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Impact of Internet Use on the Academic Advancement of Engineering Students

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Impact of Internet Use on the Academic Advancement of Engineering Students

Abstract: This study investigates the impact of internet use on engineering students and how it has contributed to their academic advancement. The participants are engineering students (n = 1376) enrolled in three universities in Lebanon who completed a survey that collected various data related to demographics, how long they have been using the internet, how many hours/week they spend on the internet, and the purpose of these activities. Participants were also asked to rate, using a 4-point Likert-type scale (1 = very little, 4 = very much), 22 items that reflected the degree to which their internet use affected their skills. Exploratory factor analysis generated four knowledge factors involved in internet use: non-formal, informal, professional, and social. Informal was shown to be the most important knowledge factor for participants, followed by non-formal, social, and professional.

Introduction

Various researchers have examined the impact of internet use on academic performance and achievement of students, and have come to diverse conclusions. On one hand, some researchers found a negative effect of internet use. Kubey, Lavin, and Barrows [1] for example found a statistically significant relationship between internet dependence and perceived academic impairment. The American College Health Association [2] reported similar findings, where 15.1% of 20,507 students declared that their academic performance was impaired by internet use and computer games. Englander [3] also showed a negative and statistically significant impact of internet hours on grade performance.

On the other hand, Cheung and Huang [4] showed that internet usage significantly correlated with students' perceptions of learning and job prospects. Other researchers showed that students' perception that internet is a useful academic tool positively and significantly correlated with their perception that grade performance is the result of their own effort [5]. Moreover, Jones [6] reported in the findings of a PEW Research Center study that 79% of the several thousand college students in the U.S. believed that the internet has a positive impact on their college academic experience. Johnson [7] related the cognitive performance of students to the frequency of internet use and found that students who used the internet more frequently demonstrated better visual reasoning.

In the present study, the relationship between academic advancement and engineering students' internet use is examined using a self-reported measure to investigate the contribution of the internet on engineering students' knowledge.

Theoretical framework

Coombs [8] defines three types of learning: formal, non-formal, and informal. Formal education is bureaucratic and curriculum driven in which the achievements are recognized by grades, diplomas, or certificates. Non-formal education describes learning that is outside of the formal educational system and tends to be short-term and voluntary. Studies of informal learning reveal

that up to 90% of adults are engaged in hundreds of hours of informal learning [9]. It has also been estimated that up to 70% of learning in the workplace is informal [10].

Context of the study

For the purpose of this study, Lebanon was considered as a case study. Lebanon, where higher education institutions provide a prosperous source of fresh engineers for the Gulf region [11], is considered among the best educational systems in the Middle East. Three universities from the top five ranked universities in Lebanon were targeted: The American University of Beirut (AUB), The Lebanese University (LU), and Balamand University (BU). According to the latest Internet World Statistics [12], there were 2,152,950 internet users estimated in Lebanon as of June 30, 2012. The reported internet penetration rate in Lebanon was 52.0% compared with the Middle East's penetration of 40.2%.

This study examines its use by engineering by asking the following questions: How does the internet influence students' knowledge in general and their learning in particular? What are the types of learning that engineering students acquire from the internet?

Method

This study offers a response analysis of 1376 undergraduate students in engineering programs who participated in a Likert-scaled survey investigating the impact of internet use on their daily learning.

The material was based on questionnaires employed in previous studies [3, 13-15] related to the internet use by students. Along with questions related to demographic characteristics, the survey included questions investigating the number of hours the students spent using the internet, the purpose of using the internet, and whether the internet had any impact on their GPA. Other questions were related to their level of expertise using the internet and if the internet was an essential requirement in their daily activities. The instrument also included 22 statements, reflecting different types of learning, where participants were asked to rate on a scale of 4 (1 = very little, 4 = very much) the extent to which internet use influenced their knowledge.

Undergraduate engineering students from the three universities participated in the survey. As of spring 2012, the numbers of students enrolled in engineering programs in the three selected universities, AUB, LU, and BU, were 1715, 2594, and 865, respectively. Professors from different disciplines in the targeted universities were contacted and asked to distribute the survey questionnaires to their students. The survey invited students to voluntarily participate while ensuring them of complete anonymity. The survey was randomly distributed to the targeted population of 5174 students and data collection ended when a sample size of 1376 was reached, thus satisfying the appropriate sample size for the given population [16] with a 26.6% response rate. Descriptive statistics were calculated to obtain the measures of central tendency and variability for each of the identified items.

Findings and Discussion

Participants were mostly male (77%) with only few females (23%) as shown in Table 1. Such percentages are not surprising because previous engineering education studies have discussed the unsatisfactory participation of women in the field of engineering in Lebanon [17]. The sample was distributed among the fields of civil (35%), electrical (32%), mechanical (21%), and others (12%).

Table 1 shows that the majority (98%) of participants own a computer at home, 93% of them have an internet connection and 75% of them have access to the internet more frequently at home than at other places such as college or cybercafés. The majority of participants (67%) revealed that they have been using the internet for more than five years, which implies that they started using internet services when they were at high school.

Table1: Demographics and general information about the use of Internet

		Students(n=1376)
Gender	Male	77%
	Female	23%
Major	Civil	98%
	Electrical	2%
	Mechanical	21%
	Others	12%
Own a personal computer	Yes	98%
	No	2%
Have an internet connection at home	Yes	93%
	No	7%
Place you most frequently use the internet	College/work	22%
	Home	75%
	Cybercafé	1%
	Other place	2%
	More than 5 years	67%
How long have you been using the internet	Less than1 year	2%
	1-3 years	8%
	3-5 years	23%
	More than 5 years	67%
Weekly hours you spend using the internet	Less than 5 hours/week	10%
	5-10 hours/week	22%
	10-20 hours/week	30%
	Over 20 hours/week	38%
Main purpose of internet use	Research/Projects	88%
	Entertainment/games, music	69%
	Assignments/school work	73%
	Communication/email, chatting	86%
	Surfing for fun	53%
Internet services affected my academic pursuit	GPA has improved remarkably	19%
	GPA has been on the decline	9%
	No impact	72%

Moreover, 68% of participants spend more than 10 h/week surfing the internet where their main purpose is to work on research and projects (88%) and communicate (86%). This finding is similar to studies in other countries. For example, Bouazza and Mahrooqi [18] found that most arts and social science students at Sultan Qaboos University use the internet for learning (81%), followed by general cultural purposes (64%) and communication with friends and colleagues (42%). Similarly, the majority of students in an introductory psychology course at a college in western Canada revealed that they used the internet mainly to complete schoolwork and for communication [19] as shown in Table 2.

The majority of participants (72%) believed that the internet has no impact on their GPA while 19% claim that their GPA has improved remarkably; 9% declared a decline in their GPA owing to internet use. Similar to these findings, Ogedebe [20] who examined the relationship between academic performance and internet services of 350 accountancy and microbiology students at the University of Maiduguri, Nigeria showed that 8% of the participants believed that their GPA had improved remarkably owing to internet use, 6% of the respondents agreed that their GPA had been declining, 28% responded that it assisted them in preparing better for semester examinations, while 58% of the respondents did not respond to the question. Englander, Terregrossa, and Wang [3] found a negative and statistically significant impact of internet hours on grade performance after analyzing the grade performance of 128 students in an introductory micro-economics course. Such diverse results should be scrutinized because they can vary based on the type of the major of students in the study and their related learning activities.

Table 2: Internet use and impact on GPA

Main purpose of internet use		
Lebanon	**Oman**[18]	**Canada**[19] **(weekly)**
Research/Projects; 88%	Learning; 81%	
Entertainment/games, music; 69%	General culture; 64%	Playing games; 8.4
Assignments/school work; 73%		School work; 42.6
Communication/email, chatting; 86%	Communication; 42%	Communication; 32.8
Surfing for fun; 53%		Visit websites; 36.7
Internet services affected my academic pursuit		
Lebanon	**Nigeria**[20]	**USA**[3]
GPA has improved remarkably; 19%	GPA has improved remarkably; 8%	A negative and statistically significant relationship between students' hours per week of internet use and student's exam performance
GPA has been on the decline; 9%	GPA has been on the decline; 6%	
No impact; 72%	No response; 58%	
	Assist in preparing exams; 28%	

To examine the impact of internet use on their learning, engineering students were asked to rate 22 items reflecting aspects of academic and non-academic skills that are needed for the pursuit of an engineering career. The 22 Likert-scaled items revealed a reliability of 0.913. Descriptive statistics were calculated to obtain the measures of central tendency as well as the measures of variability for each of the identified items. An Exploratory Factor Analysis (EFA) was employed to the data to determine which of the 22 items formed related subsets. EFA was applied with principal components extractions, eigenvalues greater than 1.00, and absolute values of more than .40 [21, 22]. Results of the Kaiser-Meyer-Olkin (KMO) measure of sampling equal to .926 and Bartlett's test ($p < .0001$) showed that using EFA was appropriate for this study [23]. The EFA with

the principal components extraction yielded four factors that accounted for 54.74% of the total variance as shown in Table 3.

Table 3 shows the rotated factor loadings, which are the correlations between the variable (the item deriving from the questionnaire) and the factor (emerged from the EFA). The size of each loading (the number that shows in Table 3) reflects the extent of the relationship between each variable and factor. For items that were loaded under two factors, only the highest loading was retained. The variance (σ^2) reported by factor1 was 36.05%, factor2 was 8.28%, factor3 was 5.35%, and factor4 was 5.05%.

Table 3: Rotated factor loadings with extraction method: principal component
Rotation method: Varimax with Kaiser normalization

	Informal knowledge	**Non-formal knowledge**	**Social knowledge**	**Professional knowledge**
Learning about various specializations for future education	.776			
Keeping me updated with news/events/discoveries	.663			
Being more familiar with computers and technologies	.643			
Advancing my knowledge about science and technology	.507			
Supporting knowledge provided by the educational system		.674		
Advancing my knowledge about my field of study		.631		
Providing me with alternative source of learning		.606		
Learning subjects on my own		.563		
Improving my academic performance		.480		
Promoting my research skills		.466		
Advancing my social networking			.642	
Enlarging the circle of my influence			.576	
Organizing and managing my daily activities			.528	
Gaining knowledge about different cultures			.496	
Learning about future career opportunities				.755
Advancing my confidence in myself				.695
Advancing my problem solving skills				.677
Advancing my oral communication skills				.683
Empowering my reasoning and logical thinking				.669
Facilitating working in a team				.636
Advancing my writing communication skills				.592
Enhancing my creativity				.444

After evaluating the items loaded under each factor, factor1 was labeled informal knowledge, factor2 was labeled non-formal knowledge, factor3 was labeled social knowledge, and factor4 was labeled professional knowledge. Four new variables were computed based on the mean of the items falling under each factor. To compare the factors as rated by users, one-way repeated measures ANOVA was applied on the four variables. Repeated measures ANOVA indicated significant differences among the four factor scores ($F(3, 4125) = 599.968$, $p < .001$). Results revealed that informal knowledge received the highest rating from participants with a mean of μ

= 3.14 followed by non-formal knowledge ($\mu = 2.95$), social knowledge ($\mu = 2.71$), and professional knowledge ($\mu = 2.53$).

The results reveal that students in this study acquired various types of knowledge. The first type, as ranked by participants, is the informal knowledge resulting from daily activities on the internet. This knowledge is related to learning about specializations for future education, and about getting updated through news, events, and discoveries. In addition, participants are becoming more familiar with computers and technologies for advancing their knowledge through the various applications and tools accessible on the internet. Nowadays, computer applications are not limited to proprietary software because a range of free, open source applications are available online that students can download and learn to use on their own. This type of learning empowers students with specific skills that cannot be acquired through formal academic learning. Students become more self-directed in their learning when they take the primary initiative for planning, carrying out, and evaluating their own learning experiences [9]. They assume ownership for their own thoughts and actions leading to the notion of "personal responsibility in learning" [24]. Recently, governments have started to recognize the profound importance of informal learning in people's lives because it can help people gain personal satisfaction, development, and fulfillment by bringing people and communities together.

The second type of learning that students acquire from using the internet is non-formal knowledge. Students use the internet as an alternative source of learning to support information provided by the educational system and advance their knowledge in their field of study. The use of the internet also promotes research skills and improves their academic performance. It is obvious that professors use various internet resources to support their teaching materials and therefore students will use the internet as a reference for their studies.

The third type of learning is the social knowledge that students acquire from interacting on the internet. Students become more knowledgeable about different cultures by making friends around the world. Given the number of social networking tools available, an important benefit of using the internet is that students learn how to manage their time and daily activities. Indeed, students have to allocate specific time for social activities otherwise they will not be able to successfully pursue their engineering degrees. This was shown in the data collected suggesting that the majority of students were not addicted to social networking and only 9% of them spent over 20 h weekly on social activities.

The last type of knowledge acquired by engineering students is professional knowledge. Students use the internet to learn about future career opportunities and advance their problem solving skills. In fact, it has been shown that engineer graduates possess adequate theoretical knowledge and technical skills, but noticeably weak creativity and innovation. Interpersonal and personal skills in leadership, management, and multidisciplinary teamwork were found to be the most overlooked aptitudes in college despite their importance in work settings [25]. With the available Web 2.0 applications, users can work collaboratively while chatting and conversing online. Such features help students enhance their team work skills including their oral and writing skills. In addition to technical knowledge and hard skills, engineers should possess soft skills in personal and interpersonal behavior to meet current employment market standards.

Finally, students should benefit from internet services because they help improve their academic performance, promote research skills and critical thinking, encourage independent and/or collaborative learning while enhancing motivation and strengthening self-confidence.
In this study, the post hoc tests using the Bonferroni technique indicated significant difference ($p < .05$) between the four factors. However, this significance cannot be seen as meaningful because the difference is not remarkable on a 4-point scale. Such a result suggests that the four types of knowledge provided by internet use contribute almost equally to the students' learning.

Conclusion

This research paper investigated the impact of internet use on engineering students and how the internet contributes to their learning development. The findings suggested four types of knowledge acquired by engineering students when using the internet. The informal knowledge appeared to be the most significant in the learning process as it keeps updating students with a variety of information. This type of learning allows students to learn specific skills that cannot be acquired through the academic learning settings. In this context, learners become more self-directed taking initiative for expanding their knowledge and more responsible for evaluating their learning experiences. It is obvious that the internet services provide this generation with a myriad of tools ranging from communication to education and entertainment. Also, the internet services appear to offer significant gains in learning and personal development in various areas for engineering students. Therefore, engineering colleges need to determine how students are using information technology and how it affects their formal learning as well as their personal and professional development. Lifelong learning includes a combination of formal, non-formal and informal learning. Informal learning may possess its particular nature as a result of context and setting, but it remains the major mode of learning for engineers throughout their career.

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