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Emerging Technologies in Higher Education



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Abstract

The 21st century is witnessing an explosion of knowledge in science and technology, specially the information and communication technology. The development of new technologies has generated a considerable amount of excitement among academics because it results in shifting the academic environment from traditional setting to new technology based learning settings. Increasing numbers of institutions of higher education offer courses using emerging technologies as alternative teaching and learning tools. However, regardless of such interests in emerging technologies in higher education, there is lack of academic research on the use of those technologies in the higher education setting. I examined many resources and cited studies to answer the some questions that arose from my study of the literature of emerging technologies in higher education; such as (i) what types of mobile wireless technologies are currently being used in higher education? (ii) How do mobile wireless technologies access to network resources? and (iii) What is the benefits of mobile wireless technologies in higher education?

I examined following of the most popular emerging technologies used in higher education:

1. Learning with the Internet
2. Learning by Design
3. Knowledge Webs
4. Virtual Communities
5. Mobile wireless Technologies
6. Mobile wireless Computers
7. Personal Digital Assistants (PDAs)
8. Mobile wireless Phones
9. Short Message Services (SMS) and Multi Media Services (MMS)
10. Wireless Computers
11. PDAs and mobile wireless Phones

Introduction

Higher education includes teaching, research, exacting applied work and social services activities of universities. Within the realm of teaching, it includes both the undergraduate level, and beyond that, graduate-level (or postgraduate level). In many developed countries, a high proportion of the population (up to 50%), now enter higher education at some time in their lives. Higher education is therefore very important to national economies, both as a significant industry in its own right and as a source of trained and educated personnel for the rest of the economy. College educated workers command a significant wage premium and are much less likely to become unemployed than less educated workers.

In the history of technology, emerging technologies are contemporary advances and innovation in various fields of technology. Various converging technologies have emerged in the technological convergence of different systems evolving towards similar goals. Convergence can refer to previously separate technologies such as voice (and telephony features), data (and productivity applications) and video that now share resources and interact with each other, creating new efficiencies. Emerging technologies are those technical innovations which represent progressive developments within a field for competitive advantage converging technologies represent previously distinct fields which are in some way moving towards stronger inter-connection and similar goals. However, the opinion on the degree of impact, status and economic viability of several emerging and converging technologies vary.

This paper describes how we can transform teaching and learning to prepare students with the skills they need for 21st-century work and citizenship. In addition, immersive interfaces (e.g., virtual worlds, augmented realities) and mobile devices pervade the lives of students

outside academic settings. We can build on these media to improve our teaching and assessment and to strengthen the links between life inside and outside the classroom.

Learning with the Internet

The internet is a complex repository containing a huge maze of information from a variety of sources. It has become a prominent source of information for many people worldwide. The Internet wave has also hit the educational landscape in many big ways. The use of emerging technologies such as the Internet as a teaching tool in Universities is not the issue now since it is pervasively used. Rather, the issue is how to effectively employ such technologies and harness fully the new opportunities created by them to promote positive student learning experiences. Universities need to consider how technology based instructional programs are mounted to ensure that students use the Internet efficaciously as a learning tool for various authentic learning activities such as conducting research on a given topic or finding relevant information for an assignment. Bruce and Levin (1997) posit that the Internet can be viewed as providing the following three basic types of tools in the educational domain:

- Tools of inquiry
- Tools of communication
- Tools for construction

In providing tools for inquiry, the Internet facilitates finding sources of information appropriate to a task, working to understand the information resources and how they relate to the task, and if possible applying this understanding in a productive way. The internet enhances students' knowledge acquisition by facilitating student's access to resources from the outside world including experts in the field, as well as interacting directly with them. Thus exposure to real life contexts of the external world trains the students to face the uncertainties of the ever-changing outside world.

In providing tools for communication, the Internet is a remarkable tool for rapid communication. Such communication can be both synchronous and asynchronous and takes on many forms such as e-mail, mailing lists, news groups, chat and video conferencing. Such interaction involves communication with students and professionals in distant places, cultures and traditions as well as facilitating teachers to be in touch with other teachers.

In providing tools for construction, the Internet promotes learning by scaffolding varieties of authentic learning activities for students. Through these activities the Internet also supports the development of students' higher order thinking skills. For example students are able to demonstrate their conceptual understanding by constructing products such as web pages. In these activities learners regulate their individual learning progress according to their own experiences and expertise. Learners can access a wealth of resources at their own pace and have meaningful interactions with the content information. For instructional activities, the Internet also has the added advantages of being adaptable for both individual and cooperative learning.

Learning by Design: Integrating Technology into the Curriculum

Computers, telecommunications and multimedia can be powerful tools for enriching student learning. They are also an essential part of preparing students for a world characterized by knowledge, work, global communications and continuous learning and change. But in order for technology to be effective in today's education system, it needs to be intelligently integrated into a rich, meaning-centered curriculum. Accomplishing this goal requires designing new kinds of creative learning environments involving the collaboration of all the stakeholders in educational reform- teachers, students, administrators, parents, researchers, the business community, curriculum specialists and technology developers.

Student design projects are effective frameworks for integrating technology into the curriculum. Design projects often require effective use of multiple intelligences, develop students' higher order thinking and problem solving skills, sensitize students to creating a product for use by a real client or user audience, and enable diverse forms of collaborative learning in engaging some students whose talents or knowledge are often not recognized in more traditional classroom environments. Design projects also encourage making connections across curriculum areas. For example, in the Institute for Research on Learning's (IRL) Mathematics through Application Project (MAP), students use computer simulation and tools to design dream homes, develop various research stations for scientists living in Antarctica, develop encryption and decoding systems for secret messages, or model population growth of animal species within different ecological systems or habitats.

Knowledge Webs

In two decades, "knowledge webs" will routinely enable higher education students distributed access to experts, archival resources, authentic environments, and shared investigations. Via information infrastructures, educators and pupils will regularly join distributed conferences that provide an instant network of contacts with useful skills, a personal brain trust with just in time answers to immediate questions. In time, these informal sources of expertise will utilize embedded "groupware" tools to enhance collaboration. Even on today's Internet, on-line archival resources are increasingly linked into the World Wide Web, accessible through "web crawlers" such as Mosaic and Netscape. In the future, Artificial Intelligence-based guides and filters will facilitate learners navigating through huge amounts of stored information.

Virtual exhibits that duplicate real world settings will form the basis of most field trips; these environments make possible a wide variety of experiences without the necessity of travel or scheduling. Distributed science projects will enable conducting shared experiments dispersed across time and space, each student learning more than would be possible in isolation about the phenomenon being studied and about scientific investigation. However, access to data does not automatically expand

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student's knowledge, nor will the mere availability of information intrinsically create an internal framework of ideas that learners can apply in real world settings. While presentational approach transmits material rapidly from source to student, often this content evaporates quickly from learner's minds. To be motivated to master concepts and skills, pre-college students need to see the connection of what they are learning to the rest of their lives and to the mental models they already use. Helping students' progress from access through assimilation to appropriation requires educational experiences that empower knowledge construction by unsophisticated learners, aiding them in making sense of massive, incomplete and inconsistent information sources. As part of using knowledge webs, to move students beyond assimilating inert facts into generating better mental models, teachers will structure learning experiences that highlight how new ideas can provide insights in intriguing, challenging situations.

Virtual Communities

Two decades hence, virtual communities that provide support from others who share common joys and trials will also enhance distributed learning in higher education institute. We are accustomed to face to face interaction as a means of getting to know people, sharing ideas and experiences, enjoying others' humor and fellowship, and finding solace. In the future, distributed learning via information infrastructures will satisfy many of these needs at any time, any place. Some students (shy, reflective, comfortable with emotional distance) even find asynchronous, low bandwidth communication more "authentic" than face to face verbal exchange. They take time before replying to carefully compose a message, as well as to refine the emotional nuances they wish to convey. This alternative conception of personal authenticity may help us understand how better to tailor instruction for diverse learning styles.

Educators will use the virtual communities' information infrastructures to make it possible to dramatically improve learning outcomes. Learning is social as well as intellectual; individual, isolated attempts to make sense of complex data can easily fail unless the learner is encouraged by some large group that is constructing shared knowledge. Virtually communities enable new pedagogical strategies that facilitate such encouragement and motivation. For example, peer tutoring aids all students involved both intellectually and emotionally, but has been difficult to implement in additional traditional classroom settings. In the future, virtual interactions will readily enable such student-student relationships outside of institute, as well as preparing their participants for later use of distributed problem solving technique in higher education settings. In addition, educators themselves need emotional and intellectual support from others who have similar challenges in their lives. In the future, virtual communities will provide a means of helping teachers find the strength to help learning keep pace with our rapidly changing and increasingly diverse society. Moreover, formal education comprises only a small fraction of how students spend their time. No matter how well learning is done, achieving major gains in learning requires that the rest

of pupils' lives be educationally fulfilling as well. This necessitates close cooperation and shared responsibility for distributed learning among society's educational agents (families, social service agencies, workplaces, mass media, schools, higher education).

Mobile Wireless Technologies

The development of mobile wireless technologies has generated a considerable amount of excitement among practitioners and academics because it results in shifting the academic environment from traditional settings to mobile learning settings. For the last several decades, wired technologies have been used by educators, school communicators, students and others in higher education to help them achieving and learning. In this century, however, institutions of higher learning are moving towards the use of mobile wireless technologies. Similar to other wired technologies, mobile wireless technologies have first been used in industry sectors such as business. The movement of mobile wireless technologies in education is recent trend, and it is now becoming the hottest technology in higher education (Levine, 2002; McGhee & Kozma, 2001; Mc Kenzie, 2001).

For the past few years, educators and students in higher education have enjoyed the many benefits of wired technology. However, wired technology provides limited access for usage due to a lack of mobility. In other words, wired technologies cannot provide anytime, anywhere functionality, a benefit now offered by mobile wireless technologies. The use of mobile wireless technologies can overcome the limitation of educational flexibility with wired technology. With the advantages of mobility, mobile wireless technologies help improve efficiency of effectiveness in teaching and learning (Maginnis, White, & Mckenna, 2000).

People often think mobile or wireless technologies are the same as mobile wireless technologies. Strictly speaking, mobile wireless technologies are different from mobile or wireless technologies simply because not all mobile technologies are wireless nor are all wireless technologies mobile. According to Malladi and Agrawal (2002), mobile wireless technologies consist of two aspects- mobility and computing. They claimed that mobile computing represents users' continuous access to network resources without limitation of time and location. Wireless means that transmission of any form of data- text, voice, video or image – is conducted through radio waves, infrared waves or microwaves rather than using wires (Dubendorf, 2003). Therefore, mobile wireless technologies is defined as any wireless technology that uses radio frequency spectrum in any band to facilitate transmission of text data, voice, video, or multimedia services to mobile devices with freedom of time and location limitation.

The freedom of time and location is related to the concept of anytime and anywhere access that represents the two main characteristics of mobile wireless technologies- mobility and reachability (BenMoussa,2003; Camponovo & Pigneur, 2003; Ng-Kruelle, Swatman, Rebne & Hampe, 2002; Turban, Lee, King, Warkentin & Chung, 2002). Mobile wireless

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technologies use public sections- antennas- or Wireless Access Points (WAPs) that are connected to wired network in a building or public area to give a way of access fir web resources and communication for mobile wireless technologies users. With mobile wireless network or service in mobile wireless devices, users can access network information anytime, anywhere. For example, people can carry wireless laptops anytime, anywhere and can access a network in public places, such as an airport and a library. In addition, handheld devices can be carried and connect a network anywhere, anytime using public stations (e.g., antenna).

An increasing number of colleges and universities are adopting mobile wireless technologies as teaching and learning tools. According to Swett (2002), more than 90% of public universities and 80% of private universities in the US have some level of mobile wireless technologies, such as mobile wireless devices and networks. In the near future, mobile wireless devices and a wireless network may be required for all students at higher education. Heavy investment on educational technology will leave no student behind as new technologies become available for education.

Mobile wireless devices used in higher education

A number of different mobile wireless devices are being used in higher education. These include web-enabled wireless phones (e.g., smart phones), web-enabled wireless handheld computers (e.g., palmtop, and tablet computers), wireless laptop computers and Personal Digital Assistants (PDAs). In learning environments, mobile wireless computers, PDAs and handheld devices are used most often. However some researchers claimed that in the future, more institution of higher education will require mobile wireless phones for students and faculty members for teaching and learning.

Mobile Wireless Computers

Mobile wireless computers commonly called, wireless laptops, and are the most popular mobile wireless technologies used in higher education. Wireless laptops have an integrated wireless card that enables short-range wireless voice and data communications. Unlike wired laptops that use an Ethernet card, also called a NIC or Network card to connect to a network, mobile wireless laptops use a wireless network interface card (WNIC) to connect to a network. WNIC uses a very low radio frequency instead of a wired connection to connect network. There are a number of schools and programs in higher education that requires students to use wireless-enabled laptops in class.

Personal Digital Assistants (PDAs)

In 2000, handheld devices, PDAs, become the newest emerging technology for education. Like the other forms of technology, PDAs were initially used as a tool for business. According to the definition from Webopedia (webopedia.com), PDAs stands for Personal Digital Assistants- a handheld device combining functionalities of computing, telephone, internet and network. PDAs have functionalities such as a cellular phone, fax, organizer, and web browser. Popular PDAs used in education are Hewlett-Packard's Palmtop and 3Com's Palm Pilot. The

University of South Dakota was the first school in the US to initiate a PDA project requiring all first year undergraduate students and first year law and medical school students to have a PDA for their study (Oliver & Wright, 2002).

Mobile Wireless Phones

Mobile wireless phones are the most popular mobile wireless technology used mainly as personal communication tool. Examples of mobile wireless phones include the following:

- **Web-enabled cellula:** similar to cellular, but has a capability of accessing the web. It uses wireless application protocol (WAP) as the system to connect to the internet through a mobile phone. Sometimes, it is called a WAP phone.
- **Wireless handset:** a sort of cellular phone providing a communications system with more features, such as voice-activated dialing, a WAP browser, and two-way text messaging.
- **Smart phones:** a combination of mobile phone and computers.

Compared to wireless-enabled computers of PDAs, mobile wireless phones are still in their infancy for teaching and learning environments. PDAs are often used with wireless services, such as Short Message Service (SMS) and multimedia message service (MMS).

Short Message Service (SMS) and Multi Media Services (MMS)

SMS or text messaging is the transmission of short text message to and from a mobile wireless phone, fax machine and IP address. SMS may be one of the most common wireless applications that are used with mobile wireless phones to support teaching and learning. With SMS, professors and students can send and receive message to and from most modern mobile wireless phones.

Unlike SMS, MMS is the more recent mobile messaging application. Therefore, fewer educational institutions have begun to test MMs as a potential teaching and learning tool. Similar to SMS, the MMS offers automatic and immediate delivery of personal messages. However, MMS can deliver all types of information, such as text messages, sound, Images, and video messages. In the near future, the use of SMS and MMS will potentially be increased in education field as technology improves.

With the increasing trend of institutions of higher education to adopt and make use of mobile wireless technology, it is likely that these devices will become more prevalent on campuses. The influence of this trend remains to be seen.

Wireless Computers

Wireless computers operate in the same ways as a regular computer just without most of the wires. Wireless Network Interface Card (WNIC) that is installed in laptop computers and uses a very low radio frequency instead of a wired connection to connect to a network, sends a very low power signal to a wireless access point (WAPs) installed in buildings a classroom. The WAPs are connected to a wired network (e.g., Local Area Network). Therefore, the WAPs serve as the bridge between the WNIC and the wire network. The WAPs support transmission for many users simultaneously, far more than wired

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networks. However, using the WAPs to connect a network, the speed of data transmission is limited to 11 Mbps making transmissions slower than wired computers whose speed is 100 Mbps.

PDA's and Mobile Wireless Phones

It is unlikely, the connection of wireless computers to wired network, PDA's, and mobile wireless phones use public stations (e.g., antenna). Therefore, users need to subscribe to wireless services that are provided by wireless service providers. With wireless services subscription, faculty and students simply punch some buttons on their mobile wireless devices to access network. Different infrastructure is required for different mobile wireless devices in order to access network resources. Therefore understanding technical aspects of mobile wireless technology may help users utilizing it more effectively in a case of technical failure.

Conclusion

Emerging technologies in higher education such as mobile wireless technologies are an interesting and very recent addition to the higher education. Their power to change the way of educating people is mind boggling. These are the new frontier for teaching and learning in institutions of higher education. Currently and in the near future many educational opportunities are made possible because of these technologies unique characteristics and positive impacts identified in higher education. Mobile wireless technologies use in higher education will continue to grow and will become the learning environment of choice.

The movement of mobile wireless technologies in education is a recent trend, and it is now becoming the hottest technology in higher education. For many, mobile wireless technologies are still far from being used in everyday life, like calculators or computers. To use these emerging technologies successfully, administrators, educators, and students must think critically to determine how to use the new technologies to achieve their educational goals, rather than greeting the new technologies with uncritical excitement.

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