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Abstract

Knowing students' belief of their capability in using the computer tasks is a key competency, necessary for learning in technology-enhanced environment. To generate a valid and reliable instrument for measuring computer self-efficacy (CSE), this study aimed to explore the underlying factors of CSE, and to find out the relationship with students' academic achievement. The respondents' CSE was assessed in terms of two dimensions, namely, general and advanced computer self-efficacy. The results revealed a statistically significant difference between Arts and Science students in terms of their CSE in favor of Science students, and also proved that there was no statistically significant correlation between students' academic achievement and their computer self-efficacy. The results provide the foundation for the instrument that allows researchers to determine students' general and advanced computer self-efficacy, and information that can be useful in enhancing students' academic achievement.

Introduction

Computers aid learning and are common tools in the workforce; therefore it is crucial for all students to become familiar and comfortable with their use (Arani 2001). The Bandura's social cognitive theory provides a solid theoretical foundation for the concept of computer self-efficacy (Hsiao, Tu, and Chung, 2012). According to Compeau and Higgins (1995, 129) "computer self-efficacy is an individual's judgment toward his or her own capability of computer use." Thus, this belief has an influence on choice of activities, degree of effort expended, and persistence of effort (Bandura, 1986). Computer self-efficacy is based on an already formed sense of self-efficacy and represents the fundamental elements applied to the field of the use and mastery of computers (Praskeva, Bouta, and Papagianni, 2008).

In this digital era, any student at a higher level who intends to achieve better and go further in academics should have the ability to explore the digital environment (Tella et al., 2007). Some students may feel confused or even lost when they encounter computers as a result of negative perceptions of their own personal capabilities (Simsek, 2011), while, individuals who have a high level of computer self-efficacy have more tendency and interest in using the computers and have higher expectations (Gülten et al., 2011). However, in this study CSE related to two different levels of individuals skills, general and advanced. The general CSE refers to an individual's judgment of his or her ability to perform across multiple computer application domains; while, advanced CSE refers to an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing (He and Freeman, 2010).

Bowers-Campbell (2008) stated that without belief in one's ability to succeed, there would be little chance for learning or achievement. There are several Arab countries lack an appropriate level of technology (Al Bataineh and Anderson, 2015), and Iraq is considered one of them, which facing the same problem of lacking technology in schools and universities, that leads most of the students to become unfamiliar with using computer technology in their learning (Abdullah et al., 2015). For these reasons, there is a need to look at the level of students' computer self-efficacy at the universities in Iraq; to know their beliefs of their capability in using the computer tasks, which might have a relationship with their academic achievement.

Self-efficacy can be an important factor for successful learning (Joo, Oh, and Kim, 2015). In Markas's et al. study (as cited in Torkzadeh and Dyke, 2002), the researchers stated that computer self-efficacy plays a significant role in system use and even in helping the individual to acquire many of the skills associated with effective computer use more easily. Moreover, studies have demonstrated that computer self-efficacy influences the individuals' estimation, expectations, emotional reactions and the effective use of information technologies (Compeau and Higgins, 1995; Looney et al., 2004). Bandura (1986) stated that the lower an individual's perceived efficacy in computer activities, the less his/her interest in acquiring computer competencies.

This study attempts to examine students' general and advanced CSE and to indicate whether there is any significant difference between Arts and Science students in terms of their CSE. According to the studies done by (Magliaro and Ezeife, 2007; Sam, Othman, and Nordin, 2005) found a statistically significant difference between Arts and Science students in their CSE in favor of Science students. Barbeite and Weiss' (2004) found that the Science students' general CSE was higher than the Arts students. Likewise, the Science students had higher advanced CSE than the Arts students. Students' achievement is one of the key contributing factors determining the student's success in various subjects and areas (Shukakidze, 2013). Lei (2010) stated that the generous investments were supported by the strongly held premise that technology can help students learn more efficiently and effectively, and as a result increase student academic achievement. In contrast, self-efficacy has been illustrated by many researchers as a factor to affect the academic achievement of the students. Based on Pantel (2008); Loo and Choy (2013), self-efficacy is one of the major variable that appears to have an important influence on students' academic performance.

However, this study attempts to examine the relationships between students' CSE and their academic achievement and tries to find out if computer self-efficacy plays any role in students' low academic achievement in the universities in Iraq. The analysis of the previous literature was found to have mixed results regarding the relationships between students' computer self-efficacy and their academic achievement. Studies indicated a significant relationship between students' CSE and their academic achievement such as, (Johnson and Galy, 2013; Tella et al., 2007; Defreitas, 2012; Hodges and Kim 2010; Kim et al. 2012); they believed that self-efficacy related to better academic achievement, and have significant direct effects on academic achievement (Joo, Oh, and Kim, 2015). While, in Agomate (2014); Abulibdeh and Hassan's (2011) studies, found no statistically significant relationship between students' academic achievement and self-efficacy.

Method

Purpose of Study

This study aimed to concentrate on students' CSE at Koya University and the relationship with their academic achievements according to the disciplines. Specifically, the study examined the underlying dimensions of computer self-efficacy, concerning the fields of study Arts and Science, and to determine the relationships with the students' academic achievement.

Research Questions

In this study the following research questions were examined:
Rq1: What are the underlying dimensions of computer self-efficacy?
Rq2: Is there any significant difference between Science and Arts students' computer self-efficacy?
Rq3: Is there any significant relationships between students' computer self-efficacy and their academic achievement?

Sample Size

The study was conducted at Koya University. The respondents for the study randomly selected from the second and fourth year students as a study sample using the proportional stratified random sampling procedure. They were 800 participants 450 Art, and 350 Science. The reason for selecting these two stages was to know the overall grades of students' academic achievement in all study materials in their last year study exams.

Research Instruments

The instrument was developed by the researchers in order to examine students' computer self-efficacy. It was consisting of 41 items used a Likert scale from 1 (strongly disagree) to 5 (strongly agree), and two hypothesized dimensions (general and advanced) to underlying the students' CSE. The first dimension represented the general

CSE which is related to the belief that individuals can perform on their own for general computer tasks. The second section targets the advanced CSE which is related to individuals' beliefs of performing more advanced computer tasks which usually require using more applications. This questionnaire was developed based on the established literature such as (Aşkar and Umay, 2001; Barbeite and Weiss, 2004; Durndell and Haag, 2002; Murphy, Coover, and Owen, 1989; Marakas, Yi, and Johnson, 1998) to develop the CSE questionnaire by modifying, changing and adding the items to be relevant in measuring the two computer self-efficacy components. In addition, the 5-point Likert scale is used for all items.

Validity and the Reliability

The questionnaire was validated by specialists and experts. The pilot tested applied on a broad sample (n= 300) at Koya University. The Principal Component Analysis PCA technique was applied to decide the number of computer self-efficacy dimensions. As a result, 27 items were reduced from the CSE questionnaire, due to low corrected item-total correlation values and the problematic items. Consequently, only 14 items were retained for the two dimensions of CSE questionnaire. The reliability for the 14 items was established at .81 for general CSE (7 items), .85 for advanced CSE (7 items), using the Cronbach alpha, indicating good internal consistency.

Research Procedures and Data analysis

After the distribution of questionnaires; only 681 questionnaires were valid 85.1 %, including 335 Arts and 346 Science students. For the data analysis; the principle component analysis (PCA) technique was applied to examine the construct validity of CSE based on the data collected from the respondents (n= 681) which was measured by 14 items. Furthermore, the Descriptive Statistics, Independent-Samples t-test, and Pearson correlation were also performed to answer the research questions.

Findings

To answer the first research question: What are the underlying dimensions of computer self-efficacy? Table 1 summarizes the correlation matrix and the descriptive statistics of the CSE items. The degree of inter-correlation among these variables justifies the use of PCA. The Kaier-Meyer-Olkin measure of sampling adequacy among the variables was .929 which is well above the recommended threshold of .6 (Kaiser, 1974) and the Bartlett's Test of Sphericity had (4522.445) reached statistical significance (*p*= 0.000) indicating that the correlations were sufficiently large. To obtain sufficient factor solution, the varimax rotation method was applied.

Table 1. Correlations matrix and descriptive statistics of computer self-efficacy

Item	.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12	.13	.14
1														
2	.475													
3	.478	.541												
4	.505	.524	.497											
5	.512	.479	.491	.648										
6	.540	.431	.496	.540	.583									
7	.472	.404	.451	.437	.508	.588								
8	.383	.360	.385	.423	.383	.449	.385							
9	.413	.352	.375	.368	.441	.518	.443	.589						
10	.341	.285	.327	.326	.370	.394	.333	.404	.465					
11	.404	.355	.361	.455	.446	.486	.360	.460	.680	.406				
12	.351	.339	.354	.364	.361	.415	.369	.348	.365	.424	.479			
13	.395	.374	.371	.378	.420	.423	.408	.329	.378	.421	.428	.580		
14	.429	.390	.423	.524	.522	.583	.468	.449	.474	.394	.495	.463	.517	
M	3.38	3.66	3.20	3.13	3.17	2.83	3.30	2.86	3.22	2.63	3.37	3.29	3.05	2.87
SD	.943	.935	1.036	1.036	.946	1.050	.986	1.364	1.372	1.265	1.322	1.220	1.115	1.069

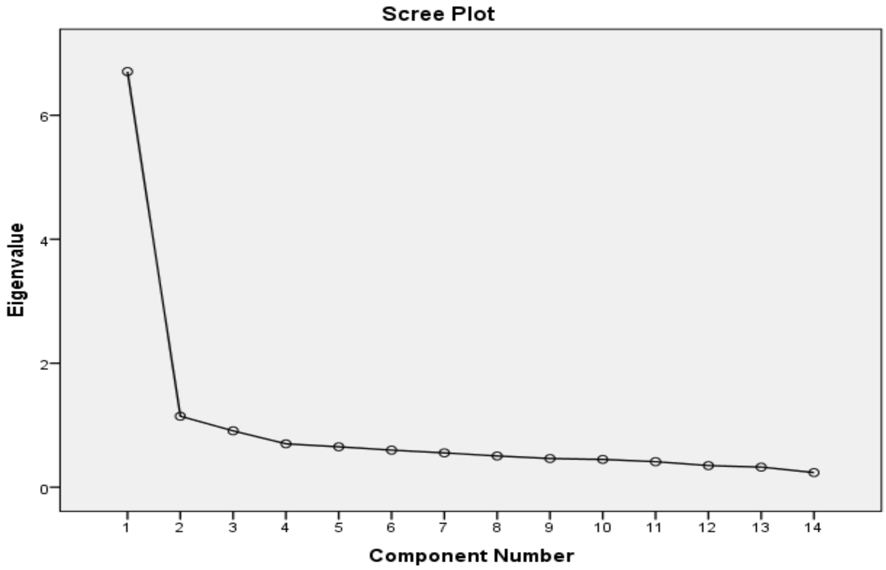

Figure 1. The scree plot of computer self-efficacy

The computer self-efficacy was hypnotized as a two-dimensional construct general and advanced underlying the students' beliefs about their capability to perform any task in their use of the computer technology. The inspection on the scree plot also pointed out that the 14 items had measured two dimensions see Figure 1. The response to 14 items was subjected to the varimax rotated PCA as a test of the construct validity. After the test, all the 14 items were retained Table 2. The analysis identified two dimensions which met the above criteria that explained a total of 56.07 % of the variance. The variance of the first dimension was 47.89 % and the other one 8.18 %. The highest eigenvalue was 6.70 for the first dimension, while the second was 1.14. The loadings of both estimated dimensions were large enough to be of statistical significance at ($p < .000$).

Table 2. Loading for three factor rotated solution of CSE and the alpha coefficient

Factor	Dimension	Items	Factor loading F1	F2	Alpha
	General CSE	1. I am skilful in using computer.	.680		
		2. I feel it is easy for me, to learn to use computer programs	.728		**.85**
		3. I feel capable to understand words relating to computer software.	.719		
		4. I feel competent to manage a computer task without help.	.752		
CSE		5. I believe that it is easy for me to master computer skills.	.731		
		6. I am able to solve the problems related to computer.	.640		
		7. I feel I could control over what I do when I use the specific program in a computer	.611		
	Advanced CSE	8. I feel competent to format my computer when it need.		.614	
		9. I am capable to set up and delete the antivirus program in my computer.		.759	**.87**
		10. I am capable to make my own music clips to insert to PowerPoint.		.685	
		11. I am capable to set up new programs in my computer without others help.		.747	
		12. I am able to make different type of shapes and figures in PowerPoint.		.665	
		13. I am able to learn advanced skills within a specific program (e.g. excel, access, PowerPoint).		.609	
		14. I believe I could fix any problem when occurs while working with computers.		.563	
Overall Alpha					**.91**
% of variance		F1=47.89 %	F2= 8.18 %		
Eigenvalue		6.70	1.14		
Total variance explained is		56.07 %			

The analysis of the two-dimension solution of the CSE factor reveals that the first dimension had significant loadings on 7 items. These variables are related to general CSE; high scores on this dimension suggest that the students may have judged positively their capabilities to execute general tasks on the computer. Therefore, the first dimension, "general CSE", appears to be the stronger dimension. The second dimension solution of the CSE factor has high significant loadings on 7 items, as shown in Table 2; they are related to advanced computer applications, which usually related to more programs and applications.

High scores on this dimension suggest that the students have had high beliefs in their skills to perform advanced tasks on the computer. In addition, the analysis produced loadings, all of which were in the same positive direction, and the solution was free from any noises such as factorial complexity and variable-specific factor, extracted positive loadings. This result has justified that the factor solution was extracted from the non-chance loading, Table 2. In order to estimate the reliability for the two dimensions of the CSE; general and advanced, the Cronbach's alpha formula was applied in Table 2. The internal consistency indices for this instrument were 0.85 for general CSE and 0.87 for advanced CSE, and 0.91 for the overall scale. The varimax rotation shows that the dimensions were moderately correlated.

Table 3 displays the descriptive statistics and the normality testing values for the CSE dimensions. From the data analysis, based on the mean scores of general and advanced CSE indicate that the students have high CSE. The mean score of the general CSE suggests that the students had higher general CSE than the advanced CSE.

Table 3. Descriptive statistics of the instrument's dimensions

Dimension	N	Mean	SD	Range		Skewness	Kurtosis
				Minimum	Maximum		
General CSE	680	22.66	5.26	7	28	-.291	.259
Advanced CSE	681	21.28	6.37	7	35	-.071	.187

To answer the second research question: Is there any significant difference between Science and Art students' Computer self-efficacy? The independent t-test indicates that students in the Science field had a positively higher CSE compared with the students in the Art field. In specific, the difference of (t (67) =-5.92, p= .000) between the two groups' means which is Art students (M=41.50, SD = 10.52) and Science students (M= 46.30, SD =10.55) was significant (p< 0.05). This means that there were statistically significant differences between Science and Art students' on their CSE in favour of Science students, Table 4.

Table 4. The t-test for art and science computer self-efficacy

Variable	Group	N	M	SD	T	df	Sig
Computer self-efficacy	Art	335	41.50	10.52	-5.92	67	0.00
	Science	345	46.30	10.55			

Moreover, the Art students' general CSE's mean score was (M= 21.88, SD = 5.21) and the mean score for Science students was (M= 23.40, SD= 5.20) this is shown in Table 5. The independent t-test reveals that the difference of (t (67) = -3.82, p=.000) between the two groups' means was positively significant (p< 0.05), which means that the Science students' general CSE was higher than the Art students' general CSE. On the other hand, regarding the students' advanced CSE, the mean score for the Art students was (M= 19.63 SD = 6.14) and the mean score for the Science students was (M= 22.88 SD = 6.19). The independent t-test shows that the difference of (t (67) = -6.86, p=.000) between the two groups' means was positively significant (p< 0.05), which means that students in the Science field possessed highly advanced CSE in comparison with the students in the Arts field.

Table 5. The t-test for art and science CSE components

Variable	Group	N	M	SD	T	df	Sig
General CSE	Art	335	21.88	5.21	-3.82	67	0.00
	Science	345	23.40	5.20			
Advanced CSE	Art	336	19.63	6.14	-6.86	67	0.00
	Science	345	22.88	6.19			

In answering the research question: Is there any significant relationship between students' computer self-efficacy and their academic achievement? This research question was tested by computing the Pearson correlations between the CSE scales and achievement, shown in Table 6. The correlations were not statistically significant between students' CSE and their achievement. The overall CSE scale was not correlated with students' achievement, (r=.016, p> 0.05). This was followed by students' achievement and their general CSE scores, (r= .000, p> 0.05). Similar results had been uncovered regarding the correlation between students' advanced CSE and their achievement (r=-.032, p>0.05). Thus, students with high or low CSE did not tend to have high or low scores on the academic achievement.

Table 6. Correlations between achievements and CSE

Variable	N	Achievement	r	p
Computer self-efficacy	680	Level	.016	.673
		Grade	.002	.966
General Computer self-efficacy	680	Level	.000	.995
		Grade	-.012	.754
Advanced Computer self-efficacy	681	Level	.027	.485
		Grade	.012	.725

Discussion

The purpose of this study was to determine the relationships between students' CSE and their academic achievement according to students' disciplines. The study found a statistically significant difference between Arts and Science students in their CSE, in favour of Science students. This may suggest that the university offers a better chance for the Science students in using technology and working in labs as opposed to the Arts students, they are less motivated to use computer applications in their learning. It is obvious that students in the Arts field in Iraq universities adhere to the curriculum of the faculties that relies on books and lectures only. They are not required to participate in a laboratory, except the computer labs, and because of the lack of computer labs in Iraq universities in general and at Koya University in particular, they are not able to use computers regularly.

As stated by Deng, Doll, and Truong (2004); computer self-efficacy continues to play an important role among ongoing users. Usually, acquiring the computer skills is associated with effective use of the computers; however, the ineffective use of computers regularly might make them feel hesitant to use it. Students' general CSE appeared to be higher than their advanced CSE. Wang, Xu, and Chan (2015) found that, general computer experience affects general CSE only and specific computer experience affects specific CSE only. This may suggest that generally students in Iraq universities are more experienced with general computer self-efficacy rather than advanced computer self-efficacy.

The study also found that the Science field students' general CSE was higher than Arts field students. Likewise, the Science field students had higher advanced CSE and that might be due to their nature of study, which is more technology-based. The findings of this current study have also revealed that the correlations between students' CSE and their academic achievement were not statistically significant.

In addition, students' achievement and their general CSE were not correlated; similar results were uncovered regarding the correlation between students' advanced CSE and their academic achievement. As it was stated by Abulibdeh and Hassan (2011) self-efficacy could only promote student achievement via student interactions in an e-learning environment. This may suggest that the students in Koya University are not interacted in an e-learning environment, hence if students have engaged in the technology environment with computer resources it would help to increase their academic achievement.

The findings of this study provides evidence of the relationships between students' computer self-efficacy and their academic achievement, and contribute to our understanding of students' low academic achievement at Koya University, which might be due to the big class sizes, as each class consist of 35 to 45 or more students. Lubienski, Lubienski, and Crane (2008) stated that, the smaller class size is significantly correlated with students' academic achievement. Moreover, an enhanced understanding of the area could lead to practical benefits (Sheldrake, 2016). In other words, students' low academic achievement could potentially be amended via lecturers or wider interventions, assuming that the subjects are sufficiently understood. The study environment might be another reason of their low academic achievement, which is none technology-based, rather than their beliefs in their capability to use computers in their learning.

Conclusion

The purpose of this study was to determine the relationships between students' computer self-efficacy and their academic achievement according to students' disciplines. The findings of this current study have revealed that the correlations between students' computer self-efficacy and their academic achievement were not statistically significant. In addition, students' academic achievement and their general computer self-efficacy were not correlated; similar results were uncovered regarding the correlation between students' advanced computer self-efficacy and their academic achievement.

The current study has contributed to the literature in several important ways. Firstly, it has provided insights into the relationship between students' computer self-efficacy, and their academic achievement. Secondly, this study has provided support for the notion that students' computer self-efficacy should be considered as an important influential factor affecting the implementation of their learning process, which is provides a better understanding of how to better make use of the computers and internet as a tool for learning. Thirdly, it has provided the foundation for an instrument that allows researchers to determine students' computer self-efficacy.

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