content providers in regular academic disciplines must exchange experiences across boundaries of technology, academic discipline, and culture. Even with the emergence of a global society, however, schools too often focus narrowly on only national and local resources and issues (Watson, 2006). A parochial outlook may prevent them from accessing international literature and discovering best professional practices from beyond their insular societies.

Educational management practices must change significantly since an enormous challenge is presented to educators by the rapidly changing world of information and communication technologies (Fullan, 2007). It is essential that students acquire high-quality ICT experience before emerging into the real world of employment (Gibson et al., 2002). Whether ICTs affect the pedagogically important physical interaction between learners and teachers is an important question.

Architectural education in Taiwan can contribute in important ways to social change and help lead the larger society in new directions. Globalization has recently contributed to a democratization of higher education. In doing so, it has forced the recognition that traditional, elitist models no longer serve the needs of a pluralistic society. Taiwan has moved toward a thorough reconsideration of educational systems and a more holistic model (MOE, 2006). That trend should continue in response to continuing changes in Taiwanese society and its position in the world economy. The need for lifelong education and pluralism will become more evident, and adult education programs can help meet that need (Somekh, 2005). The ability to learn systematically, think systematically, and learn structurally in a rapidly changing society where the volume of information grows exponenttially will be an important criterion that distinguishes learning abilities.

As Salomon (2000) notes, "Education is far too important to society to be wiggled by a technological tail. Let technology show us what can be done, and let educational considerations determine what will be done in actuality". There is an urgent need to reconceptualize the educational curriculum and re-evaluate teaching and learning models within the technological environment (Monahan, 2005; Triggs and John, 2004; Greene, 1971). Senge (1999) notes that we introduce innovations of transformations into a learning environment, sustain those innovations or transformations, and rethink the governance that will suit the innovations or transformations that have been put in place.

Collaborative study of learning and teaching works

It is first necessary to clarify the dimensions and degree of educational change needed to meet learning goals (McCormick, 2004). Collaborative learning modes in higher education facilitate student-oriented teaching and learning and succeed by applying information and communication technologies (ICTs) to incorporate knowledge from separate but related disciplines into a unified curriculum – they will only do this if the learning is designed for them to do so. ICTs make such collaborative models possible as never before, and the approach has begun to gain widespread public attention (Karagiorgi and Charalambous, 2004; McCormick, 2004). The result is an increasingly close collaboration between technology providers and teaching professionals. One difficulty, however, is that many educators and their institutions lack the required technological skills for the emerging knowledge-based society. The problem is further compounded by the lack of quality assurance mechanisms or consistent ways to evaluate teachers' technological competence (Corlett et al., 2005; Karagiorgi and Charalambous, 2004).

Lehtinen (2003) postulates a method to distinguish collaborative study from group study and notes that successful collaborative study models are characterized by equality and mutuality. Collaborative study allows learners to be treated equally and requires that they mutually respect each other. Obviously, such a requirement cannot be enforced, but rather must be facilitated by the model. Learners in such an instructional environment become more willing to study (Triggs and John, 2004; Leathwood and O'Connell, 2003). Students' gains and efforts are shared, and the sharing provides a fearless environment that is rarely attained in conventional school settings. It dissolves the stress in relation-ships among students, teachers, and administrators.

Collaborative learning is characterized by a systematic and innovative curriculum. The ability of information and communication technologies to allow collaborative study in virtual or remote environments increases the opportunity to utilize this powerful method (Keller, 2005; McCormick, 2004). Its use is increasingly advocated in the professional literature (Benenson and Piggott, 2002). Much research has shown that the quality of learning can be significantly enhanced when ICTs are approached and utilized to promote dynamic, interactive thinking (Karakaya and Senyapth, 2007; Hirschheim, 2005). Research has shown ICTs can enhance: 1) critical thinking; 2) information handling skills; 3) high-level concepttualization; and 4) problem solving. In addition, because many new technologies are interactive (Karakaya and

Senyapth, 2007) they are already being used extensively to create and sustain a wide range of collaborative processes and activity. Their users are learning to work with people who define problems differently.

During the past decade, both the roles and the processes of higher education have changed rapidly due to the increasing influence of new information and communication technologies (ICTs). ICTs are radically transforming both workplaces and the educational landscape (Christie et al., 2002,). The increase in the educational use of ICTs is driven by evidence that new technologies can improve education (Bates, 2004; Breen et al., 2001; Wenglinski, 1998). ICTs play an especially important role in the development of a knowledge-based society because they accelerate the generation, distribution, and use of knowledge. Sustaining and growing a knowledge-based society requires new methods and new skills; it also requires increased investment in human capital (Weva, 2003). Today's rapid development of ICTs and the educational methods to use them means that the educational landscape will be in a state of change for the foreseeable future.

Such a changing educational landscape demands that teachers have high-level knowledge and skills, especially competencies in new technologies. Teachers are increasingly expected to be life-long, autonomous, and self-regulated learners with the ability to adapt readily to changing circumstances (Fullan, 2007; Triggs and John, 2004; McCormick and Scrimshaw, 2001). As new pedagogical approaches and new research methods are developed to fully utilize ICTs, institutions of higher education must aggressively integrate their use into their curricula (Watson, 2006; Somekh, 2005). Though ICT has been integrated in many disciplines and has shown educational benefits, changing traditional teaching remains a challenging process. For successful integration of ICT into teaching and learning, instructors need proficiency thorough understanding of contemporary trends in pedagogy.

Conclusion

To conclude, the answer to the question "Does learning need to be embedded in a specific social or technological context for it to be effective?" must therefore, for the moment, remain only partial. Watson (2001) claims that new forms of teaching and learning will inevitably result from greater familiarity, confidence, and flexibility. John and Sutherland (2004) note that strong and practical ICT-based pedagogical approaches in the school curriculum will help teachers challenge students to reach their potential and to gain a sense of responsibility to them-selves, the school community, their families, and society in general.

Pedagogical domains for ICTs on teaching and learning foster scholastic and personal independence within a structured atmosphere, and ICTs contribute to building their confidence and trust in themselves and in technology as a tool for lifelong learning. However, in so doing, such trust enables students and teachers to be responsive to each other and to take risks. Teachers must accept the fact that learning in such an environment is often chaotic, messy, may have no distinct beginning or end, and might breed more confusion. Teaching and learning with ICT occurs before genuine understanding of learning occurs, be it learning as knowledge construction, learning.

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