

The Role of Information Technology in Higher Education: Motivation and Enhancement of Student Learning

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Abstract

A study was performed to identify what the undergraduate students think the role of the information technology (IT) should be in higher education. Comparisons between the responses and the students' major, year, sex, and age have shown that for the most part, students strongly agree that computer labs, personal computers, internet, and the instructor taking advantage of IT tools in lectures are necessary components of successful education. Some of the beliefs and attitudes students hold towards information technology are found to be significantly different between different demographic groups. We use these findings to support our deductions on what IT tools must be used in a successful education based on our over 10 years of teaching experiences in various universities in various countries (at the International Black Sea University, Tbilisi, Georgia, Bogazici University, Istanbul, Turkey, and the University of Central Florida, Orlando, USA) in various departments (Department of Computer Engineering, Department of Computer Science, Department of Marketing, Department of Criminal Justice and Legal Studies).

Key Words: Evaluation; Curricula; Computer-related Degrees.

1. Introduction

With rapid developments in information technology (IT), most university students demand more use of IT in their education for two main reasons: (1) it helps the course material be presented in a more comprehensible way; (2) it gives them familiarity with the high-tech tools they might be expected to use in their future careers after graduation. Some universities have already started making changes to their curricula and making arrangements to be more inviting to students by introducing new methods of education such as field trips to big companies, and inviting representatives from such companies to give seminars as part of the curricula so that the students are exposed to practical career scenarios. Most of the classes are held in computer labs and the topic of the lecture can be immediately simulated, programmed, or demonstrated on computers. It is not too far in the future that classrooms will be equipped with smart touch panels/screens, projectors, sound systems, tele/video-conference systems, television and radio broadcast/receive systems and other high-tech equipments. Such developments in education also come with some overhead: To utilize such classroom environments require training of faculty and students in order for them to use these tools efficiently and also it is important to have the ability to manage them. Managing the high-tech classrooms needs the system administrator properly setup the IT tools in the classroom and the instructor to control these tools actively in class such as turning off the internet access during his/her talk. The role of IT has been investigated by various researchers (Davis 1989, Knezek and Christensen 2002, Leidner and Jarvenpaa, 1995, Selwyn 1997,

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Shaw and Marlow). In this paper, we focus on distance-learning, computer-management and control tools, and standardization of the IT tools for familiarization of the students to the cutting-edge IT tools. Our survey results have shown that the students also favor distance-learning, computer labs, and use of computers in lectures.

2. New IT Trends in Higher Education

2.1. Distance Learning

One of the most recent and fastest growing needs in education is to eliminate location, transportation, classroom space, and time restrictions. In developed countries such as the United States, the transportation problems are rare but the distances traveled are huge. In developing countries such as Georgia, the distances are short but the transportation is difficult. Either way, in most cases, traveling takes a big portion of the day for students. Moreover, especially for higher education when the students are more independent of their families, they need to work to earn for their living expenses and even to support their families, it is not feasible to ask them to come to the school during the day time when they are supposed work and make money. Thus, distance learning is an alternative recently employed in the U.S. Some argue that distance learning is a technology looking for a problem. Many argue that face-to-face is a requirement and cannot be eliminated. Others argue there are major problems with face to face education; other than above mentioned time and place restrictions, it also puts the responsibility of learning more on the shoulders of the student himself/herself, rather than as some do: coming to the classroom and just listening, if listening, to the instructor and expecting him to teach everything about the course to all the students in the classroom.

Distance learning resolves conflicts with other classes. The student is free to download the recorded lectures and study them at their own pace. Actually, some students would study the movies of the lectures at double speed, saving them time for most part and pausing or reducing the speed back to normal when the lecturer starts talking about something the students does not know much about. If a student misses a lecture due to sickness, traffic, etc, the lecture is available on the web. Some students just like to repeat the lecture that is made available on the web to reinforce their learning. Some may like to listen to the lecturer and do not take any notes in class not to lose focus because the lecture will be on the web anyway. Moreover, distance learning allows greater access to those who are restricted geographically. For example, in Georgia, cities like Telavi, Batumi, Zugdidi do not have many universities, and via distance learning students would be able to access the rich educational materials of many universities in Tbilisi, the capital of Georgia, by taking courses online.

However, many faculties in the U.S. have not accepted the distance-learning technology and do not use it because it is not required for the time being. However, many use it only in a “mediated” mode: some time in a face-to-face setting supported by on-line content. It is a fact that distance education has been institutionalized in the U.S. and is not going away.

Here are some other facts that support distance learning:

- ! Students expect class assignments, notes, materials to be available on-line
- ! About 60% of students prefer courses that have an on-line component
- ! Lectures take up too much time of the students and students do not have time at school for practice; and, homework is difficult to solve alone. Therefore, online practice (or problem session) hours are necessary for the students to be encouraged to work on their own with the support of the lecturer.

However, these solutions come with some overhead some listed below and may make it impractical for implementation in developing countries:

- ! Students must have personal computers
- ! Needs access to fast Internet connections
- ! Must have numerous large student computer labs that are available 24/7 with support staff, which creates additional costs of education

- ! Creates new demands for faculty to understand how to effectively utilize the teaching technique and technology, which, too, needs additional financing

Strengths of Distance Learning:

- ! Overcomes limits of place and time and is convenient
- ! Provides access for nontraditional, rural, and other students
- ! Gives all students better access to certain faculty members
- ! Improves institutional flexibility
- ! Adds enrollments without the cost of new facilities
- ! Makes new markets for institutions
- ! Provides opportunity to experiment and share resources
- ! Promotes risk taking
- ! Attracts more motivated students

Weaknesses of Distance Learning:

- ! Discourages peer-to-peer learning and socialization opportunities
- ! Requires more academic support to help students succeed
- ! Limits use by older people who aren't familiar with technology
- ! Restricts financial-aid opportunities, which are not always available for e-learners
- ! Doesn't promote an active-learning environment
- ! Curbs a professor's ability to communicate passion for his or her subject
- ! Increases work for faculty members
- ! Discourages faculty buy-in, especially when tenure is at stake
- ! Raises costs (upfront costs, maintenance costs, content costs, faculty incentives, need for expensive technology like video)
- ! Creates more intellectual-property issues
- ! Creates more security issues
- ! Transforms education to a commodity and furthers corporate structure of the university

We also would like to do a small case-study on the University of Central Florida, Orlando, which is one of the 10 largest in the U.S. with 48,000 students on main campus with 64,000 taking courses (Online@UCF):

- ! Implemented a major distance learning program about 8 years ago.
- ! Faculty training required prior to teaching on-line
 - o One semester long course for faculty
 - o Faculty member receives a new laptop for attending, or stipend by the Faculty Center for Teaching and Learning supports excellence in teaching and learning, successful research, creative endeavors and the professional fulfillment of faculty and staff in the local and global environment (<http://www.fctl.ucf.edu/>).
 - o Students must be admitted to the University; and for many courses must also be admitted to a particular program. Undergraduate students must also complete a student orientation either in person or over the Web.
- ! Offers fully online:
 - o 7 undergraduate degree completion programs
 - o 10 graduate degree programs
 - o 12 graduate certificates
 - o 300+ courses every semester from all academic areas.
- ! Fully On-line Undergraduate Degree Completion Programs
 - o Health Services Administration, B.S.
 - o Liberal Studies, B.A. or B.S.

- Nursing R.N. to B.S.N.
- Radiologic Sciences A.S. to B.S.
- Technical Education and Industry Training, B.S.
- Engineering Technology, B.S.E.T.
- Information Systems Technology, B.S.

2.2. Computer Management Consoles

We have mentioned above that managing the high-tech classrooms needs the instructor to control these tools by software or hardware based centralized management has already become an essential component of higher education. Most people who have got involved in procedures with many computers and smart electronic devices will easily define the problems regarding control of computers and similar devices. Comparing to just several years ago, today there are adequate solutions regarding remote computer management issue. These are mainly:

- ! Operating System imaging and migration (remote installation)
- ! Software distribution (remote installation)
- ! Management of computer remotely
- ! Application management, restriction
- ! Broadcasting a screen, message, file, etc.
- ! Gathering file, folder, etc.
- ! Live monitoring of screens
- ! Dynamic test, exam, and quiz
- ! Video, voice, text contact

2.3. More High-Tech on Education

Specific purpose smart devices using embedded application programs are crucial for standardization and maintenance of high-tech tools in education. Such specific purpose devices/computers are already in use in industry, agriculture, and military. We could prepare packages of programs for educational use. These efforts have started long time ago in America and Europe, for example, in the mid--1980s the Ontario ministry of education decided to standardize the computers used in schools in order to reduce maintenance costs. They eventually settled on a selection of features that they felt would be the minimum required of a classroom computer. Without such standardization, due to fast advances in information technology, skills students in some schools would acquire throughout their education can be outdated, which may hold them from getting top jobs in their fields and even if they do, due to their outdated skills, they would also spend time adapting to demanding and cutting-edge IT career environments. Even tough a university may rank lower; it may give better education by employing someone from a cutting-edge industry part-time, who would deliver lectures and familiarize the students with up-to-date IT tools.

Most of the American universities have short and long term (3, 5, 10 years) plans made about investment and enhancement of their technology. Some current researches related with computers are listed here that soon can be applied in education:

- ! MultiTouch panel computers
- ! Thin client machines
- ! Embedded smart machines
- ! Programmed chips/microcontrollers for specific purpose applications
- ! Education Computers with Limited functionality
- ! Use of mobile embedded systems
- ! Use of smart virtual machines

3. Survey on the Use of IT in Education

3.1. Data Collection

For preparing the survey questions, we have set up a group, one professor from Computer Engineering Department, one professor from Marketing Department under Faculty of Business Administration, and the Head of IT Department at the International Black Sea University (<http://www.ibsu.edu.ge/>). First, we prepared many questions regarding the use of technology in education, using ideas and suggestions from our lecturers and students. After several meetings to eliminate some questions to get a compact yet comprehensive version of the questionnaire (Havelka 2003), we distributed the questionnaires in the following way: For some departments with the permission we entered into courses and explained the purpose of the study to motivate the students for participating in the survey and to get the most accurate responses from them, which ended up in very satisfactory and reliable results. However, we also let some of the students fill the survey in canteen (food court) or on campus during breaks, and even at home.

We obtained 150 participant students to our survey. We also collected some demographic (personal) information from the participants: major and year at the university, sex, and age. Among the 150 students who filled out survey, 44 were Engineers (ENGINEERS), 58 were from Faculties of Business and Management and Social Sciences (BUSINESSMEN), and 42 were from Faculty of Humanities and School of Languages (PHILOLOGISTS). 33 students were freshmen, 28 were sophomores, 61 were juniors, and 25 were seniors. 95 were male and 53 were female. For age information, we have had three main groups: 72 of them were aged between 17 and 20, 64 of them were between the ages of 21 and 24, 12 of them were between 25 and 27 years old.

3.2. Survey Results

Table 1 displays the results of mean scores for each perception of information technology statements used in the study. The statements in Table 1 have been arranged in order of the magnitude of the mean score. The highest mean score (4.61) was for the statement that computer labs are useful for education. They also felt that using the Internet (to search for information) for preparing a report/project/thesis is critically important (4.4) as stated in (Ray and Day, 1998). Students think that education systems becoming international via global communication systems and this will increase agreements/partnerships between countries for education (4.37). They also think that lectures become much more efficient if lecturers use information technology for his/her lecture (audio-visual aid) (4.32). “There should be a laptop computer for each student through his/her education period in school/university” is another statement they felt most strongly about.

On the other hand, they disagree in a lesser extend that education should be totally online without obligatory attendance. (2.64); and, student can continue and finish his/her education successfully by use of technology without teacher (2.66).

3.3. Analysis of the Survey Results

Our further analysis showed that student responses to most all questions were independent of the major (department) of the students. Table 2, 3, and 4 show the top-10 statements of ENGINEERS, BUSINESSMEN, and PHILOLOGISTS, respectively. As seen from these tables, most of the statements in top-10 were common to all three.

Table 1. Mean Scores and Standard Deviation for Each Perception of Information Technology Statements. Mean scores are based on a five-point scale ranging from 1= disagree to 5= agree.

Statements	Mean	StdDev
Computer labs are useful for education.	4.61	0.73
Using the Internet (to search for information) for preparing a report/project/thesis is critically important.	4.40	0.98
Education systems becoming international via global communication systems and this will increase agreements/partnerships between countries for education.	4.36	0.85
There should be a laptop computer for each student through his/her education period in school/university.	4.32	0.99
Lecture becomes much more efficient if lecturer uses technology for his/her lecture (audio-visual aid).	4.32	0.96
Using information technology makes students more successful.	4.21	0.84
There should be training seminars about computer science and technology regularly.	4.18	0.99
If you know computer programs and technical devices better, you will have better success at school.	4.17	1.02
Technologic instruments should be used for all kinds of courses.	4.10	1.08
I would donate technologic devices to schools, if I had the opportunity.	4.04	1.05
Everyone should have a certificate which shows his/her technology/computer knowledge.	3.99	1.15
If course notes were accessible via internet, I would be more successful.	3.99	1.10
Considering great advances in technology, education could have been more successful and efficient than it is now.	3.96	0.98
Logic & programming (beginner level) courses should be a standard in education, like math, literature, history, etc.	3.83	1.15
Knowing computer technology, mobiles, etc. in childhood period causes student to be successful in his/her education period.	3.66	1.16
Can't think of education without technology.	3.59	1.25
Computers and mobiles make students have concentration problems and make them less able to find time to read and study.	3.58	1.19
Our lives and minds are being occupied by technology, which will be invaluable after 10 years.	3.49	1.12
Technologic products decrease student's social life.	3.35	1.14
Education should be totally online without obligatory attendance.	3.35	1.39
Internet currently gives more harm than benefit to students in terms of getting them educated in their fields by wasting their time.	3.08	1.32
In past, people were more successful in their education period because they were not busy by mobile phone, online chat, internet surf, etc.	3.02	1.39
My Life = internet surf, game, online chat, computer, mobile phones, etc...	2.68	1.33
Student can continue and finish his/her education successfully by use of technology, without teacher.	2.66	1.36
Education should be fully online without obligatory attendance.	2.64	1.37
Overall Avarage	3.72	1.11

Table 2. ENGINEERS Mean Scores and Standard Deviation for Each Perception of Information Technology Statements.

Statements	Mean	StdDev
Using the Internet (to search for information) for preparing a report/project/thesis is critically important.	4.61	0.75
Computers and mobiles make students have concentration problems and make them less able to find time to read and study.	4.43	0.68
Everyone should have a certificate which shows his/her technology/computer knowledge.	4.36	0.71
Can't think of education without technology.	4.36	1.03
Lecture becomes much more efficient if lecturer uses technology for his/her lecture (audio-visual aid).	4.29	0.76
If course notes were accessible via internet, I would be more successful.	4.29	0.85
Computer labs are useful for education.	4.27	0.89
In past, people were more successful in their education period because they were not busy by mobile phone, online chat, internet surf, etc.	4.27	0.89
Using information technology makes students more successful.	4.09	0.83
There should be a laptop computer for each student through his/her education period in school/university.	4.06	0.97

Table 3. BUSINESSMEN Mean Scores and Standard Deviation for Each Perception of Information Technology Statements.

Statements	Mean	StdDev
Using the Internet (to search for information) for preparing a report/project/thesis is critically important.	4.6379	0.6407
Can't think of education without technology.	4.438	0.8381
In past, people were more successful in their education period because they were not busy by mobile phone, online chat, internet surf, etc.	4.2125	1.1957
Computers and mobiles make students to have concentration problems and make them less able to find time to read and study.	4.2069	1.0721
Everyone should have a certificate which shows his/her technology/computer knowledge.	4.1552	0.9329
There should be a laptop computer for each student through his/her education period in school/university.	4.1034	1.1346
Knowing computer technology, mobiles, etc. in childhood period causes student to be successful in his/her education period.	4.0862	0.9231
Lecture becomes much more efficient if lecturer uses technology for his/her lecture (audio-visual aid).	4.0228	1.236
If course notes were accessible via internet, I would be more successful.	3.9891	1.0847
Education systems becoming international via global communication systems and this will increase agreements/partnerships between countries for education.	3.9138	1.1127

Table 4. PHILOLOGISTS Mean Scores and Standard Deviation for Each Perception of Information Technology Statements.

Statements	Mean	StdDev
Lecture becomes much more efficient if lecturer uses technology for his/her lecture (audio-visual aid).	4.6905	0.5626
In past, people were more successful in their education period because they were not busy by mobile phone, online chat, internet surf, etc.	4.6268	0.6915
Using the Internet (to search for information) for preparing a report/project/thesis is critically important.	4.5476	0.8612
There should be a laptop computer for each student through his/her education period in school/university.	4.4524	0.7055
Can't think of education without technology.	4.4524	1.017
Computers and mobiles make students to have concentration problems and make them less able to find time to read and study.	4.4286	0.6678
I would donate technologic devices to schools, if I had the opportunity.	4.3571	0.8503
If course notes were accessible via internet, I would be more successful.	4.2901	1.0418
Computer labs are useful for education.	4.2405	0.9825
Everyone should have a certificate which shows his/her technology/computer knowledge.	4.2381	0.759

Using *t* tests (to compare the averages of two samples) indicated that the following differences were the most significant between the demographic groups:

- ! PHILOLOGISTS argued that “Lecture becomes much more efficient if lecturer uses technology for his/her lecture (audio-visual aid)” more strongly than both ENGINEERS and BUSINESSMEN.
- ! ENGINEERS stated that “There should be training seminars about computer science and technology regularly” more strongly than BUSINESSMEN.
- ! ENGINEERS more strongly argued that “If you know computer programs and technical devices better, you will have better success at school” in comparison to PHILOLOGISTS.
- ! Male students more strongly believed that “Logic & programming (beginner level) courses should be a standard in education, like math, literature, history, etc.” than the female students did. These results are supported by (King and Bond, 2002), which presents an investigation of computer anxiety by gender and grade.
- ! Freshmen stated that “Computer labs are useful for education” more strongly than senior students did.
- ! Students between 25 and 27 years old stated more strongly that “Education should be totally online without obligatory attendance” than students between 17 and 20 did. Clearly, the elder the students are, the more responsibilities they have such as taking care of family, wife, children, and therefore they need to work in part or full time jobs while studying. Therefore, they would be more interested in an online education.
- ! Students between 25 and 27 years old stated that “If you know computer programs and technical devices better, you will have better success at school” and “Technologic instruments should be used for all kinds of courses” with a higher mean score than the students between 17 and 20.

4. Conclusions

We have conducted a study to investigate students’ attitude and behavior towards the use of technology in educational methods. With our over 10 years of teaching experiences in various universities in various countries, at the International Black Sea University, Tbilisi, Georgia; at the Bogazici University, Istanbul, Turkey; and at the University of Central Florida, Orlando, USA in various departments Department of Computer Engineering, Department of Computer Science, Department of

Marketing, Department of Criminal Justice and Legal Studies, we think that in this time and age students must be given access to distance learning (if not fully online, at least in a mediated type) and schools must have up-to-date technology to give students familiarity with the tools they would be expected to use when they get jobs upon graduation. The survey results support our suggestions.

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