The Transformational Promise of Information and Communications Technologies (ICTs) for the Professional Education of Architects

Tsungjunag Wang
Department of Architecture, National Taipei University of Technology, Taiwan // tjwang@ntut.edu.tw

ABSTRACT
The ever-expanding use of new information and communication technologies (ICTs) is especially significant to professional education in relatively isolated nations such as Taiwan. Interaction with university faculties outside the country would vastly improve the Taiwanese education of architects, for example, and this is sufficient reason for the full implementation of ICTs in architectural schools in that country. This article 1) explores how ICTs hold a promise for transforming the process of professional education in architecture, 2) examines the issues and difficulties of implementing ICTs in the teaching of architecture, and 3) discusses how a greater use of ICTs in architectural education would enhance both the ability of students to work collaboratively and the opportunity for professors to enjoy much greater participation and collegiality in the world-wide academic community of architectural educators. Particular attention is given throughout the paper to the epistemological and educational paradigm of constructivism and the cultural considerations of implementing ICTs in an Asian nation such as Taiwan.

Keywords
ICTs; professional education; collegiality TPCK; academic collaboration

Introduction
This paper attempts to answer three fundamental questions about the possibility of using ICT to transform the delivery of education to professional architects. First, what are the potential benefits of ICT for teachers and students in higher education professional programs such as architecture? Secondly, what are the issues that all too often act as barriers to the full development of an ICT-rich learning environment in higher education? Finally, what are the particular issues involved in implementing ICT to transform the teaching of architecture in a rapidly developing nation such as Taiwan?

The response to these research questions requires, at the outset, a selective literature review regarding the use of ICTs in professional education, specifically in architecture. The review focuses, first, on the relationship between the rhetoric and the practice of implementing ICTs in educational systems, and, secondly, on important cultural issues involved with this kind of implementation. One recurring theme is the idea that ICTs have the potential for radically transforming educational practice; another is the idea that ICTs promote the constructivist paradigm of epistemology. The review concludes with an examination of the use of ICTs in architectural schools, concentrating on both the successes and the difficulties that have been observed so far.

The literature review will be followed by a compact case study of how ICT has been used in the educational system of Taiwan to date. This, in turn, will be followed by a theoretical grounding of the discussion in the educational paradigm of constructivism. A full discussion of the use of ICT in professional education, particularly in relation to Taiwan, will conclude the paper.

A Brief Review of the Literature
The first thing a review of the literature reveals that there has been an abundance of positive claims published in recent years about the promise that ICT holds for transforming higher education in the twenty-first century, but there has also been a disturbing lack of empirical evidence to support these claims. Stensaker et al. (2007) sum up the situation very well when they describe their own findings about the difficulty of putting ICT theory into practice at universities: “. . . it is not the visions, the visionaries (institutional top-management) and the economic foundations that seem to be lacking, but an effective link between, purpose, people, and pedagogy inside the institution” (p. 431). Wong and Li (2008), in one of the more substantial empirical studies of how ICT is actually used in contemporary
education, confirm the need for a multi-layered approach to instituting and assessing ICT, one that combines lofty educational goals with the day-to-day work of teachers in order to effectively manage change.

The idea that ICT is culturally embedded is taken for granted by experts in the field of education. For example, Zhang (2007) makes an important distinction between the pedagogical cultures of Western nations and Eastern nations. While the West has a long educational tradition, dating back to Socrates in ancient Greece, of individual discovery through debate between learners and teachers, the Eastern educational tradition, based on Confucius in ancient China, emphasizes what Zhang (2007) calls “a group-based, teacher-dominated, and centrally organized pedagogical culture” (p. 302). In fact, in almost all Eastern nations the implementation of ICT in educational settings is controlled by central government agencies, and usually these agencies have national plans that are geared specifically to meet the economic demands of globalization and the social demands of the information age.

One recent study is very informative about the impact of ICT on the professional education of architects. Based on research in the United States, Japan, and Europe, Andia (2002) reviews how the architectural profession has received and incorporated ICT over the past thirty years. His most significant finding is that professional architects have used ICT mainly for the purpose of enhancing existing practices that have been in place for at least one hundred and fifty years, while architectural schools have used ICT to transform both architectural imagination and architectural practical possibilities. Andia points out that ICT has dramatically affected architects at both the level of skills and the level of professional culture. From the 1970s to the mid-1990s architects developed computer-assisted design (CAD) techniques, and since the mid-1990s architects have made great use of the networking capabilities of ICT to improve the design/build process. Architectural academia, however, has challenged the traditional tributary role of the profession. As the author puts it, “Schools have become experimental laboratories for creating design machines, promoting new architectural imagination and treatment of materials, and finally extending the architectural realm to cyberspace” (p. 7). Andia identifies five distinct discourses that have evolved in architectural academia since the 1950s: design methods, CAD visualization, paperless architecture, information architecture, and virtual studios. The trend of these discourses is to move the vision of architecture from the physical world to the virtual world. The question is, Can architects learn to design for both realities? This is the most important challenge that professional architectural education faces at the present time.

The Case of Taiwan

The great economic growth enjoyed by Taiwan throughout the 1980s and the 1990s encouraged the national government to institute broad educational and social policies designed to place the country at the center of the new information age where it can take advantage of the wealth of opportunities offered by globalization (Tu & Twu, 2002). Most of the attention of implementing ICT in Taiwanese education has focused so far on the K-12 curriculum, with the principal use of ICT being computer-aided instruction (CAI). One empirical study indicates that CAI has provided a modest improvement over traditional teaching methods in Taiwanese schools (Liao, 2007). Nevertheless, it appears that, despite the Ministry of Education’s rhetoric about the benefits of ICT for education, ICT itself is seldom taught as a subject in the K-9 schools of Taiwan, thus delaying the learning of basic computer skills (ChanLin et al., 2006). The implementation of ICT in the Taiwanese educational system is still in the early stages, but it certainly has not yet realized its promise.

There is, however, some evidence that ICT has been incorporated, rather tentatively, into higher education settings in Taiwan. Yang (2008) reports that one university class was taught to use Socratic dialogues, the basis of constructivist learning, through asynchronous online delivery by a creative professor and several teaching assistants. Young and Ku (2008) describe a joint online distance education project carried out collaboratively by a university in Taiwan and a university on mainland China, something that would have been unthinkable without the benefit of ICT. Chiu (2002) discusses the ways in which computer-assisted design (CAD) has been used in one Taiwanese architectural school, though this article also emphasizes that CAD is only a tool and that human management skills for dynamic organization is actually more important than ICT. Nonetheless, there is growing optimism on many campuses that ICT is destined to transform higher education in Taiwan, particularly the education of architects and engineers, mainly because of its potential for increasing collaboration and collegiality among faculty members.
ICT and Constructivism

The hands-on, exploratory, interactive nature of ICTs, particularly the Internet, causes them to gravitate toward the postmodern epistemology and educational theory of constructivism. In fact, if constructivism had not already existed, it seems likely that ICTs would have invented it to explain how they operate. According to Murphy (1997), “Technology is increasingly being touted as an optimal medium for the application of constructivist principles of learning.” When educators speak about ICTs transforming the teaching and learning process, they always mean that the new process is learner-centered, not teacher-centered or even knowledge-centered. Moreover, constructivist epistemology contends that knowledge is not based on an objective reality that is discovered; instead, knowledge is created or invented by learners actively giving meaning to their engagements with problems (Jonassen, 1991). Some argue that this meaning is based on individual experience, while others believe that it is socially situated (Ernst, 1995). Either way, as Means & Olson (1997) point out, constructivist pedagogy holds the promise of transforming the relationship between teachers and students in the direction of empowering learners to be much more active and interactive in the classroom:

Teachers will design the overall structure for project activities and provide the resources that students need to do them, but students will have much more responsibility for their own learning and for producing finished products that meet high standards. Teachers will function as roving coaches, helping individual students or groups over rough spots and capitalize on the ‘teachable moment’ within the context of the students’ engagement in their work. (p. ix)

This is what Means & Olson call “The Vision” of technology-supported constructivist classrooms.

Constructivism is not new. In fact, this epistemological and educational paradigm resides at the heart of Western civilization in the teaching method of Socrates who elicited knowledge from students by asking them carefully-chosen questions. Human reason, leading to the discovery of eternal ideas beyond individual experience, after the manner of the ancient Greek philosophers Plato and Aristotle, was glorified during the European Renaissance, culminating in the philosophical writings of Descartes and the founding of modern science by Newton. Nevertheless, beginning in the seventeenth century European philosophers started to question what humans can actually know through the senses and rationality. Locke, Hume, and later Kant all argued that objective reality, independent of the person experiencing it, is unknowable. Once this sceptical attitude became fairly well established among intellectuals, the development of constructivism as an epistemological and educational theory was inevitable (von Glasersfeld, 1989; Hawkins, 1994).

It seems fitting that the strongest progenitor of constructivism should be the early twentieth century American philosopher John Dewey (1897; 1902; 1938) whose teachings are known as pragmatism. This school of philosophy rejects the duality of ideas and objects in favor of the theory, adapted from Darwin, that human beings know the world by interacting with it. Dewey’s philosophy is called pragmatism because he believed that the purpose of intellectual inquiry is not to understand reality apart from experience, but to learn how to function in the best possible way within any given situation. Dewey called his theory of epistemology instrumentalism, a term that has virtually the same meaning as constructivism (Field, 2007).

Discussion

A. A Word about the Benefits of ICTs

The benefit of ICT for students – at least according to the enthusiasts – is that it will help transform them from being passive and uncritical receptacles of past knowledge into being active and creative learners, ready to take responsibility for the future. The benefit of ICT for teachers is that it will allow them to interact more freely and collaboratively with students to foster social change. But that is only the beginning. ICT networks offer the possibility of great professional development in the form of the immediate sharing of research and theoretical discourse anywhere in the world. Collegiality is fundamental to the profession of education, especially at the university level, and ICTs have already created vast networks of teachers and professors that span the globe.

It is impossible to overestimate the value of these networks to the education of professional architects. As Andia argues, architectural schools have already evolved into centers of experimental ICTs, particularly in the field of
design. Leading architectural schools in America, Europe, and Japan are capable of sharing the newest technologies with architects, professors, and students in more marginal areas, such as Taiwan, and it would be foolish of universities in lesser developed nations not to take advantage of ICTs to keep them current and competitive in the profession of architecture. It must be remembered that architecture is project-driven and almosttotally at the mercy of economic forces.

B. Some Issues with ICT and Some Possible Solutions

A recurring theme in the discourse on the use of ICTs in education is the frustrating, but apparently inevitable, gap between theory and practice (Condie & Livingstone, 2007; Haydn & Barton, 2007). Loveless & Ellis (2001) sum up the situation perfectly:

We feel that the introduction of these technologies into classrooms and schools is having an impact on teaching and learning that does not necessarily reflect the ways in which children and young people experience and appropriate the technology in their lives outside school. Neither is the prophetic claims being made about the role of ICT in learning being realized in classroom practice as a whole. (pp. 1-2)

What then is the problem? There is a tendency among enthusiasts of ICT, who take for granted the belief that everyone should get on board and share the progressive journey to the future, to blame some teachers for being old-fashioned. Jordan & Jameson (2005) point out that radical change will not occur in the profession of teaching until it occurs among teachers as a whole, and they offer much practical advice about converting oneself and one’s colleagues to the cause through such practices as holding positive discussions with fellow teachers and avoiding political in-fighting about matters of authority.

In contrast, however, to the assumption that ICT is a given for contemporary education, Dale et al. (2004) argue that “learning,” “teaching,” and” ICT” are not de-contextualized absolutes, but are, in fact, all spaces that are constructed in any given situation, and therefore the relationships among them are negotiable. This means that educators need to be wary about any rhetorical claims about the implementation of ICT. These authors even suggest that the implementation of ICT in education might be more supply-driven, from an educator’s perspective, than it is demand-driven. In other words, policy makers, both at the institutional level and at the state level, might be more committed to implementing ICT than educators sometimes are. If this is the case, the problem might be at least as much vertical as it is horizontal.

Unwin (2007) describes this aspect of the problem precisely: “Technologies in education have often been seen and used as providing the answer to all our educational problems. ICT is no exception, often being promoted by politicians (and sold by retailers/software manufacturers) as the solution to efficient learning” (p. 300). Both states and universities need to appear technologically ascendant in order to “sell “higher education to the public in the marketplace of the global village. Unwin’s main argument, however, is that the implementation of ICT in higher education affects the professionalism of university teachers. He admits that constructivism provides a general theoretical framework for teaching with ICTs, but he also contends that even within this provisional paradigm higher education teachers often do not have the proper pedagogical training in ICT to be able to integrate these new technologies into their teaching, and even if they did have the training, they would still find it difficult to keep up with the constant and rapid changes of ICT.

Unwin believes that the best theoretical solution to date for the problem of ICT training for higher education professionals is TPCK, or Technological Pedagogical Concept Knowledge, a construct developed by Koehler et al. (2004; 2007) and Mishra & Koehler (2006). TPCK is a kind of knowledge that combines technology and content with pedagogy. Not just knowledge about the content of a course and knowledge about the technology available, TPCK is knowledge about the appropriate pedagogy for combining content and technology. In other words, TPCK integrates, in a complex fashion, what an educator should know and how he or she should use technology to teach that knowledge. The value of TPCK, according to Unwin, is that it does not treat technology as knowledge separate from content and pedagogy – the way that educators are usually taught ICT. He gives the example of learning to use PowerPoint but not learning the content and pedagogy for which it is best fitted. TPCK overcomes that failure, and Unwin believes it is a valuable pedagogical model for training future educators in ICT.
Laurillard (2002) calls into question the theoretical framework of constructivism itself as a proper pedagogical model for any but the highest form of education:

To support students properly in their own exploration of what is known in a field, where its frontiers are, and where they might be extended is extremely costly in staff time. Guidance is a labour intensive process, which means that any one academic can only service a small number of students. Assessment is also labour intensive, as each case must be judged on its own merit, not in terms of a pre-defined “model answer.” And working at the frontiers of knowledge is essentially a lonely task done by individuals and very small groups, not amenable to any form of mass education or support. That is the proper model of post-graduate education, but that is where it must be confined. (p. 2)

Laurillard’s practical reminders are sobering, and they tend to make the glowing prophecies of the many ICT enthusiasts sound glib indeed. It should be noted here that even at the Harvard Graduate School of Design architectural professors found the implementation of ICT as a pedagogical method extremely time-consuming and labor intensive, seriously straining the resources of the university (Wiske et al., 2001).

Certain questions about implementing ICT for pedagogical purposes will not go away. Why is there such a gap between promise and practice? Who is to blame for the gap? Is ICT being forced upon the education system by enthusiasts and policy makers eager to be up to date and to compete in the global marketplace? Is constructivism, the educational paradigm that is always associated with ICT, appropriate for any level lower than postgraduate studies? Scholars need to continue examining these issues carefully. They also need to examine another issue -- the cultural context of ICT -- perhaps even more carefully.

C. Technology Is Not Neutral

Loveless (2000) argues that ICTs are not neutral tools for learning, but are instead “cultural artifacts” in the hands of both students and teachers. As such, they are affected by, and they affect, the culture in which they are found. These effects are likely to be profound in some cases. Studies on the ways that ICT affect educational systems, such as Davis et al. (1997) and Davidson (2003), generally agree that the new technologies hold considerable promise for enhancing the quality and availability of education in virtually all areas, but that they cannot simply be grafted onto old methods of teaching and learning. ICTs demand their own accommodations, and when these accommodations are recognized and used, the resulting enrichments can be manifold. And yet the cultural changes associated with implementing new technologies are bound to be materially transformative but ideologically disruptive.

Professional education in architecture is not immune to cultural changes, and many schools of architecture have eagerly jumped on the ICT bandwagon both in their traditional course offerings and in courses designed to meet the continuing education needs of professional architects and designers. This enthusiasm is reflected in a flurry of publications on the subject in scholarly and professional journals in the field. Whole conferences have been devoted to the uses of information and communication technologies in architectural, engineering, and design education. Indeed, a review of such conferences reveals not only a significant number of them, but several separate organizations devoted to the study of, or advancement of, the use of information and communication technologies in professional education in architecture. Cheng (1996, 1997, 1998, and 1999) has been particularly prolific in advocating a stronger role for ICTs in architectural education. Her works have both described and advocated the use of ICTs in studio-based instruction and in instruction in graphic design.

The Taiwanese educational model for architecture, following the ideas of Schön (1984), has evolved from apprenticeship systems into studio-based, tutorial environments. The design studio is currently viewed as a learning environment in which skills and values can be developed within a spirit of open inquiry. The model has served students and professionals well in many respects, but both constituencies need ways to incorporate rapidly-advancing technologies into both education and practice. These programs, like other professional education programs, are currently in upheaval, at least in part because of the perception that new technologies will inevitably transform them. Eagerness to adopt new methods, as well as fear of the outcomes in adopting them is characteristic of the professional architecture education in Taiwan today. We have already noted how disruptive the epistemology of constructivism, the ideological framework of ICT, can be to Asian educators. Taiwanese universities and professional programs often lack modern perspectives and remain mired in traditional methods, so much so that both teaching and professional practice fail to meet the nation’s needs, despite the government’s claim that the nation is
committed to modernization and global economic competitiveness through the general adoption of ICT (e-Taiwan Project, 2005).

In Taiwan pedagogical changes are taking place in a setting of rapid social and political change. Not only is there a long-standing conflict between mainland Chinese communists and Taipei democrats (Gu, 1996), mirrored by the local conflict between the Kuomintang and the Democratic Progressive Party (Hsiao, 2008), but recently a neo-Nazi party, the National Socialist Association, has been formed by university graduates and students (Turton, 2007). It is significant to note that at the heart of this radical new party’s doctrine is a commitment to return to the traditional ideals of Confucius. Such young intellectuals are not likely to be sympathetic to the Western ideology of constructivism underpinning the educational use of ICT. It seems reasonable to assume that these encompassing political and cultural changes will also affect how educational changes occur.

Will professional educators in Taiwan, specifically professional educators in architecture, embrace the changes and challenges attendant with the new ICTs, even while they are managing the political, professional, and institutional changes occurring around them? Wang’s impassioned (2008) plea for a total transformation of architectural education through the implementation of ICTs is certainly understandable in the context of Taiwanese society as a whole. Future research needs to focus on the acceptance and use of ICTs in architectural education in Taiwan in order to shed some light on how effective such technologies can be as they are adopted amidst a turbulent world of social change.

**Conclusions**

This paper has attempted to explain how the expanded use of ICT is currently changing pedagogical practice, particularly in the professional education of architects in developing Asian nations. ICT was demonstrated to have great pedagogical promise, but there is still a large gap between its transformative potential for education and its actual performance to date. ICTs encourage students to become interactive learners, and they offer teachers, particularly those in higher education, a means for conducting and sharing research beyond all previous limitations of time and geography and culture. Moreover, through the effective use of ICT educators can assist society as a whole to grow toward greater inclusiveness and progressive social change. The principal problems associated with using ICT for educational purposes appear to be a persistent failure to find a link between theory and practice and the difficulty of training teachers to use ICT creatively, although the recent introduction of Mishra & Koehler’s (2006) concept of TPCK may soon change that.

The general pedagogical difficulties associated with implementing ICT in higher education are seen to be complicated in Taiwan by cultural considerations, particularly the Asian reluctance to accept a new technology so strongly associated with the Western epistemology of constructivism. Nevertheless, there is optimism that the professional education of architects in Taiwan will continue to grow and become more competitive through an expanded use of ICTs.

**References**


