

Thinking About Technology Effects on Higher Education

By Mohammed F. Fahmy

Technology today extends over many fields and is very complicated in nature. Learning to “do” technology is an important way to understand and to learn what technology really means. In academia, this implies a needed change in our teaching methods and the design of new applied teaching methods to explain the processes resulting in the development of technology in the “real” world. Explanations of such processes are sought and are taught in new lab/classroom instructional settings that enhance the teaching of problem-solving skills. In a recent publication of the International Technology Education Association (ITEA, 2002), it was cited that “recent research on learning finds that many students learn best in experiential ways by doing, rather than only by seeing or hearing” (p. 5).

It is no wonder that in recent years a new wave of “experiential learning” has flooded academia. At the national level many universities, particularly publicly supported institutions, were required to develop and implement experiential learning methods across all of their disciplines and in their curricula. To encourage such practices, funds were made available from several state and federal sources. The resources allocated for this new methodology were, as usual, meager and not enough to achieve the stated goals. Some colleges, in pursuit of such funds, established what they called experiential learning classrooms as their main application of such newly encouraged teaching methods just to continue to benefit from the newly allocated funds. Continuous funding of these new experiential learning efforts to establish the infrastructure and to acquire needed equipment and hardware was, as usual, not adequately allocated or provided for, resulting in a long and laborious process in implementing such worthy efforts in academia. Students today not only need to learn how to do technology, they also need to learn how to live in today’s world, which has become one that is buzzing with information and misinformation. Students need to know how to col-

lect, sift through, and organize the information made available to them to augment and assess their own learning process. Ehrmann (1999) emphasized the value of technology by stating that “technology (in the broadest sense of that term) is providing a foundation for the reorganization of higher learning” (p. 42).

Technology and Change

To fully realize how technology and change are related, I will first define change and then discuss some factors such as need for change, importance of change, and resources needed to implement change in this section.

First what does *change* mean? The 1940 edition of the *Winston Dictionary* lists some of the definitions of the word change as: “to alter as, to change one’s habit; to vary; to undergo alteration; to pass from one place to another.” A more recent 1997 *Merriam-Webster Dictionary* cites some of the definitions of change as: “to make or become different, alter; to replace with another; ...etc; (n) the act, process, or result of changing; etc,” which is almost the same as that cited in the 1940 edition of the *Winston Dictionary* above.

Need for Change

Should we implement *every* new technological discovery in all professional fields once we know about it? Obviously the answer is no, we should not, at least until we understand the ramifications of such implementation. Next, what should we look for before even thinking of changing our established ways or procedures? Common sense necessitates that we should study the new technological phenomenon, decide whether it relates to our existing practices, and then study the possibility of its implementation. In other words, we must be sure that we understand the new technology and whether it would be a better fit of what we already have or not. Moreover, would it really benefit the organization if it is implemented? Or, at least be aware of the downside of its applications, especially if the new technology has not been studied and understood well enough yet.

Importance of Change

Once the new process, or technological phenomenon, has been carefully studied, we need to identify the areas and personnel that it will have direct impact on when fully implemented. Next, we need to convince those involved that the sought-after change will bring positive results both to the individual and general levels. In other words, explain why the organization will be in better shape and list the benefits, which will be brought about as a result of implementing this new technology or change. People can only be “champions of the cause” if they understand the consequences of its implementation on their personal lives and the organization as a whole.

Resources

Allocation of resources to bring about and to implement the new technology or practices is a very important and essential factor if any change is to be instituted. Such resources are needed for (a) feasibility and pilot studies; (b) training, re-training, or hiring of new trained personnel; (c) building the infrastructure (i.e., acquiring the new equipment or hardware needed for the full implementation of the new processes); and (d) continued assessment of the implementation of the process.

This factor (allocation of resources) could be viewed as the most important one in the process of change. Two sectors of our economy that might be viewed as the most successful in implementing new technologies because of readily available resources are *industry* and the *military*.

The military branch of the government, which may be viewed as the boldest in the implementation of new technologies, has proven to be at the forefront of technology applications. Its hierarchal structure and leadership structure—coupled with the generous resources made available for its development and annual operational cost, and other such factors as clear vision, willingness to try, ability to recognize value, impact on the success of mission, etc.—are believed to be the direct reasons as to why the military is way ahead of civilian organizations in the implementation of new technologies. The nature of the military as well as the

fact that the mere survival of its members depends vastly on the new applications mandates that it must be at the cutting edge of technology use and implementation.

On the other hand, many industries have realized that their own success and survival in a globally competitive arena depends greatly on their ability to implement new, relevant technologies to stay ahead of their competition, not only nationally, but also at the global level. Unlike the military, the industrial sector—even though it is willing to apply new technologies—is not as bold. There are other factors that private industry has to consider. At the forefront of such factors is the margin of profit. There has to be a very delicate balance between what the private sector is willing to spend on new technology applications and the margin of profit it has identified for itself to stay competitive. Another factor in the implementation of new technologies is the fear of the ramifications if the technology has not been fully understood yet. In the private sector, such failures may bring losses as a result of lawsuits and compensations for a failed product.

A third sector that may be involved in technology applications and the changes they bring about is the public sector, whose funding depends mainly on allocated funds by public institutions (e.g., local government, etc.). Public educational institutions fall under this category. Usually the progress such institutions achieve in the arena of technological applications and the changes they bring about is very slow compared to the other two sectors discussed above. The key factor here, again, is simply resources. Public academic institutions are, for the most part, governed by the resources made available to them more so than their ingenuity and willingness to implement new technologies. In their quest to apply new technologies needed for their ultimate survival and to stay competitive, public institutions are always compensated by meager allocations of funds controlled by their governing bodies. Such funds are often not enough to cover the needed changes. Many of these institutions, however, have stayed very close, if not at the cutting edge, by seeking external funds from a variety of sources such as other more fortunate government agencies (e.g., the mili-

tary, the National Science Foundation, the Department of Energy, etc.), industrial partnerships, or private foundations. The degree of success in finding external organizations willing to fund such efforts in higher education depends on many factors, including:

- Classification of the academic institution (land grant, research, comprehensive, etc.).
- Reputation of institution (public relations and marketing, previous dealings).
- Infrastructure of institution.
- Influence of institution on local or national government (pork monies allocations).
- Willingness of faculty and their ability to market their ideas and to make a convincing case for the funding organization to buy into their vision.

Recent Changes in Academe

Ehrmann (1999) described the three main revolutions that have taken place in education. The major transformation (or the first revolution) took place 2,500 years ago when the “oral exchange” between teachers and students was augmented by reading and writing. In his characterization, Ehrmann stated that “the rigidities of memorization were replaced by the even-stiffer rigidity of the written word and, later, the printed page” (p. 44). The second revolution, according to Ehrmann, started when students and teachers shared the same facilities (libraries, laboratories, etc.), which was the beginning of the educational community and campus life. This brought financial resources, not previously available, which caused the creation of a very complex environment (instructors, administrators, technicians, staff, students, publishers, etc.). The third revolution identified by Ehrmann is the one “made possible by computing, video, and telecommunication” (p. 42). One can safely term this third revolution as the technology revolution, which has brought about more learners and an inevitable change in the way higher education delivers its services. Even though this change is certain, its character “is not yet clear” (p. 46) according to Ehrmann.

The Future of Academe

What does the future hold for academe has

been the recent topic of many researchers and academicians. While there is not one single model that identifies clearly how all the researchers see the future of academe, there is a common vision of many of the anticipated elements of change. In the sections below, some of such elements are shared and discussed.

Technology and the Classroom

Carlson (2000) cited the issue of integrating technology with instruction as the single most important issue facing higher education. Other factors, which were identified in the same study as of less priority, were replacing outdated hardware or software, providing user support, providing online distance education, and integrating e-commerce into college and university Web sites and all other institutional services. While only 10% of college courses used electronic mail as a tool for instruction in 1994, Carlson cited that over 60% of courses in 2000 used this tool. According to him, 7% of courses had Web sites in 1994, whereas in 2000 the number was more than 30%. The report by the National Commission on the Cost of Higher Education (1998) concurred with these findings and noted that institutions were faced with the need to provide new equipment and infrastructure to accommodate this type of offerings. To meet the cost of such technology implementation, the report stated that institutions mandated computer/instructional technology fees ranging from \$55 to \$140 per student, hence passing some of such costs on to the students and their families. It is strongly believed that this trend will continue in the future to enable higher education institutions to update their classrooms and laboratories with the needed contemporary infrastructure required to deliver instruction to their students whether on campus or at a distance over newly established networks.

Other Technology Applications

According to Carlson (2000), academe is still lagging behind society at large in the application of some technology trends such as personal digital assistance devices (e.g., Palm Pilot) that campuses have not been able to integrate into their campus networks. E-commerce services is another area that shows academe far behind the private sector in application and use. Only 18.8% of the institutions surveyed, according to Carlson,

have set up e-commerce services (e.g., to pay tuition with credit cards) on their Web sites. The majority of colleges (80%) still do not see e-commerce applications as a service that should be allowed on campus Web sites. Like e-commerce, there are new e-learning companies such as Quisic 2000 (chronicle.quisic.com), which advertises that it believes that asking the right questions and learning new ways to answer them is essential. Further, the company claims to offer e-learning solutions for business education to help students and faculty achieve important goals. CollegeNet (www.corp.collegenet.com), another new e-company, has announced that its services are designed “to turn your school’s homepage into an engine for web commerce as streamlining commerce with the new generation.” Furthermore, Pelline (1997) and Kyrnin (2002) described a new technology, the “push technology,” made available by the commercial Internet providers, as a phenomenon that is inevitable. Push technology describes efforts to make local information available to all users linked to the institution’s network, hence pushing information to users rather than waiting for them to seek it. This way, push technology becomes a tool for educators to deliver instruction over a wider network.

As can be seen from the foregoing discussion, higher education institutions will be faced with more demands to cope with the fast-changing technologies and will be required to implement changes to accommodate such applications in order to deliver services in a manner that satisfies their clientele and to stay competitive at the same time.

Academe and the Information Society

Educators and society perceive the industrial revolution in general as a major reason for the shaping of our societies today. Many professionals and intellectuals believe a new revolution started recently, namely, the information/communication revolution, which will shape our future. This revolution in the exchange of information has been mainly caused by the great and rapid advances in technology. Levine (2000) identified new technologies as the major forces that have the power to change our university and college systems and the way they deliver their services as we know it

now. Other forces cited in his article were shifting demographics, the entrance of commercial organizations into higher education, the changing relationships between colleges and the federal and state governments, and the move from an industrial to an information society. He further listed nine major changes in higher education as inevitable changes that should not be ignored:

1. The creation of numerous and diverse “higher-education providers” that are global and more technologically advanced institutions. Such institutions will change the current practices and will necessitate a much faster response to an international student body, due to their ability to deliver instruction globally, if they are to stay successful and competitive.
2. The three types of higher education providers will be either brick universities (i.e., the traditional residential campus as we know it now), click universities currently known as virtual universities, or brick and click universities, which is a combination of both types that he predicts to be the most successful and competitive ones in the future. Gregory C. Farrington, president of Lehigh University, stated, “residential colleges might band together to share courses using the Internet” (as cited in Young, 2000,1) to provide their students with highly specialized courses and hence cutting their cost of delivery. Ehrmann (1999) added to these shared efforts among universities online libraries so that physical and virtual campuses complement one another and provide more services to their “customers” at a much lower cost. As a result, new entities in higher education, consortia, partnerships, etc., will emerge.
3. More individualized higher education in which students set the educational agenda due to their diverse backgrounds. In this case, institutions will react to customer needs rather than setting the educational agenda as they traditionally have done. Education will be provided

wherever and whenever students decide to receive it: at home, in the office, in the car, or on campus. This will simply be achievable because of the new emerging technologies.

4. A shift of focus of higher education from teaching to learning. In other words, instead of a certain number of credits to measure student achievements, a competency-based education in which student outcomes are measured and assessed will be used.
5. The current triangle of teaching-scholarship-service that describes the activities of most of today's universities will become predominantly focused on teaching as dictated by for-profit and other new providers in higher education.
6. The creation of a new rock-star professor in which the name of the professor, not that of the institution, will be the most important in bringing in business for the university. In other words, professors will become increasingly more independent of colleges and universities. Young (2000) cited a new book that predicts that institutions will market lectures of their superstar professors and place them on a World Wide Web site, replacing outdated traditional lecture delivery.
7. Degrees will be replaced by a transcript in which students' competencies delineate the level of their skills and knowledge. Students no longer have to reside on any specific campus to obtain a degree; rather, they can move around and accumulate more recognized skills and competencies.
8. Educational portfolios, or "educational passports," will have to be created and maintained to identify students' achievements wherever and whenever they were gained.
9. Public and private support will be directed to students rather than to educational institutions.

Whether we agree that the future holds some or all of the above listed changes, many recent articles have listed many such changes in

the future of academe. Young (2000) cited a new book whose authors concluded that both technology and market forces can "improve university teaching, streamline offerings, and bring education to more students than ever" (p. 1).

Faculty Security and the Tenure Process

Another recent shift in higher education and university practices involves the process of tenure. Wilson (1998) discussed the issue of tenure and its future. He argued that colleges that have abolished the tenure process and now hire new faculty on an "annual contract" basis are increasing in numbers. He further stated that there are currently 40 institutions in the United States hiring professors on contract appointments, hence increasing the percentage of such institutions from 19% in 1979 to 28% in 1998. Even though such news is not readily announced, the phenomenon of hiring more adjunct professors has risen from 22% in 1970 to a new high of 42% and has attracted the attention of many educators. According to Wilson, this new trend will result in professors hired on contract to be either focused on teaching or research, but not both. He further explained that new titles of such professors will commonly be known as lecturers, research scientists, instructors, or clinical faculty and that they will not be considered voting faculty on many campuses. Changes in the tenure process have been long anticipated by many in academe. An overhaul of that process in the next few years will not surprise many at all.

Impact of Technology/Change on Other Areas of Academe

The impact of technology and the resulting changes on nonacademics of higher education is cited by Ault, Hainline, and Abunawass (1999). Areas and personnel affected by technology in academe include:

- Staff and the way they provide their services.
- Academic offices.
- Training of personnel and technicians and quality of performance.
- Bargaining and the changes in the workplace.
- Ability of institutions to "market" themselves.

Such areas that are impacted by the technological changes will, undoubtedly, need a process of re-evaluation so we can get the best services to the students who are, after all, impacted by all the services provided by or depending on the above listed areas.

Conclusion

Technology and technological applications are, indeed, a continuous process that dates way back in our human history. Every time a new technology comes around, a process of change accompanies its implementation. Higher education, like any other sector in our society, is affected by technology applications and always races to institute the necessary changes to implement it. As a matter of fact, many of the new technological applications were discovered and developed into prototypes, which were tested and modified on many campuses. However,

the full implementation, which needed resources beyond academe's reach, was always a long and laborious process.

If higher education and academe are to improve the rate of change that technological applications bring, they need to find new ways to fund such efforts. Educational institutions started to seek partnerships with industry, government, and the private sector as means of providing part or most of the costs associated with the implementation of such new technologies. It is believed that it is through such partnerships that the process of change will be accelerated better than it is today.

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