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Effectiveness of an Electronic Performance Support System on Computer Ethics and Ethical Decision-Making Education

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ABSTRACT

This study examined the effectiveness of an electronic performance support system (EPSS) on computer ethics education and the ethical decision-making processes. There were five different phases to this ten month study: (1) Writing computer ethics scenarios, (2) Designing a decision-making framework (3) Developing EPSS software (4) Using EPSS in a case-based computer ethics education process (5) Analyzing all of the data collected from the implementation. A total of 15 computer ethics scenarios were written by the researchers and revised in accordance with the opinions of 12 experts from different universities. Barger's (2008) ethical decision-making model was adapted to a flow chart for generating a decision-making framework for the system. Quantitative and qualitative research methods, multivariate analysis of variance and semi-structured interviews were used together to investigate the effectiveness of the system. The results showed that the EPSS that was developed improved the decision-making skills of the students in the experimental group who were faced with different computer ethics scenarios during the implementation of the study. To present a balanced view both positive and negative comments made by the students regarding the EPSS were recorded and are presented in the study.

Keywords

Media in education, Interactive learning environments, Pedagogical issues, Higher education, Computer ethics

Introduction

Computers play an important role in modern societies. We communicate with our friends, read articles, share documents end even find new social groups via computers. If a technological tool is so nested within the daily life of the human being, it is then inevitable that new social problems will emerge related to its usage. Some of these emerging issues consist of different ethical cases. Barger (2008) pointed out that old ethical problems have evolved into new complex ones because of the remarkable operating capacities of computers. However, ethical principles are not based on punishments as is the case with the legal system or on changeable rules as is the case with personal morality. The most important goal in ethics is to regulate social relationships among individuals by using a global perspective. Mason (1986) categorized the ethical problems of the information age under four headings: Privacy, accuracy, accessibility and property. The attributes of intellectual property, the rules of access to common knowledge, the certain limits of individual or official privacy and the problems arising from the transmission speed of wrong data are a few of the subtopics discussed under these headings. Specific ethical approaches, concepts, policies or values related to computers are studied in the field of computer ethics. The most effective and scientific way to cope with ethical issues is by using the ethical decision-making models proposed by different researchers. However, using these ethical decision-making models to solve the computer-related ethical issues faced in everyday life can be tough and include complex processes for individuals to follow. In this regard, using an EPSS in the role of the facilitator of an ethical decision-making process can be an effective and easy way to reach logical solutions to ethical issues.

In the literature, it can be seen that there have been a few attempts to support ethics or computer ethics education processes through the technological tools. Coldwell (2000), with his study titled "It is possible to teach computer ethics via distance education", investigated the possibilities of accessing computer ethics content by using Internet connections. At the end of his research, he mentioned that if the required technological infrastructure is not used then providing an online computer ethics course would be harder than doing so through traditional methods, In 2005, an online computer ethics course was given by Ferhan Odabaşı and Abdullah Kuzu (Uysal & Odabasi, 2013), which was a project financially supported by European Union. In this 6-week course, case-based methods were used for online ethical decision-making and evaluation processes. In another study, Biggerstaff (2008) used the online environment to give a social work ethics course. She used a case-based ethics education model in her study.

In a new attempt, an online EPSS named BILEP was developed in this study to support computer ethics education and ethical decision-making processes. The effectiveness of the system was examined over the span of the 3-month experimental study in a computer ethics course. During this experimental study, an attempt was made to find answers to these specific research questions: (a) What could be the positive effects of an EPSS on a theoretical computer ethics education? (b) What could be the positive effect of an EPSS on an ethical decision-making education? Additionally, at the end of the experimental process, the opinions of the participants regarding the BILEP system and the use of such software in ethics education were recorded in semi-structured interviews.

Literature review

Theoretical bases of computer ethics

The impact of the use of technological tools has increased dramatically in recent decades. As a result, the ethical use of computers and information technology has also become a subject of great interest. Grant, Stahl and Rogerson (2009) stated that computer ethics, which is a relatively new discipline, brings together people such as computer scientists, engineers, teachers, academicians, philosophers and psychologists in order to discuss ethical issues. The impressive foundations for computer ethics were laid down by Norbert Wiener between the 1940s and 1950s; the significant efforts of Donn Parker, Joseph Weizenbaum and Walter Maner in the 1970s; James Moor's and Deborah Johnson's contributions in the 1980s and Krystyna Gorniak's hypothesis in the 1990s (Bynum, 2001).

In his groundbreaking article "What is Computer Ethics?" Moor (1998) stated that computer ethics is a special field of ethical research and application. He also mentioned that computer ethics involves the analysis of two areas: "the analysis of the nature & social impact of computer technology" and "the corresponding formulation and justification of policies for the ethical use" (Moor, 1998). Like James Moor, Walter Maner (1996) made reference to computer ethics as a unique field of study. This statement was based on his view that the "involvement of computers in human conduct can create entirely new ethical issues, unique to computing, that do not surface in other areas" (Maner, 1996, p.139). On the other hand, Johnson did not defend the issue of the uniqueness of computer ethics and proposed that ethical issues surrounding computers are "new species of old moral issues" (as cited in Moor, 1998). According to Barger (2008), like Johnson, computer ethics are not qualitatively different from media ethics or legal ethics or any other kind of professional ethics.

According to Gotterbarn and Rogerson (1998), both Moor (1985) and Gorniak (1996) demanded that the impact of the computer is pervasive in all aspects of society. While Moor (1985) concluded that people need to apply ethics to the policy vacuums created by computers, Gorniak questioned the applicability of traditional ethics to global ethics (Gotterbarn & Rogerson, 1998). Like Gorniak (1996), Johnson (1999) stated that computer ethics will disappear as a separate branch of applied ethics. In addition, Johnson said that information technology would become very commonplace and it would be perceived simply as an aspect of everyday life (as cited in Bynum, 2001). Also, in order to study computer ethics, people should be aware of the nature of moral judgment and the limitations of ethical decision making in computing (Stamatellos, 2007).

Ethical decision-making models

It can be said that the most important part of the developed EPSS is an "expert support system" in which user can find a step-by-step ethical decision-making platform. Before designing this part of the software, authors conducted research on the fundamentals of ethical decision making and decision-making models. The details of this research are presented below:

Ethics provides reasons for how humans should act and it addresses the process of ethical decision making. Ethical decision making is the process of evaluating and choosing among alternatives by the taking into consideration of ethical principles. In making ethical decisions, it is important to discriminate and eliminate unethical options and select the best and most appropriate ethical alternative. This process requires individuals to make hard choices.
There are a variety of models available in the effort of to explain and predict the process of ethical decision making (Corey et al ,1998; Mattison, 2000; Robinson & Reeser, 2000; Welfel, 2006; Cottone, 2001; Stephenson & Staal,

2007; Kohlberg, 1969). These models can make the decision-making process easier and more systematic. The heuristics approach, which is a stepwise procedure, is commonly used in ethical decision-making models.

Ethical decision-making models can be developed for specific domains such as marketing, social science, clinical psychology, law and computers or can be employed in general frameworks. For instance, the Canadian Psychological Association (1991) have developed a model consisting of seven steps for psychology, Corey et al. (1998) have developed a model for law and Barger (2008) and Maner (1999) have developed a model for computer ethics.

In this study, the model proposed by Barger (2008) is used to specify the general framework of an electronic support system. Barger (2008) suggested a model consisting of steps involving the answering of questions in order to resolve computer ethics dilemmas. The steps are:

- Briefly describe the ethical issues
- Identify the stakeholders and state what each of them would like to offer as the solution to the problem.
- Define three solutions to the case, mark them and select the solution you would choose.
- Decide if the solution you chose would be acceptable for everyone.
- Determine if this solution is accordance with what is natural.
- Decide if there would be a majority agreement that this solution is the most efficient.
- Make a decision if this solution is the one to which you feel most committed in your own conscience.
- Determine which philosophy you feel was the most influential in your solution to this case.

These steps were used for designing the algorithm of the performance support software developed by researchers. As the first step, all items were converted to an algorithmic structure, and later, a flowchart of the software was created in accordance with the phases of this algorithmic text.

Why EPSS for ethical decision making?

Performance support systems are performance-oriented tools which are used individually and intended for specific problems. The main aim of an EPSS is to support the user during an operation and try to prevent the interruption of the process. There are various definitions of electronic performance support systems. Raybould (1990) defines EPSS as "a computer-based system that improves worker productivity by providing on-the-job access to integrated information, advice, and learning experiences". These systems can be designed for various purposes. For instance, Van Schaik et al. (2002) used EPSS within the domain of 'quantitative research methods' to facilitate learning. Sleight (1993) stated that EPSS has a two-part characteristic. The first part is to provide access to the specific information and tools needed to perform a task. The second part is providing access to the information and tools at the time the task is to be performed. Levin (1994) stated that EPSS facilities can offer many different benefits for an organization. Nguyen and Klein (2008) examined the effect of EPSS and training on user performance, time on task, and time in training and positive effects of EPSS usage were detected on user performance and time in training in this study. However, Bastiaens et al. (1997) developed an EPSS for a large Dutch insurance company and found that EPSS did not produce the expected benefit of an increase in productivity. According to Raybould (1990), it is composed of an Advisory System (expert system), an Information Base (interactive documentation), Learning Experiences (support) and Productivity software.

The main characteristics of EPSS are that they are computer-based, they provide access during tasks, they are used on the job, they are controlled by the worker, they reduce the need for prior training, they are easily updated, they provide fast access to information, they do not display irrelevant information, they allow for different levels of knowledge in users, they allow for different learning styles, they integrate information, advice, and learning experiences and that they possess artificial intelligence (Sleight, 1993).

Considering the remarkable features of EPSSs, it is believed that the specific and unique attributes of decision-making processes for ethical cases can be supported through the use of an EPSS in different ways. In this study, by the taking into account of these kind of potentials for EPSS usage, the possible effects of this software on ethical decision making as well as theoretical computer ethics education were investigated within the span of the 3-month experimental study.

Methodology

Rationale

Case-based computer ethics and ethical decision-making processes consist of very subjective topics such as open-ended scenarios or philosophical comments. Therefore, talking about only a theoretical content related to ethical issues would be insufficient for computer ethics education. On the other hand, finding a practical solution to an ethical problem is more important than learning scientific content for individuals. In this respect, the rationale for the development of BILEP system can be explained in terms of combining the basic scientific content and a solution-oriented tool in the same software. Hereby, it was aimed to propose a new approach to the provision of online computer ethics education as an alternative to traditional methods.

Writing computer ethics scenarios

In order to create a case-based educational environment, 15 different ethical scenarios related to computer ethics were designed by researchers. All content was selected from actual problems in computer ethics and written in accordance with the four important ethical areas outlined by Mason (1986): Privacy, accuracy, property and accessibility. A sample from the scenarios can be seen below:

Title: Security Threat
Ali chooses improvement of commercial systems and security threats as a research subject for his Informatics Ethics course. He develops an algorithm for the purpose of implementing his project in a practical process. He can find the security vulnerabilities of the companies' network systems with this algorithm and decides to use these security vulnerabilities in his project. His advisor professor approves Ali's project and gives him a very high project grade. When one of the companies that Ali has entered searches for the source of the attack, they find university laboratory as a source of this attack and informs the chancellery of the university.

After having written the first manuscripts for the scenarios, an evaluation form was prepared in order to check some key features concerning the structures of the scenarios. Each manuscript was sent to three different scientific experts in order to be evaluated and the last revisions were made using the responses and comments of the experts. These revisions were discussed under four titles: the grammatical mistakes of the text structures, the relationships of determining roles to the cases, the relationships of the cases to computer ethics and the details concerning the cases that were still required. At the end of the process, some detailed revisions were made to the scenarios based on the responses from the experts and the final versions were uploaded to the BILEP system.

Designing flowchart of expert system

Before starting to develop the expert module of BILEP, it was thought by researchers that the only way to adapt a theoretical model to the software was to design a logical and clear flowchart. To this end, an elaborate flowchart was designed in accordance with Barger's (2008) eight steps ethical decision-making model. Each step of the model was written in short commands onto a systematical and organizational flowchart. The first part of this detailed flowchart can be seen in Figure 1.

As seen in Figure 1, some steps of the model, which were too abstract to adapt to a programming language, were represented with digits in the flowchart. For example, in order to represent the statement "Identify the stakeholders and state what each of them would like to offer as solution of the problem", a loop counting by the number of the roles was created and it was required for us to write possible solutions for each role. Additionally, these possible solutions for the roles were scored out of 100 by comparing the total score of users' own solutions at the end of the process. Hereby, users had the opportunity to make comparisons between different solutions and choose one of them.

After designing the process, the coherence of the flowchart with the underlying model was checked for each item and the last structure of design was shaped by taking into account the thoughts of the scientific experts.

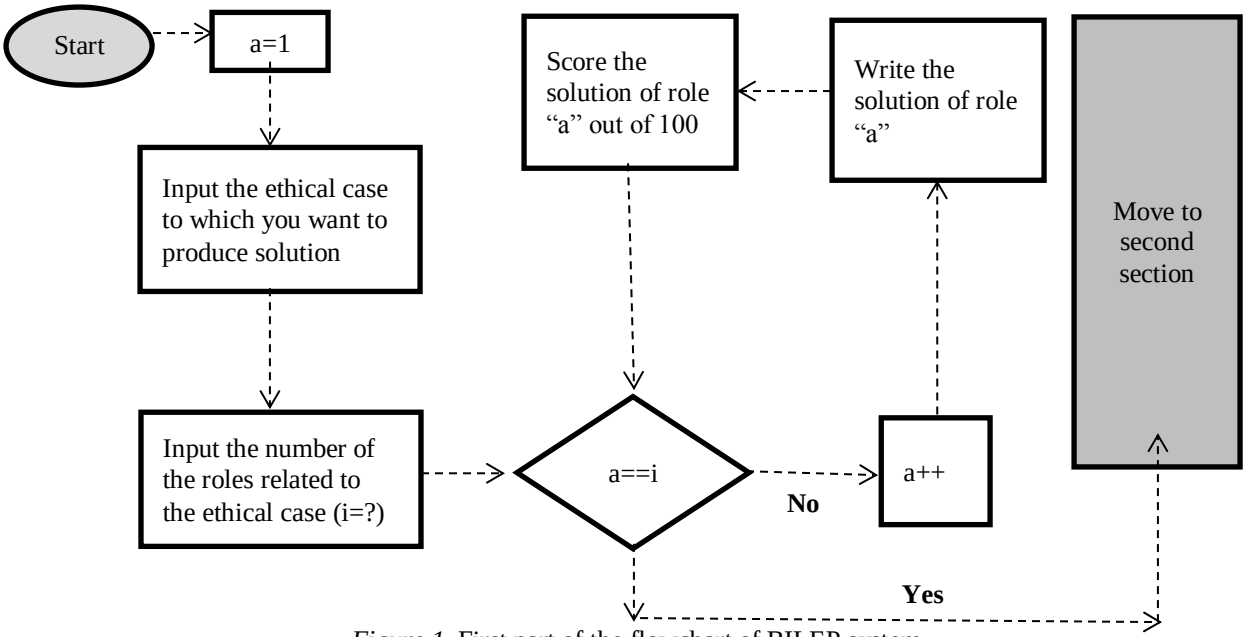

Figure 1. First part of the flowchart of BILEP system

Developing EPSS software

ASP.NET 4.0 software, the SQL Database management system and Adobe Flash CS5 authoring language were used for developing different parts of the BILEP EPSS software. BILEP is composed of five modular sections: (1) Knowledge support system, (2) Expert support system, (3) Ethical scenario forum, (4) User portal and (5) Communication panel. The whole organization scheme of BILEP can be seen in Figure 2.

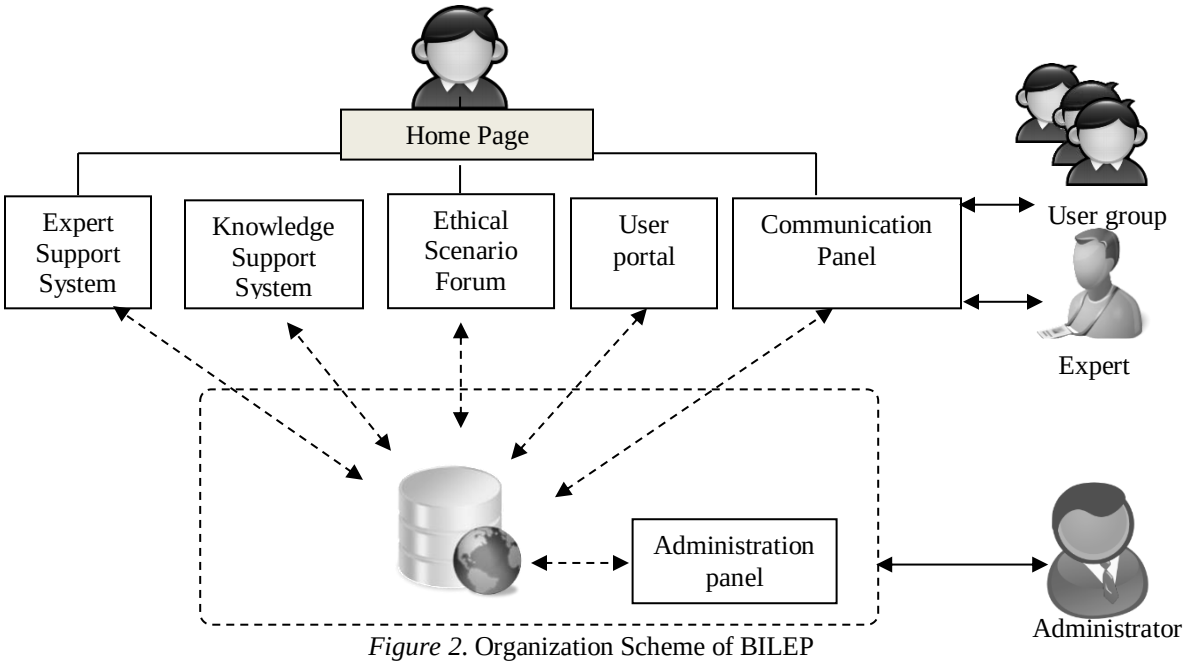

Figure 2. Organization Scheme of BILEP

All data used in different sections were recorded in a database file which could only be managed by the administrator of the system. The expert support system was used to support the ethical decision-making steps for the participants. Theoretical information about computer ethics could be accessed through the knowledge support system. 15 ethical

scenarios were designed and added to the ethical scenario forum section during the development process of the BILEP system. Additionally, a synchronous communication panel, namely a 'chat panel', was placed in the system to communicate with the expert in cases of problems concerning the process. The homepage of BILEP system, which includes all menu items and links provided in order to reach the modules, can be seen in Figure 3.

Figure 3. Homepage of BILEP system

Considering the aim of the study, an attempt was made to develop BILEP with a tidy interface and simplicity was a very important part of the development process. Users opening the page can view the login section at the top of the page and items linked to modules on the left side. Furthermore, the final comments on ethical scenarios, together with the usernames of the authors, can be seen on the right side of the page.

Participants

A total of 40 university students who attended the "Computer Ethics" course for the first time in the 2011-2012 spring semester were participants in this study. Participants were between 19 and 22 years of age; 23 females and 17 males. Their department was the Department of Computer Education and Instructional Technologies in the Faculty of Education. It can be said that this group was not a representative sample as all of the subjects were third-year students who were taking the computer ethics course for the first time. All students participated in the study during the experimental implementation. Computer Ethics was a third-year undergraduate course including two theoretical and two practical classes each week. All participants were divided into two groups which composed the experimental and control groups of the study, respectively. The groups in the study were assigned randomly as experiment and control. In order to eliminate the possible negative effects of random assignment: (1) Prior knowledge of the participants was taken under control by getting their pre-experimental academic scores through a pretest exam. (2) The ages of group members were compared (Average ages of Experimental and Control group members were 21.2 and 19.7, respectively). (3) Researchers checked the gender differences between two groups (it was seen that there were 12 females and 8 males in experimental group, 11 females and 9 males in control group). The students in the experimental group were supported only with BILEP EPSS while the others were supported by the lecturer of the course during the three months of the implementation. Additionally, at the end of the experimental process, seven students among the experimental group who volunteered to take part in the qualitative study were interviewed about the usage of the BILEP system and its future implementations.

Experimental implementation

The experimental part of the study commenced after the design and development processes of the BILEP system were complete. During these three months, the experimental and control groups of participants were given computer ethics lectures by the same lecturer. All educational content was the same for both groups. The only difference between the groups was that the students in the experimental group used the BILEP system as a support tool through the Internet connection, while the other group was supported by the lecturer in practical classes. Pre and post academic success tests related to theoretical ethics and ethical decision-making processes were used to compare the educational growth of the groups. The test questions were prepared according to the conceptual framework by undertaking a literature review and including course content concerning relevant topics such as computer ethics,

software piracy, basic ethical issues and Internet ethics, security options for Internet. After that, the questions were revised with respect to the opinions of experts in the field before their implementation. The test-retest reliability coefficient of the academic success test used in the study was 0.79.

Semi-structured interviews

After the experimental process, semi-structured interviews were conducted with seven students from the experimental group. All of these students volunteered to be interviewed. Each participant was individually interviewed and interviews were conducted in Turkish. Throughout the interviews, the researchers sought to obtain students' thoughts on computer ethics education, their comments on the effectiveness of the process and suggestions for possible additions to BILEP.

Results

Quantitative results

In order to examine the academic growth of the students taking the computers ethics course, an academic success test was developed by the researchers. The developed test was composed of two different sections including different subtitles: one of them was computer ethics and the other one was ethical decision making. Due to the contextual differences between these two topics, the scores obtained were analyzed separately.

Before the three-month experimental implementation process, the prior knowledge of the students was tested. At the end of the process, the same academic success tests were conducted as posttests and comparisons were made between both the pretest and posttest scores of the students in different groups. The pretest and posttest results are shown in Table 1.

Table 1. Pretest and posttest scores of the participants

Sub-categories of the academic success test on computer ethics	Pretest		Posttest	
	Mean	SD	Mean	SD
Control Group				
Ethical decision making	19.00	6.20	25.00	5.78
Theoretical computer ethics	30.00	6.15	35.80	7.28
Experimental Group				
Ethical decision making	21.20	5.52	31.20	7.52
Theoretical computer ethics	33.40	6.65	38.40	9.02

As seen in Table 1, only very slight differences were found between pretest scores of the groups at the sub-categories level. The independent samples *t*-test method was used to analyze the significance level of the difference between pretest scores. The *t*-test results showed that there were no significant differences between the groups in terms of both of the two sub-categories ($p > .05$). After these results had been obtained, it was decided to use multivariate analysis of variance (MANOVA) to analyze the differences between the posttest scores of the groups. Three important assumptions of MANOVA (normal distribution of dependent variables, homogeneity of covariance matrixes and equality of error variances) were confirmed before using this analytical method. The MANOVA results of the posttest scores are shown in Table 2.

Table 2. MANOVA analysis results of the posttest scores

Source of Variance	Dependent Variable	Sum of Squares	*df*	Mean Square	*F*	*p*	Eta Squared (η^2)
Corrected Model	Ethical decision making	384.400a	1	384.400	8.536	.006	.183
	Theoretical computer ethics	67.600b	1	67.600	1.005	.322	.026

	Ethical decision making	31584.400	1	31584.400	701.383	.000	.949
	Theoretical computer ethics	55056.400	1	55056.400	818.522	.000	.956
Group	Ethical decision making	384.400	1	384.400	8.536	.006	.183
	Theoretical computer ethics	67.600	1	67.600	1.005	.322	.026
Error	Ethical decision making	1711.200	38	45.032			
	Theoretical computer ethics	2556.000	38	67.263			
Total	Ethical decision making	33680.000	40				
	Theoretical computer ethics	57680.000	40				

It can be seen in Table 2 that no significant differences were found between the "Theoretical Computer Ethics" scores of the participants ($F(1,38) = 1.005$, $p > .05$). However, it was revealed that the "Ethical decision-making" scores of the groups significantly differed from each other in favor of the experimental group ($F(1,38) = 8.536$, $p < .05$). In other words, the analytical results showed that the BILEP system positively affected the improvement of the ethical decision-making knowledge of the students. Furthermore, it was found that whole test point was affected by the "Ethical Decision Making" scores ($\eta^2 = .183$) rather than "Theoretical Computer Ethics". ($\eta^2 = .026$). After the posttest comparisons, paired samples *t*-test analyses were conducted to reveal the level of in-group academic growths. The paired samples *t*-test results for the control (Table 3) and experimental (Table 4) groups' scores are presented below:

Table 3. Paired samples *t*-test results for control group scores

Sub-categories of test		Mean	*N*	*SD*	*df*	*t*	*p*
Ethical Decision Making	Pretest	19.00	20	6.20	19	4.17	.00
	Posttest	25.00	20	5.78	19		
Theoretical Computer Ethics	Pretest	30.00	20	6.15	19	4.65	.00
	Posttest	35.80	20	7.28	19		

Sub-categories of test		Mean	*N*	*SD*	*df*	*t*	*p*
Ethical Decision Making	Pretest	19.00	20	6.20	19	4.17	.00
	Posttest	25.00	20	5.78	19		
Theoretical Computer Ethics	Pretest	30.00	20	6.15	19	4.65	.00
	Posttest	35.80	20	7.28	19		

Table 4. Paired samples *t*-test results for experimental group scores

Sub-categories of test		Mean	*N*	*SD*	*df*	*t*	*p*
Ethical Decision Making	Pretest	21.20	20	5.52	19	6.045	.00
	Posttest	31.20	20	7.52	19		
Theoretical Computer Ethics	Pretest	33.40	20	6.65	19	2.54	.02
	Posttest	38.40	20	9.02	19		

The *t*-test results revealed that the computer ethics education process in each group significantly affected the academic growth of the students in the areas of "Theoretical Computer Ethics" (control group: $t = 4.65$, $p < .05$; experimental group: $t = 2.54$, $p < .05$) and "Ethical Decision Making" (control group: $t = 4.17$, $p < .05$; experimental group: $t = 6.04$, $p < .05$) levels.

Given the results of the whole quantitative analyses, it can be said that EPSS-supported practices positively affect the level of ethical decision-making knowledge. On the other hand, the same effect did not take place with regard to theoretical computer ethics education. This result is compatible with the performance-oriented characteristics of EPSSs. After the experimental implementation, semi-structured interviews were conducted to collect the comments and suggestions of the participants concerning computer ethics education as well as the usage of BILEP system.

Interview results

During the semi-structured interviews, different questions about computer ethics and using the BILEP system were asked of the participants. Due to the short and similar answers of the students, a brief theme analysis was performed on the answers instead of a detailed one. Interview data were categorized according to the questions. The most repeated and the most salient answers in each question are presented in the following section.

Firstly, the thoughts of the participants on the necessity of computer ethics education were requested. The importance of computer ethics education was emphasized by all of the students. Some of them explained their reasons with the following statements:

"In my opinion, computer ethics education is very important for individuals. We need to know how to make the right decision when we are faced with a complex ethical problem in our everyday life." (Student C interview, 15 June, 2012).

"Nowadays, everybody is interacting with each other through online social environments and sometimes individual privacy is a big problem, that's why I think that everybody in our digital age should get computer ethics education." (Student F interview,15 June, 2012).

"Yes, I believe that computer ethics education is necessary, because, we are using Internet and using online shopping sites more than before. Some people might abuse these kind of online implementations, in such cases, we need to know what can we do and how can we respond." (Student E interview, 15 June, 2012).

Secondly, the opinions of the students regarding the most important points of an ethical decision-making process were recorded. It can be said that the approaches of the students could be divided into two general categories: the realistic approach and case-based approach. Examples of some statements expressing the realistic approach were as follows:

"Empathy should be the first step of the process, it is important to find a conciliatory resolution by looking at things from the different points of view of stakeholders in the ethical issue" (Student B interview, 15 June, 2012).

"Problems should be analyzed and the stakeholders in the problem should be determined, and later, we must ask this question to ourselves "If I were them, what I would want to be done?". By answering this question we can make the right decisions." (Student G interview, 15 June, 2012).

"I think that the most important point of the process is to be able to be impartial while making a decision on an ethical issue." (Student D interview, 15 June, 2012).

One student made a case-based response to this question:

"We must think in accordance with the case, ethical issues can be different from case to case. Therefore, a specific ethical decision-making process must be composed for each case." (Student B interview, 15 June, 2012).

After being asked general questions related to computer ethics, students were asked for their evaluations of using the BILEP system as an ethical decision-making assistant. All of the responses were positive in different ways, some examples are written below:

"The steps in the BILEP system provided us with the opportunity to think more elaborately than before, to write comments for the scenarios and discuss the different comments with our friends." (Student C interview, 15 June, 2012).

"The steps of the ethical decision-making system lead us to think about cases more elaborately and, in addition, we could see the various comments made by other friends on the same case and discuss them within this system."(Student A interview, 15 June, 2012).

Lastly, the suggestions from the participants concerning possible additions and improvements to the BILEP system were recorded. One student suggested the following improvement:

"When I first used the system, the steps of the expert module were very complex for me. I think it is better if a popup window on which there is a short description of how to use the expert system would appear before the process, so novice users can use the system without any confusion." (Student G interview, 15 June, 2012).

Technical problems faced while using the system were seen as the major problems for the students. An example comment is presented below:

"I was faced with some technical problems while using the expert system. When I wanted to switch to the previous step, my session was closed automatically, it was really frustrating for me to log in the system again and again." (Student A interview, 15 June, 2012).

It must be said that such technical problems mentioned by the students resulted from the hardware and Internet connection problems of the computer laboratory rather than the software structure of BILEP. Considering the content of all comments concerning the computer ethics implementation and usage of the BILEP system, it can be stated that a high level of satisfaction among the participants regarding the usage process of BILEP was recorded at the end of the study. However, in order to provide more convenient usage to users, it would be required for us to design less complex modules than those that currently exist. Additionally, it would be useful to provide an information window which appears on the first page of the BILEP expert module, so users can be informed about the possible technical problems they may encounter during usage. Moreover, during the interviews, the emerging consciousness regarding the importance of computer ethics education and the ethical decision-making process in minds of the students show that the experimental process ended with positive results in a qualitative, as well as a quantitative, sense.

Discussion

In this study, the effectiveness of EPSS on computer ethics education and the ethical decision-making process was examined. According to the results of the study, although there is no significant difference between the "Theoretical Computer Ethics" scores of the participants, there is a significant difference in terms of the "Ethical Decision-Making" scores of the groups. This indicates that the EPSS was successful in supporting students when performing tasks related to ethical decision making. When the related literature is considered, it could be stated that this finding is consistent with the study carried out by Raybould (1990) who stated that EPSS can be used in an advisory role for an ethical decision-making process. EPSS provides both specific information and access to the information at the time the task is to be performed (Sleight, 1993) so this result is also compatible with the characteristics of EPSS. Van Schaik et.al (2002) developed an EPSS for the domain of 'quantitative research methods' as taught within a psychology degree course and found that EPSS was successful in supporting students when performing tasks related to quantitative research methods. Levin (1994) stated that EPSS users have a high motivation to learn, they are in control of the learning process and their need to know the specific information is higher than in traditional training. Furthermore, Nguyen and Klein (2008) examined the effect of EPSS and training on user performance, time on task, and time in training. The results showed that participants receiving only EPSS and those receiving training and EPSS performed significantly better on a tax preparation procedure than participants who received only training. In this study, it was found that EPSS-supported practices positively affect the level of ethical decision-making knowledge.

However, it was also seen that the findings of this study are not supported by Kalota and Hung (2012) who claimed that EPSS did not improve participants' learning. Bastiaens et al. (1997) developed an EPSS consisting of information, advice and learning material about products for a large Dutch insurance company which sells insurance products to their clients. They compared EPSS with the traditional environment. However, some older employees who were willing to work with the system preferred the traditional way. Bastiaens et al. (1997) stated that EPSS is not as successful as the literature often states.

Semi-structured interview questions were asked to investigate the students' views on computer ethics and the BILEP system. First of all, the thoughts of the students on the necessity of computer ethics education were requested. The students interviewed highlighted the significance of computer ethics education. The students also shared their thoughts about the most important points of the ethical decision-making process in terms of realistic and case-based approaches. The students interviewed also stated their evaluations and recommendations concerning the BILEP system. Some of the students talked about BILEP positively and stated that the system required them to think about the cases systematically. As stated before, EPSS can provide support and improve and enhance performance in the learning process (Raybould, 1990; Milheim, 1997). Moreover, some students mentioned technical problems that they faced in the process. One of the students also talked about the complexity of the expert module in the system. This result supports the study of Kalota and Hung (2012) who stated that while a majority of the participants had positive feedback about EPSS, a couple of the participants found it confusing. However, Van Schaik et al. (2002) could not find significant correlation between students' performance in terms of success in using the EPSS. Students in this study suggested in the semi-structured interview that social interaction could be integrated into the system. This could represent a possible future addition to EPSS.

Furthermore, according the study, the significant difference in terms of ethical decision-making scores is supported by qualitative results. The volunteered participants in the experimental group, who shared their thoughts about BILEP system as an ethical decision-making assistant, said that the systems made them to think more elaborately and systematically. Also they stated that their knowledge about the ethical decision-making process was increased. It might be said that the BILEP system helped students to think more deeply in ethical decision-making process as they stated. Moreover, some of the participants talked about looking at situations from different perspectives and stressed the importance of empathy. These opportunities that were provided by the BILEP system might be other impacts that affected the difference between the groups in terms of ethical decision making.

Many instructional methods have been used for the instruction of ethics in different domains such as medical ethics, work ethics, teacher education ethics, etc.; however, computer ethics is a relatively new field of study and it is difficult to envisage a variety of instructional methods at the present time. EPSS is used to reduce the cost of training staff while increasing productivity and performance and has a wide variety of usage in different domains. Furthermore, the positive effects on the performance of users can be seen in previous studies (Van Schaik et al, 2002; Levin, 1994; Nguyen & Klein, 2008). In this study, the results also showed that a developed EPSS can improve the decision-making skills of students and feedback from the students was considerably positive.

Conclusions

The present study showed that an EPSS can be used as an effective tool in order to support practical education processes related to computer ethics. It can be stated that the most important part of such kinds of implementation is having a first step to use an EPSS within ethical education. As adults of this technological age, we are supposed to prepare the next generation to be individuals who are conscious of the computer ethics issues that they will possibly face in the future. It is believed that the BILEP online system developed in the scope of this study will be very useful for both students taking computer ethics courses and adults who are confused about the computer ethics that manifest in daily life. Additionally, improving the capacity of the system with new scenarios, members and comments can lead to people living all around the world becoming aware of the importance of ethical issues related to technological tools.

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