



EVALUATION OF INFORMATION AND COMMUNICATION TECHNOLOGY USAGE FOR ENGINEERING STUDENTS

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Abstract

Information and communication technologies (ICT) play an important role in engineering. For this reason, this study aims to reveal the pattern of computer usage of engineering students, and evaluate the impact of students' computer and self-efficacy in their higher education. A questionnaire was administered to target students from three departments; Mechanical, Industrial, and Electrical & Electronics engineering located in the Engineering faculty. It was observed that the increase in the use of computers and the increased availability of software tools significantly affected the learning behaviors and expectations of engineering students.

Keywords: Teaching/learning strategies, learning communities, media in education, public spaces and computing

MÜHENDİSLİK ÖĞRENCİLERİ İÇİN BİLGİ İLETİŞİM TEKNOLOJİ KULLANIMININ DEĞERLENDİRİLMESİ

Özet

Bilgi iletişim teknolojileri mühendislikte önemli bir role sahiptir. Bu nedenle, bu çalışma mühendislik öğrencilerinin bilgisayar kullanım modelini ortaya çıkarmayı ve bu öğrencilerin bilgisayar bilgilerinin ve öz-yeterliliklerinin yükseköğretimlerine olan etkisini değerlendirmeyi amaçlamaktadır. Bu amaçla bir anket Mühendislik Fakültesinde bulunan Makine, Endüstri ve Elektrik-Elektronik mühendisliği bölümlerinden hedef öğrencilere uygulanmıştır. Sonuç olarak mühendislik öğrencilerinin bilgisayar kullanımındaki ve yazılım araçlarına ulaşılabilirliklerindeki artışın, bu öğrencilerin öğrenme alışkanlıklarını ve beklentilerini büyük ölçüde etkilediği gözlemlenmiştir.

Anahtar Kelimeler: Öğretim/öğrenim stratejileri, öğrenim toplulukları, eğitimde medya, kamusal alanlar ve bilişim

1 Introduction

It is generally agreed that ICT has an important role in education [1]. New methods have been added to the conventional education system such as e-learning, remote learning, and mobile learning. The existing technology such as e-mail has been superseded by Web 3.0 which offers a range of educational technologies including different types of multimedia sharing, remote laboratories and 3D interactive modeling [2]. The latest ICT has tremendous potential and presents educators with immense opportunities for learning those were not previously available.

These opportunities involve learning experiences inside and outside the classroom, together with the planning and development of educational materials. There are various studies that reflect these learning experiences. Through a survey Palmer (2000) [1] revealed differences between on-campus and off-campus students in terms of their computer

usage patterns involving, for example, Web and e-mail access. Kuhlemeier and Hemker [3] measured the Internet and computer skills of students aged 13-15 with an objective test. They reported on the importance of education given at school. Fan and Li (2005) [4] investigated the gender differences in college computer science majors in Taiwan. Significant gender differences were not found for prior computer experience and female students achieved significantly higher scores in their computer science programs. As a result the authors recommended that more female students enter the male dominated field of computer science.

Computer aided applications in the engineering encompass; computer programming, numerical analysis, computer simulation, Computer Aided Design (CAD), Computer Aided Manufacture (CAM), electronic communications, information retrieval, computer aided learning and assessment, project planning, process control, budgeting, data communications and software development [2].

3 Results

3.1 Evaluation of the questionnaire data

Some limitations were encountered during the implementation of the questionnaire. First, the number of students from each department was not the same; therefore, it was not possible to obtain homogeneity across the three departments. A second limitation was the gender distribution across the departments. As shown in Figure 1, 78% of students (130) were male and 22% (37) were female. Of the total participants in each department the percentage of the female respondents was; 13% in ME, 20% in EEE and just under 50% in IE.

Mobile learning is the learning through mobile computational devices. The latest mobile technology with wider screens such as; tablet PCs, PDAs and mobile phones [5] have been utilized in education. The important features of mobile environments are based on wireless connections via the types of devices given above, which are bringing about a paradigm change in the learning model [6].

Another change has taken place in terms of educational resources that can be accessed from anywhere via broadband connections. For instance, open courseware from well-known universities provides additional support to students via the Internet. Open courseware allows the sharing of resources and helps to overcome the limitations of information resources of a university [7]. Researchers who have investigated the relationship between Web experience and Web attitude have found that students with greater experience possess more positive attitudes [8], [9]. Kumar and Kaur (2005) [10] conducted research on the use of Internet by Engineering Colleges in India, which showed that the Internet had become a vital instrument for teaching, research and the learning process.

Engineering has evolved significantly to meet the needs of society in recent years. Therefore, the curriculum applied to engineering education is being adapted to provide students with a sufficient basis to ensure their successful entry into the profession [11].

This paper aims to determine the status of engineering students in Balıkesir University and to analyze their behavior in terms of their computer and ICT usage.

2 Methodology

2.1 Participants

In this study, a questionnaire was administered to 3rd year students attending the departments of Electrical & Electronics (EE), Industrial Engineering (IE) and Mechanical Engineering (ME) in the engineering faculty of Balıkesir University in the 2010 spring term. The selection of students from the 3rd year cohort ensured that they were familiar with their department and its ICT facilities.

The data obtained from the 167 students (130 males and 37 females) constituted 10% of the total number of students in the faculty. The distribution of the participant students was; mechanical engineering ($n = 106$), electrical and electronic engineering ($n = 26$) and Industrial engineering ($n = 35$).

2.2 Research Instrument

The questionnaire used to collect data consisted of three sections; the first section collected demographic characteristics (e.g., gender), and computer and Web experience (e.g., PC ownership, Web-usage frequency and Web-usage activities). In the second section there were 38 questions, categorized by five-point Likert Scale (from "1=strongly disagree", "2=disagree", "3=undecided", "4=agree", to "5=strongly agree"). This section aims to determine the expectations of students in terms of their use of ICT and it is designed to measure awareness of the opportunities offered by ICT. The last section elicited the student's point of view concerning the computers and ICT facilities of the faculty.

Control questions were included to detect any inaccurate information from the students in the questionnaire. Descriptive statistics were subjected to analysis after the explanatory factor analysis.

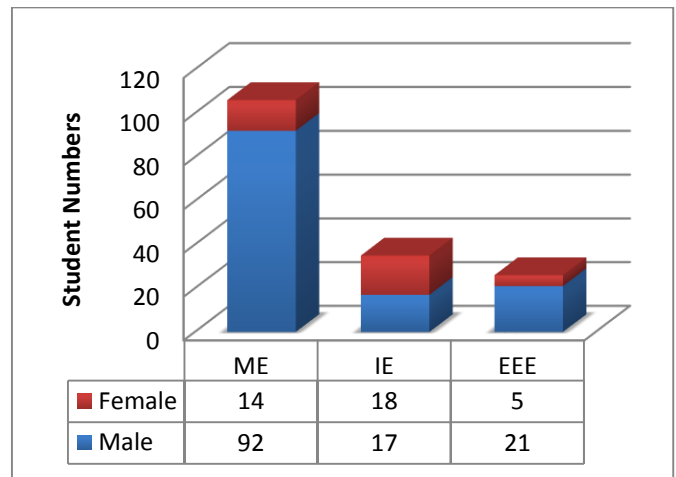


Figure 1. Distribution of participants according to gender

As shown in Figure 2, the largest number of participants were from the ME department and the smallest number from EEE.

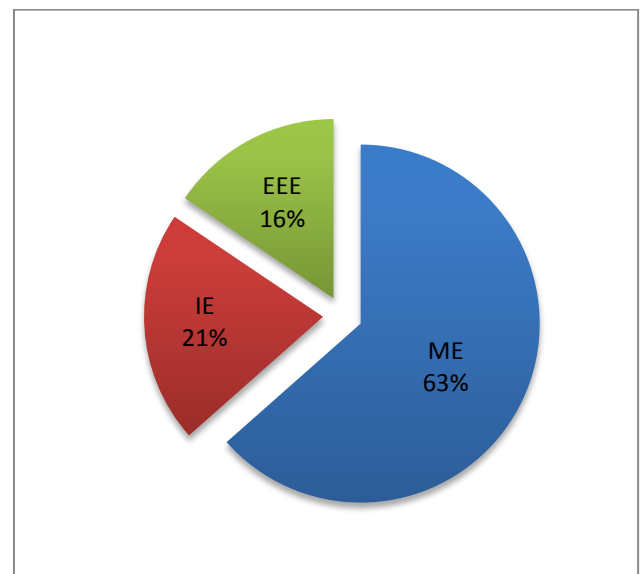


Figure 2. Distribution of participants according to department

As seen in Figure 3 educational background of the students responding to the question was as follows; 38% (62 students) graduated from Anatolian high schools, 26% (44 students) from Super high schools, 26% from Classical high schools, 2% (4 students) from science high schools, the remainder, 8% (13.36%) graduated from other high schools.

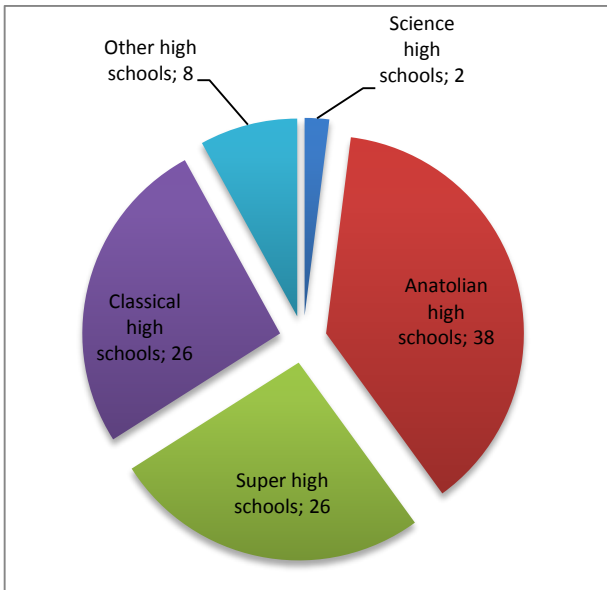


Figure 3. Distribution of participants according to high school graduation

Figure 4 presents age range of the participant students. As shown in Figure 4 the majority of students (142) were in the 20 to 23 age range, which would be expected in 3rd grade students at a Turkish University.

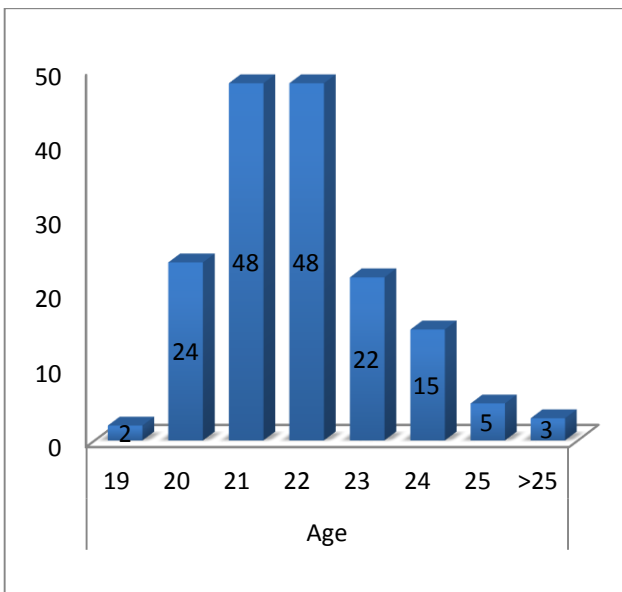


Figure 4. Age range of participants

An examination of the 1st section of the questionnaire (Questions A1 to A5) showed that 95.81% of the 167 participants to the questionnaire have their own computers. Also, 18.57% (31 students) have a personal desktop computer, 46.12% (77 students) have notebooks, 1 student has a netbook, 3.59% (6 students) have a desktop computer and a notebook, 1.8% (3 students) have a notebook and a netbook. Only 1.8% (3 students) have a netbook, a notebook, and a desktop computer.

Table 1. Average values of the responses to the 2nd section of the questionnaire

Q. No	Measurement Criterion	IE	N	EE	n	ME	n
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Only one student has a notebook, a netbook, and PDA. However, 26.95% (45 students) do not have any computer devices and they fulfill their computer needs when outside the campus or off-campus in two ways; 50% use their friends' computers the other half use computers at the facilities at Internet cafes.

In addition, the descriptive statistics indicated that the PC-ownership of the male students (93.8%, n = 122 out of 130) is higher than the female students (59.8%, n = 22 out of 37).

In terms of the use of the department or faculty computers; 20.36% of students who completed the questionnaire use faculty computers for their studies; 2.4% (4 students) use them for communication, 1.79% (3 students) use them for entertainment, 1.79% (3 students) use them for lessons and projects but also for communication and one student stated that they used them for studies/projects and entertainment. However, it is notable that 73.05% (122 students) do not use faculty computers at all.

Figure 5 shows the daily computer use behavior of students. 11% of students use computers for more than 7 hours a day, 22% of students for 4 to 7 hours, 32% of students for 2 to 4 hours, and the remainder stated that they use computers for less than 2 hours a day.

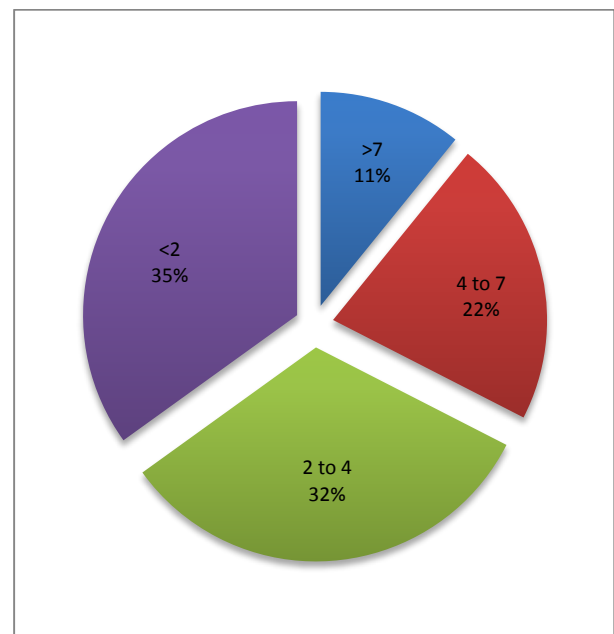


Figure 5. Computer use (hours per day)

3.2 Descriptive Statistics

It is seen that the students generally use computers their studies for research and projects and sometimes use them for entertainment. The questions and their calculated average values for descriptive statistics of the 2nd section are given in Table 1.

B2	Using a computer for lessons and projects	3.7642	34	3.7308	26	3.4623	106
B3	Using a computer for entertainment	3.1714	35	3.4615	26	3.4245	106
B4	Proficiency about ICT	2.6000	35	3.5417	24	3.5566	106
B7	Using programs related to your future profession	2.8529	34	3.5200	25	3.6415	106
B8	Believing in the necessity of computer lessons	4.0857	35	3.6667	24	3.6857	105
B9	Being a good computer user is a necessity for the profession	4.8000	35	4.6957	23	4.6887	106
B10	Current ability to use a computer is sufficient for future profession	2.6857	35	3.2917	24	3.6476	105
B11	Believing that English is necessary for the use of the computer	4.5714	35	4.1250	24	4.1827	104
B12	Frequency of email activity (check, send etc.)	4.3714	35	4.0417	24	4.3113	106
B13	Frequency of use search engines for lessons / project	4.6571	35	4.2917	24	4.1792	106
B14	Frequency of use search engines for entertainment	3.7143	35	3.8333	24	3.5810	105
B15	Frequency of use Internet for lessons and projects	4.4857	35	4.2500	24	4.0667	105
B16	Shopping via the Internet (e-trading)	2.0857	35	2.2917	24	2.5283	106
B17	Undertaking banking transactions via the Internet (e-banking)	1.8000	35	2.0833	24	2.5472	106

Although the students appear not to consider themselves as having adequate knowledge of computing for their academic and social needs, however, they believe in the necessity and importance ICT. Furthermore, the participant students responded that the computer usage is obligatory in their profession. To have a sufficient understanding of the English language is obligatory for computer usage is a very common consideration. The participants also indicated that they often

use email as well as search engines. Using the Internet in relation to their courses and projects is common among the respondents. Questions and their calculated average values for descriptive statistics of the 3rd section are presented in Table 2.

Table 2. Average values of the responses to the 3rd section of the questionnaire

Q. No	Measurement Criterion	IE	n	EE	n	ME	n
C1	Adequacy of the number of Faculty / department computers	1.4000	35	2.0417	24	1.6476	105
C2	Adequacy of computer hardware of Faculty / department computers	1.5714	35	2.0870	23	1.8190	105
C3	Faculty / department has computer programs required by your profession	2.4571	35	2.7083	24	2.9333	105
C4	Use faculty computers and IT tools for communication and entertainment.	1.4286	35	2.2917	24	1.3714	105
C5	Use faculty computers and IT tools for homework/ projects purposes?	1.6857	35	2.4167	24	1.8000	105
C6	University web pages, announcements and communication services are adequate	2.2000	35	2.9167	24	2.6476	105
C7	Faculty web pages, announcements and communication services are adequate	2.2571	35	2.8750	24	2.7596	104
C8	Departmental web pages and other information and communication services are adequate	2.3429	35	3.0000	23	2.7115	104
C9	Faculty members' web pages and other information and communication services are adequate	2.0286	35	3.0417	24	2.0490	102
C10	The digital presentations of course materials in the digital media are adequate	2.2000	35	2.4167	24	2.1238	105
C11	Licensed software is offered by department	2.0000	35	2.4167	24	2.6571	105
C12	Efficiently use the professional software related to your department	2.2571	35	2.7917	24	2.8857	105
C13	Licensed software used in the department is provided when needed	2.2000	35	3.3333	24	2.9231	104
C14	Consideration that training in the use of professional software will be useful for future career	4.3529	34	4.1739	23	4.1275	102

The statistical analysis of the responses in the 3rd section of questionnaire shows that faculty/department computer hardware and specific subjects that are related to the educational programs are not sufficient. Furthermore,

students are having problems in using faculty/departmental computing facilities to complete assignments and projects. Participants considered that the departmental and academic Web pages are not satisfactory in terms of making announcements and conveying information about the courses. Most of the students agree that there are advantages of the use of specific educational programs for their future career.

3.2.1 Importance & Correlation Test

Descriptive statistical calculations also assist in the investigation of the importance tests of different approaches of groups that can be categorized. The general approach of the participants is given in the total points column and the binary

results are presented in the related columns. The paired t-test results summarized from the responses of the different group participants for the 2nd and 3rd section are given in Tables 3 and 4 respectively. Here, five indicates strong agreement with one indicating strong disagreement.

Table 3. Summary of the results of the 2nd section of the questionnaire

Q. No	Measurement Criterion	Total points	IE -EE	EE -ME	IE -ME	Female-Male
B2	Using a computer for lessons and projects	3.5636	Exist	Non exist	Non exist	Non exist
B3	Using a computer for entertainment	3.3735	Non exist	Non exist	Non exist	Exist
B4	Proficiency about ICT	3.3515	Exist	Exist	Exist	Exist
B7	Using programs related to your future profession	3.4573	Exist	Non exist	Exist	Exist
B8	Believing in the necessity of computer lessons	3.7683	Non exist	Non exist	Non exist	Non exist
B9	Being a good computer user is a necessity for the profession	4.7134	Non exist	Non exist	Non exist	Non exist
B10	Current ability to use a computer is sufficient for future profession	3.3902	Exist	Non exist	Exist	Exist
B11	Believing that English is necessary for the use of the computer	4.2577	Non exist	Non exist	Non exist	Non exist
B12	Frequency of email activity (check, send etc.)	4.2848	Non exist	Non exist	Non exist	Non exist
B13	Frequency of use search engines for lessons / project	4.2970	Non exist	Non exist	Non exist	Non exist
B14	Frequency of use search engines for entertainment	3.6463	Non exist	Non exist	Non exist	Non exist
B15	Frequency of use Internet for lessons and projects	4.1829	Non exist	Non exist	Non exist	Non exist
B16	Shopping via the Internet (e-trading)	2.4000	Non exist	Non exist	Non exist	Non exist
B17	Undertaking banking transactions via the Internet (e-banking)	2.3212	Non exist	Non exist	Exist	Exist

Table 4. Summary of the results of the 3rd section of the questionnaire

Q. No	Requested to be measured the criteria	Total point	IE -EE	EE -ME	IE -ME	Female-Male
C1	Adequacy of the number of Faculty / department computers	1.6524	Exist	Exist	Non exist	Non exist
C2	Adequacy of computer hardware of Faculty / department computers	1.8037	Non exist	Non exist	Non exist	Non exist
C3	Faculty / department has computer programs required by your profession	2.7988	Non exist	Non exist	Non exist	Exist
C4	Use faculty computers and IT tools for communication and entertainment.	1.5183	Exist	Non exist	Non exist	Non exist
C5	Use faculty computers and IT tools for homework/ projects purposes?	1.8659	Exist	Non exist	Non exist	Non exist
C6	University web pages, announcements and communication services are adequate	2.5915	Non exist	Non exist	Exist	Non exist
C7	Faculty web pages, announcements and communication services are adequate	2.6687	Exist	Non exist	Exist	Non exist
C8	Departmental web pages and other information and communication services are adequate	2.6728	Exist	Non exist	Exist	Non exist
C9	Faculty members' web pages and other information and communication services are adequate	2.1925	Exist	Exist	Non exist	Non exist
C10	The digital presentations of course materials in the digital media are adequate	2.1829	Non exist	Non exist	Non exist	Non exist
C11	Licensed software is offered by department	2.4817	Non exist	Non exist	Exist	Exist
C12	Efficiently use the professional software related to your department	2.7378	Exist	Non exist	Exist	Exist
C13	Licensed software used in the department is provided when needed	2.8282	Exist	Non exist	Exist	Exist
C14	Consideration that training in the use of professional software will be useful for future career	4.1824	Non exist	Non exist	Non exist	Non exist

After the importance test, multiple correlation analysis was carried out. According to this analysis, there is a medium positive relation between the responses to questions B4 and B10, B7 and B10, B13 and B15, B16 and B17 in part 2. There are also medium positive relations between the responses to the questions C9 and C10, C8 and C9, C4 and C5 in part 3. Overall, the responses to the questions have positive high-level relations.

3.2.2 Reliability analysis

The reliability of the questionnaire was measured by control questions. The 1st section of the questionnaire aims to reveal the students' demographic situation; so there is no need for a reliability analysis for this section. The 2nd section of the control questions were examined with a paired t test to determine the differences between the responses to the main questions, and to the control questions; B1 to B6, and B15 to B24.

The consequence analysis indicated that the responses to questions B1, B5, and B6 were inconsistent and these consequences are not reliable so these questions were flawed. In the 2nd section 14 questions, between B2 and B4, B7 to B17, were used in the reliability analysis. The Cronbach's alpha, which takes on values between 0 and 1 for the consistency of the questionnaire, was calculated at 0.715 for the 2nd section of the questionnaire. Therefore, it can be seen that the 2nd section questions are independently reliable. For the 3rd section, the Cronbach's alpha for the 14 questions from C1 to C14 was calculated 0.801. Thus, the questions in the 3rd section are also reliable, hence the Cronbach alpha values of more than 0.7.

4 Discussion

This study aimed to reveal the pattern of computer usage, attitude and expectations from the department of engineering students. A questionnaire was administered to students from three different engineering departments. The results obtained show the necessity to revise the structure and the framework of the curriculums.

The participating students from the Engineering and Architectural Faculty are willing to use computers and ICT. Most of the students have personal computers. They use internet and IT in their daily life and for their educational requirements. In addition, although the different student groups have different attitudes towards IT, computer facilities and the educational software facilities of the faculty and departments, their commonly held opinion is that the IT infrastructure, hardware and software facilities of faculty are not sufficient. They also indicated that they have difficulty in obtaining specialized educational software in their fields. Thus, this study shows that information; communication technology, hardware, and software foundation must be sufficient for satisfactory education. Also, the contents of the existing departmental and academic web sites must be updated and developed.

Future work could extend the current work by engaging in detailed departmental studies to determine students' views on specific topics such as the type of software that should be provided by faculty.

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