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Editorial

Fueling New Technology

Donald G. Perrin

In the 1980s and 90s, we introduced computers in to schools and colleges. Initially it was a sporadic introduction into libraries, classrooms, and laboratories. Cost, training, and lack of materials were barriers to rapid introduction. Technology was advancing at a prodigious rate so early obsolescence was a problem. In the eighties we went from green text to full color graphic screens; PC to Macintosh; DOS to Windows OS; unformatted text on the screen to WYSIWYG (what you see is what you get) when the displayed information is formatted exactly as in print.

Computers grew rapidly in power, speed, and capacity; processors went from 8 to 16 to 32 to 64 bits and multiple processors. Networks facilitated interaction and sharing of resources. Thousands of applications and programs were introduced every year. Search engines and hyperlinks revolutionized the way we managed information. With the multitude of innovations, there was no way that end-users could keep up. In the nineties, we perfected the Graphic User Interface. This made computers simple to use and opened the Internet to the masses. Computers became essential in workplace and home. There was explosive growth of email, blogs, and social networks.

In the nineties, we saw spectacular growth of computer labs in schools and colleges. These were managed by libraries, media centers, computer centers, and academic departments. A new group, information technology, provided computer services for both administration and teaching. Because of limited budgets, institutional functions such as payroll had priority over academic needs. In the late 90s, there was substantial government funding in the United States for educational use of computers. This enabled schools and colleges to make a quantum jump toward the future. It exposed flaws in teacher training, faculty expertise, and management of educational computing that were largely corrected during the first decade of the new millennium.

The 18-month cycle for development and implementation of each new generation of computers and software posed problems for educational managers. It meant that, whatever the initial investment, approximately 20% of that amount needed to be committed every year to keep technology current. Also, software ceased to be compatible with earlier technology because the majority of sales were for new computers. Classes requiring advanced computer applications need new equipment, older equipment can be used by computer labs and clerical staff.

Before the year 2000, most students could not afford computers. As computers became essential to business, the education process, and everyday life, price in relation to computing power continued to fall. Many students acquired their own PCs, laptops, notebooks, and smart mobile communication devices. As the demand for computer laboratories diminished, many were absorbed into libraries.

Advances in computer assisted instruction and online learning facilitated excellent graphics, video, networks, internet access and interactivity. “Cloud computing” will further reduce cost and improve access. This is good news for education, which is reeling from cutbacks in a weakening world economy. The bad news is that education lacks an adequate inventory of relevant online learning resources, particularly for higher education. This means that already overburdened teachers must develop their own course materials for online learning. Massive funding is needed for professional development and validation of creative, state-of-the-art materials to advance the quality of teaching and learning. Since government is reducing services to meet its burden of debt, substantial support from foundations and philanthropists would be invaluable.

Editor's Note: Predictors of success are important to effective introduction of a new technology. This is a complex and significant study of factors involved in introduction and development of E-learning.

Institutional Support and E-Learning Acceptance: An Extension of the Technology Acceptance Model

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Saudi Arabia and Malaysia

Abstract

Owing to broad global attention given to e-Learning, various studies have been conducted by educational institutions and different organizations as well as the governments of various nations (Rosenberg, 2001). The Saudi Ministry of Higher Education is among those educational organizations that proposed the use of E-learning in Saudi Arabia. The Saudi Ministry of Higher Education recognised the need of integrating Information and Communication Technology (ICT) in various universities in Saudi Arabia. The Saudi Gazette (2008) by Madar Research reported that "the Saudi Arabian E-learning industry is projected to reach $125 million USD in 2008 and is set to grow at a compound annual rate of 33 per cent over the next five years". However, several researches have indicated that the students are still unwilling to use E-learning tools and participate effectively in the online mode (Al-Jarf, 2007; Alenezi, Abdul karim, Veloo, 2010). Thus, this research extended Technology Acceptance Model (TAM) to include three institutional related variables: facilitating conditions, training and institutional technical support. Five universities participated in this research and 408 usable questionnaires were analysed. The findings showed that the TAM model was applicable, valid and reliable to investigate the students' acceptance in higher education context In Saudi Arabia. The three examined institutional variables have significantly contributed to the students' Acceptance of E-learning.

Keywords: Students' E-learning Acceptance, TAM, facilitating conditions, training and institutional technical support.

Introduction

The significance and relevance of E-learning to higher education has been palpably felt. Educational organizations and the governments of various nations realise that now is the opportune time to focus on the benefits derived from E-learning (Rosenberg, 2001). Saudi Arabia is one of those nations that promote the use of E-learning in its higher education institutions. The Saudi Arabian E-learning industry is projected to reach USD 125 million in 2008 and is set to grow at a compound annual rate of 33 per cent over the next five years, according to a recent study conducted by Madar Research (Saudi Gazette, 2008). Various research and studies have been conducted to promote the use of E-learning to foster better education worldwide (Webster & Hackley, 1997). Unfortunately, some research on E-learning, particularly in Saudi Arabia, did not develop optimum E-learning for various reasons. Al-Jarf (2004) has demonstrated that the Saudi students showed less reaction and participation in using E-learning compared to Ukrainian and Russian students when posting their responses under the discussion threads.

In recent days, the trend seems to be the same students are still unwilling to use E-learning tools and participate in the online mode (Al-Jarf, 2007; Alenezi, Abdul karim, Veloo, 2010). Al-Jarf (2007) pointed out that using the online system for her English course was a total failure.

Several internal and external institutional factors were found to have significant influence on online learning acceptance (Galletta et al., 1995; Igbaria et al., 1997; Yi et al., 2001). For example, Igbaria et al. (1997) confirmed that the organisational factor highly influences the technology acceptance. This research will consider three institutional variables namely facilitating conditions, training and institutional technical support. The reason behind this is the significant effects of proposed variables in influencing new technology acceptance (Amoako-Gyampah & Salam, 2004; Curtis, &Payne, 2008; Ngai, Poon & Chan, 2007).

In order to determine and investigate the factors that affect E-learning acceptance, the TAM has been chosen as the fundamental model for the current study. The reasons for the choice are the TAM's applicability, validity, reliability and its tremendous popularity in acceptance studies in different settings (Landry, Rodger, & Hartman 2006; Masrom, 2007; Ngai et al., 2007; Roca, Chiu, & Martínez, 2006; Selim, 2003; Saadé & Bahli, 2005; Saadé & Galloway, 2005). Thus, this research empirically investigates the role of variables in influencing the students' E-learning acceptance.

Literature Review

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is one of the most widely applied models in studies of individual intention and the usage of technologies. TAM was adapted from more general human behaviour, the Theory of Reasoned Action (TRA). The model was initially developed and validate by Davis (1986, 1989). Davis, et al. (1989) developed TAM as a theoretical basis to provide an explanation of the determinants human computer usage behaviour that is general directly from generic TRA (Fishbein & Ajzen, 1975). According to Davis (1986), this model is important in understanding use of the Information System as well as Information System Acceptance behaviours. TAM is an extension of the theory of reasoned action (TRA). However, the latter theory lacks distinction if the behaviour of users towards technology depends on intentions or attitudes (Klein, 1991). TAM believes that the individual's intention to use the technology depends on how useful the technology is to the user and how easily it can be used in terms of functionality. It is also believed that the usefulness of the technology is directly proportional to the ease of use (Davis, 1989). Perceived usefulness is also seen as being directly impacted by perceived ease of use.

TAM suggests that perceived ease of use and perceived usefulness of Information Technology (IT) are the main determinants factors of IT usage. Davis (1989, p. 447) defines perceived ease of use (PEU) as, "the degree to which an individual believes that using a particular system would be free of physical and mental effort". Moreover, Davis (1989) defined perceived usefulness (PU) as "the degree of which a person believes that using a particular system would enhance his or her job performance". The two major key constructs of TAM, PU and PEOU, have capability to predict an individual's attitude towards using a particular system. Both constructs PU and PEOU will influence an individual's attitude (A). (Davis et al., 1989) defined attitude as individual's positive or negative assessment of the behavior and is a function of Perceived Usefulness and Perceived Ease of Use: Attitude (A) will influence the Behavioral Intention (BI) of using particular system, and, in sequence, Actual use of use the system (AU). Actual use (AU) will be predicted by the individual's Behavioral Intention (BI) which is considered in this study as the E-learning Acceptance concept. However, the Attitude was eliminated from this research based on the suggestion of Davis et al. (1989) findings, which demonstrated that the power of the TAM in predicting the individual's acceptance is equally good and parsimonious without the attitude mediating effects. Likewise, Venkatesh and Davis (1996) eliminated the attitude variable from their proposed model because the attitude, as a mediating construct, did not seem to mediate fully the effect of perceived usefulness and perceived ease of use on behavioural intention. This was confirmed also by Wolski and Jackson (1999), who stated that the relationship between Attitude and behavioural intention was not supported. Behavioral Intention (BI) refers to individual's intention to perform a behavior and is a function of Attitude and Perceived Usefulness (Davis et al., 1989). The actual use will be included in this research through the researchers' debates on this construct and its self-reported measures issue. The relationships between the mentioned constructs are presented in Figure 1, as shown below. Therefore, TAM model will be basic and theoretical grounds for the current study.

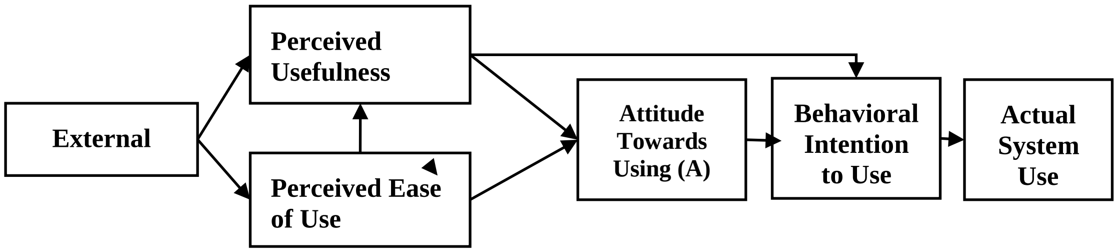

Figure 1.Technology Acceptance Model (TAM)
Source: **Davis et al. (1989)**

Institutional Influence and E-learning Acceptance

With the recent growth in investment in new technologies among institutions of higher education, the organizations have to be aware of their impact on the success and acceptance of these technologies. Several organisational internal and external factors revealed their influence on online learning acceptance (Galletta et al., 1995; Igbaria *et al*., 1997; Yi *et al*., 2001). The cited studies have shown the impact of internal and external organisational factors on perceived ease of use and perceived usefulness while other studies have suggested that training workshops have their impact on the students' attitude and their intention to use online learning systems (Yi et al., 2001). Thus, the current research will investigate the role that the institutional factor plays on the students' willingness to accept or reject using the E-learning system in Saudi universities. The facilitating conditions, training and technical support will be considered as institutional factors that could influence the students' acceptance of E-learning implementation and will be studied from the organisational prospective.

Facilitating Conditions (FC)

Facilitating Conditions are defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system" (Venkatesh et al, 2003, p.453). In other words, the facilitating conditions can be those fulfilled by universities in providing their students with the basic knowledge, necessary resources and assistance while the students are using an E-learning system. Facilitating Conditions have been identified to be a strong predictor for usage behavior (Venkatesh et al, 2003).

Ely (1999) cited in Succi (2007), identified eight conditions that affect the success of the implementation of innovative educational technologies: 1) "Dissatisfaction with the status quo" which indicates the users' attitude towards new techniques, 2) "Knowledge and Skills" which indicates that level of users' knowledge about the implemented system, 3)" Adequate Resources" which refers to available resources necessary to a particular system,4) "Adequate Time" which refers to the availability of the time provided by the institution to educate the users in using the system, 5)" Rewards or Incentives" which indicates the role of the organisation in providing the users with external motivation elements such as non-financial and financial rewards, 6) "Participation" which refers to the institution's effort to encourage the users to use the system, 7)" Commitment" which stands for the organisation management's commitment to use the system, 8)"Leadership" which refers to the management's active contribution in the implementation of the system. The proposed conditions have appeared to be significant in terms of the organisational context. Accordingly, this study will consider the proposed conditions in the measurement of the facilitating conditions construct.

Thompson et al. (1991) adapted the Triandis model of human behavior to build the Model of PC Utilization. They predicted the usage behavior rather than the intention to use. Their findings indicated that the facilitating conditions play crucial role to simulating the users' behavior and not only the intention. These findings opened the door for further investigation into the role of facilitating conditions. For instance, Bock and Kim (2000) investigated the model of PC by expanding the facilitating conditions factor to include rewards. They found that facilitating conditions also had a positive effect on users' behaviour.

Venkatesh et al. (2003) built the Unified Theory of Acceptance and Use of Technology (UTAUT). The facilitating conditions were direct determinants of users' usage behaviour and have shown enormous impact on the users' acceptance. Venkatesh et al. (2003, p.470) suggested that future research should attempt to "test additional boundary conditions of the model in an attempt to provide an even richer understanding of technology adoption and usage behaviour". The researchers have suggested investigating more conditions due to its impact on technology acceptance.

Based on the information provided above, the present research will investigate the direct relationship between the facilitating conditions and the students' acceptance and use of the E-learning system.

Training (TR)

Training (TR) in this study is defined as institution's effort to teach and train their students to acquire E-learning skills. The studies that extended the TAM have included Internal Training as a significant factor influencing the students' acceptance of using online learning (Igbaria et al, 1997; Wolski & Jackson,1999). The studies concluded that training had a positive impact on users' acceptance and their intention to use a particular system.

Wolski and Jackson (1999) applied the technology acceptance model in Educational Institutions. They investigated the teachers' acceptance of new technology used for academic purposes. The TAM in this study has shown its ability to predict the users' acceptance. However, the extended factor "Subjective Norm" was insignificant. They suggested that the role of the Incentives and Training on technology acceptance would be the significant key factor that determined acceptance.

Igbaria et al. (1997) conducted a study to investigate the factors affecting personal computing acceptance. The original relationships between the TAM constructs were proven. The authors have examined the training and management support and its influence on perceived usefulness and perceived ease of use. The findings indicated that training had a positive influence on both the TAM constructs, together with the management support.

Thus, the training provided by the institutions will be considered a key factor for the successful implementation of E-learning. Its relationship with the students' intention to use E-learning will be investigated.

Institutional Technical Support (ITS)

Institutional Technical support (ITS) in the current study is defined as institution capability to provide qualified people to support the E-learning system users when they encounter any system difficulties i.e. a help desk and online support. The lack of technical support was cited as one of most important barriers to E-learning implementation (Behl et al., 2007, Schifter, 2000; Shannon & Doube, 2004). Kleinman and Entin (2002) stated that technical support must be available during the online courses in order to offer a sense of confidence for the online learners.

Several studies have been tested to determine the influence of technical support on students' acceptance of technology (Igbaria et al., 1996, 1997; Ngai et al., 2005; Venkatesh& Davis, 2000). The studies indicated that different types of support such as management support and internal computing support have influenced the users' perception towards using specific technology

Ngai et al. (2005) investigated the students' perception towards the WebCT tools. The researchers investigated around 836 students in Hong Kong. They extended the Technology Acceptance Model (TAM) to include technical support as an external factor. The study findings indicated that perceived usefulness and perceived ease of use are able to predict the students' acceptance of web course tools through a positive attitude among students. The Institutional Technical Support (ITS) had a direct influence on both: perceived usefulness and perceived ease of use. The researchers concluded that technical support was a significant factor that could influence the students' acceptance of WebCT. Furthermore, Venkatesh and Davis (2000) examined the role of Management support, Internal computing support and External computing support on users' acceptance. The researchers confirmed that support systems provided by the management or technical staff seemed to be vital factors influencing the users' intention to use computer technology.

Igbaria et al. (1996) tested microcomputer usage through their motivational model. The model used organisational support as a critical factor affecting the usage together with Complexity, Usefulness, Enjoyment and social pressure. Their model explained approximately 28% of the variance. They found that organisational support had significantly influenced the users' usage of microcomputer.

In brief, the technical support provided by the institutions seems to be a crucial issue particularly with the E-learning system. As it is a new form of technology, many students will encounter some technical difficulties that will need to be resolved. The lack of technical support will be crucial in E-learning implementation. In this present research, the influences of Facilitating conditions, Training, and Institutional technical support on students' E-learning acceptance were investigated.

Research Model and Hypotheses

Based on the original TAM model and based on the previous literature review regarding these three variables, null hypotheses were summarised as follows and the Research model is proposed (as depicted in Figure 2).

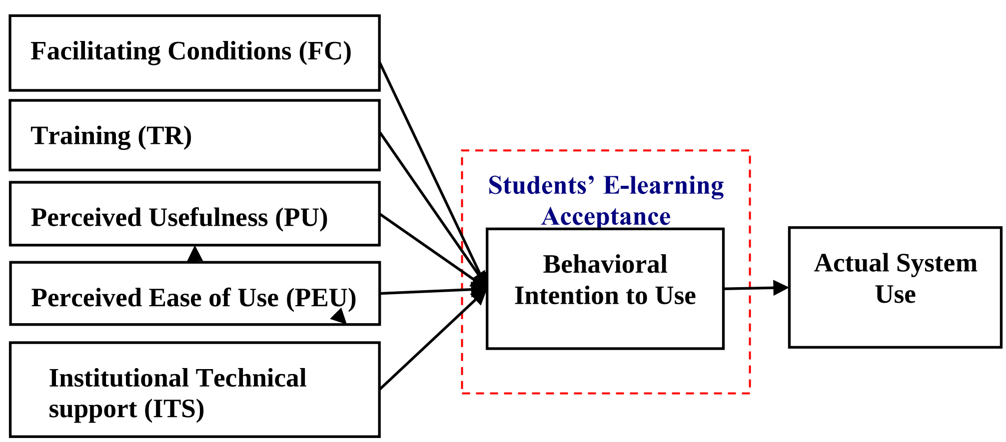

Figure 2. Proposed Research Model

$H_0$1: Facilitating Conditions (FC) have no influence on the students' E-learning acceptance.

$H_0$2: Training (TR) has no influence on the students' E-learning acceptance.

$H_0$3: Perceived Usefulness (PU) has no influence on the students' E-learning acceptance.

$H_0$4: Perceived Ease of Use (PEU) has no influence on the students' E-learning acceptance.

$H_0$5: Institutional Technical Support (ITS) has no influence on students' attitudes toward the using E-learning.

$H_0$6: Perceived ease of use has no influence on students' perceived usefulness.

$H_0$7: Students' acceptance has no influence on the students' Actual E-learning System use.

Research design

Measurement Scales

The questionnaire consisted of 34 Items in order to measure the proposed research model factors. The measurement was adapted from prior research (Amoako-Gyampah, K. & Salam, A. F,2004;Curtis, M. & Payne, E.,2008; Ngai, Poon, & Chan, 2007; Suh & Lee, 2007). A pilot study was conducted in order to develop the measurements and the adapted scales. Moreover, the pilot study was performed in order to check the internal consistency and reliability of the utilised questionnaire. The questionnaire was distributed to 50 students from Al-Jouf University in session one 2009/2010. The returned and usable questionnaires were 48 and two questionnaires were excluded from the analysis due to the enormous number of unanswered questions. The analysis of internal consistency was obtained from the interval scale items only. Overall, the pilot study data revealed an acceptable high alpha reliability coefficient of all items which were above 0.70. Therefore, all items were retained for the main study. Thus, the questionnaire distribution to the targeted sample can be justified.

Sample and data collection

Based on research population which is 156, 429 students, it is appropriate to select a minimum sample of 384 students from the entire research population (Krejcie, & Morgan, 1970). Four hundred and eighty questionnaires were randomly distributed to the students at five universities in Saudi Arabia. The usable response rate was 85% with 408 undergraduate students from five different governmental universities. The profile of respondents is portrayed in Table 1.

Table 1
Profile of Respondents

University	Frequency	Percentage
King Saud University	125	30.6
King AbdulAziz University	161	39.5
King Faisl University	38	9.3
King Khalid University	45	11.0
Aljouf University	39	9.6

Data Analysis and Findings

Reliability and Factor analysis

Construct validity and reliability analysis were examined to ensure that the obtained responses are valid and reliable for further analysis. Exploratory Factor Analyses (EFA) represented by principal components analysis (PCA) with Varimax rotation were performed. All required criterion to perform the factor analysis were achieved. Kaiser-Guttman criterion was applied regarding the number of variables to be extracted. Only variables with eigenvalues equal to or greater than one can be extracted (Guttman, 1954; Kaiser & Dickman, 1959). The items with loading 0.300 or greater were considered to be acceptable (Hair et al., 1998). The factor analysis has individually been performed on each of the following scales because the ratio of five subjects per item (5:10) suggested by Coakes and Steed (2003) and the ratio of ten subjects per item (1:10) to run a single factor analysis were not achieved (Hair et al., 1998). Therefore, the factor analysis was performed separately for the original TAM constructs and the technological factors namely system performance, system response, system interactivity and system functionality. The Cronbach's alpha coefficient above 0.60 is considered as acceptable and justified (Nunnally& Bernstein, 1994; Sekaran, 2000). Therefore, the suggested acceptable cut-off level of 0.60 was applied in this research. Table 2 represents the obtained results from factor analysis of the TAM model. Table 3 represents the results obtained from factor analysis of a total of 14 items that were used to measure the Institutional Factor (IF). An institutional factor consists of three variables: Institutional Technical Support (ITS), Facilitating Conditions (FC), and Training (TR). It has respectively 5 items, 5 items and 4 items. Table 3 provides the results of the factorability on the Institutional variables items.

Table 2

Factor analysis of TAM constructs

Items	1	2	4	5	α
Actual Use (AU1)	0.924				0.77
Actual Use (AU1)	0.807				
Behavioral Intention1(BI1)		0.788			0.76
Behavioral Intention2(BI2)		0.781			
Behavioral Intention3(BI3)		0.766			
Behavioral Intention4(BI4)		0.727			
Perceived Ease of Use1 (PEU1)			0.727		0.74
Perceived Ease of Use2 (PEU2)			0.708		
Perceived Ease of Use3 (PEU3)			0.688		
Perceived Ease of Use4 (PEU4)			0.683		
Perceived Ease of Use5 (PEU5)			0.654		
Perceived Ease of Use6 (PEU6)			0.446		
Perceived Usefulness1(PU1)				0.770	0.76
Perceived Usefulness2(PU2)				0.724	
Perceived Usefulness3(PU3)				0.722	
Perceived Usefulness4(PU4)				0.672	
Perceived Usefulness5(PU5)				0.639	

Items	1	2	4	5	α
Percentage of Variance Explained	11.611	58.641	29.595	18.027	
Total Variance explained	65.713	58.641	24.088	47.622	
KMO	0.597	0.747	0.806	0.806	
Bartlett's test of sphericity approx. chi square	1143.143	395.366	960.369	960.369	
Df	36	6	55	55	
Sig.	. 000	.000	. 000	. 000	

According to Table 2, the overall KMO exceeded the minimum requirement of 0.50. The probability association with Bartlett's test of sphericity was significant (p<0.05). The results for factor analysis yielded that the two factors (AU, BI) have eigenvalues greater than one that explained 65.71, 58.64, and 62.914 respectively of the total Variance explained. Perceived usefulness with eigenvalues of 1.98 explained about 47.62% of the total variance Perceived ease of use with eigenvalues of 3.25 explained about 24.09% of the total variance. The factor loading for all examined variables were acceptable and justified. Therefore, the results indicated a goodness of the current study factors' measurements and consider acceptable for further analysis.

Table 3

Factor loading for the Institutional Factor (IF)

Items	ITS	FC	TR	α
Institutional Technical Support1 (ITS1)	.69			0.75
Institutional Technical Support2 (ITS2)	.68			
Institutional Technical Support3 (ITS3)	.63			
Institutional Technical Support4 (ITS4)	.60			
Institutional Technical Support5 (ITS5)	.59			
Facilitating Condition1 (FC1)		.72		0.76
Facilitating Condition2 (FC2)		.69		
Facilitating Condition3 (FC3)		.67		
Facilitating Condition4 (FC4)		.66		
Facilitating Condition5 (FC5)		.64		
Training1 (TR1)			.85	0.73
Training2 (TR2)			.83	
Training3 (TR3)			.56	
Training4 (TR4)			.52	
Eigenvalues	4.66	1.66	1.33	
Percentage of Variance Explained	33.28	11.86	9.49	
Total Variance Explained	54.63			
KMO	.76			
Bartlett's test of sphericity approx. chi square	2036.49			
df	91			
p.	.000			

According to Table 3, the overall KMO was 0.76 which exceeds the minimum requirement of 0.50. The probability association with Bartlett's test of sphericity was significant ($p<.05$). The principle component methods revealed the presence of three main components with eigenvalues exceeding one, explaining 54.63 of the total variance. Institutional Technical Support (ITS), which includes four items, accounted for 33.28% of the total variance explained with an eigenvalue of 4.66. The factor loading of its items was acceptable as it ranged from 0.59 to 0. 69. Facilitating Conditions (FC) (eigenvalue = 1.66) contributed 11.85 % of the total variance explained. Its factor loading ranged from 0.64 to 0.72. Thus, the factor items met the current research criteria and five items were retained. Training (TR), represented by 4 items accounted for 9.49 of the total variance explained with an eigenvalue of 1.33. The items factor loading ranged from 0.52 to 0.85. The results of analysing the factorability of the Institutional Factors (IF) items met the research criteria and resulted in retention of all 14 items for further data analysis.

Hypotheses Testing

Regression analysis technique was used in testing the proposed hypotheses. Simple liner regression analysis was performed in order to investigate the examined variables influence on the students' E-learning acceptance and also to examine the E-learning acceptance prediction of Actual system use Before testing the proposed hypotheses, several assumptions were met such as normality, linearity, homoscedasticity and independence of errors terms, multicollinearity and multivariate outliers (Hair et al, 1998; 2006; Pallant, 2001; Coakes and steed, 2003). The results of the regression analysis of tested hypotheses are given in Table 4.

Table 4
The Regression Analysis Results

DV	IVs	R^2	F	Beta	*t*	*p.*	The Null Hypotheses
ELA	FC	.308	177.948	.555	13.340	.000**	**H1: Rejected**
ELA	TR	.176	85.266	.419	9.234	.000**	**H2: Rejected**
ELA	PU	.104	14.346	.204	2.085	.038*	**H3: Rejected**
ELA	PEU	.130	26.926	.330	2.632	.009**	**H4: Rejected**
ELA	ITS	.339	204.767	.582	14.310	.000**	**H5: Rejected**
PU	PEU	.254	47.580	.254	5.252	.000**	**H6: Rejected**
AU	ELA	.211	106.769	.459	10.333	.000**	**H7: Rejected**

* $p <.05$, ** $p <.01$

ELA: E-Learning Acceptance, **FC:** Facilitating Conditions, **TR:** Training, **PU:** Perceived Usefulness, **PEU:** Perceived Ease of Use, **ITS:** Institutional Technical Support, **AU:** Actual Use.

Conclusions, Discussions and Suggestions

As portrayed in Table 4, the results yielded that the Perceived Usefulness and Perceived Ease of Use significantly influenced the Students' E-learning Acceptance. It also confirmed the significant relationship and influence between the Perceived Usefulness and Perceived Ease of Use. Moreover, the results indicated that the Actual Use was significantly driven by E-learning acceptance.

The research findings were consistent with the majority of previous researches on the TAM model, particularly the effect of both TAM predictors' namely perceived usefulness and perceived ease of use on the users' behavioral intention (E-learning acceptance) to use new technology (Landry, Rodger, & Hartman 2006; Masrom, 2007; Ngai et al., 2007; Roca, Chiu, & Martínez, 2006; Selim, 2003; Saadé & Bahli, 2005; Saadé & Galloway, 2005). The obtained findings indicated that the attitude towards using E-learning fully mediated the relationship between perceived usefulness and E-learning acceptance. It is also partially mediated the relationship between perceived ease of use and E-learning acceptance. The results contradicted the Davis et al. (1989) findings, which demonstrated that the power of the TAM in predicting the individual's acceptance is equally good and parsimonious without the attitude mediating effects. Likewise, Venkatesh and Davis (1996) eliminated the attitude variable from their proposed model because the attitude as a mediating construct did not seem to mediate fully the effect of perceived usefulness and perceived ease of use on behavioural intention as confirmed also by Wolski and Jackson (1999), who stated that the relationship between Attitude and behavioural intention was not supported. In this research, TAM model showed the power and parsimonious of the TAM model in predicting the individual's acceptance without the attitude mediating effects.

As pointed out earlier, the finding indicated that there was a positive relationship between perceived ease of use and perceived usefulness. This can be confirmed by the majority of technology acceptance research findings particularly E-learning acceptance findings (Babenko-Mould, Andrunsyszyn, & Goldenberg, 2004; Davis et al., 1992; Gefen & Straub, 2000; Masrom, 2007; Ngai et al., 2007; Ong et al., 2004; Rezaei, Mohammadi, Asadi, and Kalantary, 2008; Selim, 2003;; Sun, Tsai, Finger, Chen, & Yeh, 2008; Szajna, 1996; Tung & Chang, 2008; Saadé & Bahli, 2005). Consistent with this research finding, Sun, Tsai, Finger, Chen, & Yeh (2008) conducted an empirical study to investigate the significant factors affecting online system satisfaction. The research confirmed the positive relationship between perceived ease of use in relation to perceived usefulness. The findings also indicated that perceived usefulness of the online learning system would positively influence the learners' satisfaction with this system. Furthermore, Tung and Chang (2008) utilised the TAM in order to investigate the students' intention to use online courses. This study investigated whether the Taiwanese students accepted the online courses or not. The study findings also indicated the original positive relationship between ease of use and usefulness as proposed by Davis et al. (1989). In line with this research finding, Ong and Lai (2004) conducted a research to examine the students' acceptance of E-learning by extending the TAM with gender as a demographic characteristic. The study showed that the students who had a high level of belief that online courses were easy to use showed an increase in their acceptance of online learning. In addition, they found that the perceived ease of use has a significant relationship with the perceived usefulness of using E-learning system. Therefore, the relationship between perceived ease of use and perceived usefulness was possibly justified because of their nature that related to the E-learning system characteristics and their proven influence on the users' beliefs, attitudes and their behavioural Intentions.

The present research findings indicated that there is a positive relationship between perceived usefulness and E-learning acceptance, which was indicated through the behavioural intention variable. The previous research findings were confirmed and support this research finding of the relationship between perceived usefulness and students' acceptance (Davis et al., 1992; Gefen and Straub, 2000; Ong et al., 2004; Masrom, 2007; Ngai et al., 2007; Rezaei, Mohammadi, Asadi, & Kalantary, 2008; Saadé & Bahli, 2005; Selim, 2003; Szajna, 1996; Tsai, Finger, Chen, & Yeh, 2008, Tung and Chang, 2008). For instance, Rezaei, Mohammadi, Asadi, and Kalantary (2008) conducted a research in order to predict the factors affecting the E-learning system in Agriculture schools in higher education. The study showed "a strong direct influence of perceived usefulness on students' intention to use e-learning" (Rezaei et al., 2008, p.90). It also indicated that there was a positive relationship between students' intention to use E-learning and perceived usefulness besides the internet experience, computer self-efficacy and affect.

Several implications were obtained from the research findings. The applicability and validity of the TAM and its related original constructs were confirmed in the Educational context especially in the area of E-learning in Saudi Arabian institutions of higher education as consistent with the research that examined the TAM's applicability in the area of E-learning (Lee et al., 2006; Masrom,2007; Rezaei, Mohammadi, Asadi, & Kalantary,2008; Saadé, Tan, & Nebebe,2008). The perceived ease of system use influenced the perceived usefulness and both constructs were significantly influenced E-learning acceptance through the mediating effects of the students' attitude. Thus, it also confirmed that the TAM is able to include additional factors that could influence technology acceptance besides the confirmed original directions and relationships between TAM's constructs.

There are limitations related to the sample size and number of universities that participated in this study. However, it would be useful for future research to implement the research examining these factors and instrumentations with more universities' either governmental or private ones, in order to obtain a better representation for the entire population and ultimately represent optimum generalization. Furthermore, the research was limited only to university students, it is therefore future research should consider other university members such as research assistants, lecturers and administrators in order to identify their trend to accept
E-learning and determine the important factors that could affect their acceptance. This study is also limited to subjective measure of the Actual use (Self-reported) which influences the accuracy of measuring the students' actual system usage. Therefore, future research should examine the actual system usage using objective measures such as actual system access frequency recorded by a computerised system. The reported R-square yielded other additional variables that might be needed particularly from the Institutional perspective since the Institutional variable significantly contributed towards the E-learning Acceptance. Therefore, future research could investigate and test more additional Institutional related variables. The level of students' participations in their E-learning courses still weak and they are still unwilling to use E-learning tools and participate effectively in the online learning mode. Future research should investigate in depth this phenomenon and conduct further studies in the area of E-learning readiness and perceptions as well as evaluate the current learning management systems adopted by the universities.

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Editor's Note: Discussion and dialog play an important role in teaching and learning, whether in the classroom, distance learning, or study groups. Whatever asynchronous discussion lacks in spontaneity, it recovers by the opportunity to think through ideas and responses and do additional research. As a result, asynchronous discussions can be high in participation, quality of ideas expressed, and success in solving problems.

Faculty Use of Asynchronous Discussions in Online Learning

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USA

Abstract

This study investigated a number of factors associated with the faculty use of asynchronous discussions in online courses including: instructor behaviors and attitudes, the structure of discussion assignments, types of discussion rubrics and their use, facilitation style, and comparisons between online discussions and face-to-face discussions. Data was collected from faculty at two different institutions who taught undergraduate or graduate classes. The results indicate that faculty are significantly involved in discussion activities and report that they spend considerable time doing so. The results also suggest that faculty teaching graduate courses believe that online discussions result in more and better interaction compared to face-to-face courses, whereas undergraduate faculty found online courses decreased interaction and quality of interaction compared to face-to-face courses. It is proposed that the Community of Inquiry model may be a useful framework to conduct further studies of how faculty make use of discussions in online courses and the factors that influence effectiveness of student learning.

Keywords: asynchronous learning, discussion boards, online teaching, learner interaction, community of inquiry, effectiveness online learning, rubrics, facilitation

Introduction

Asynchronous discussions are central to the design of most online courses. Prior research studies have reported correlations between interaction in online courses and faculty satisfaction (e.g,. Hartman and Truman-Davis, 2001), student satisfaction (e.g., Dziuban, Moskal, Brophy, & Shea, 2007; Swan, Shea, Fredericksen, Pickett, Pelz, & Maher, 2000), and student success (e.g., Hartman Dziuban, and Moskal, 2000; Wu & Hiltz, 2004). However, little has been written about the relationships between learning outcomes and specific faculty behaviors vis-a-vis online discussion organization and facilitation.

This research study investigated key faculty organizational factors that impact upon effective online discussions in undergraduate and graduate online courses. Data was collected across two different institutional environments and the similarities and differences between full time and adjunct teaching, and between academic disciplines were examined. Faculty were also asked to rate the amount and quality of interaction in their online classes compared to on-campus classes as well as the degree of connectedness to students.

Methodology

Data for this study was collected by a survey sent electronically to faculty. The survey consisted of a 39 item online questionnaire with an optional identification field for a follow up contact. Faculty responded to the survey based upon one course that they had taught in the last three terms.

The survey investigated a wide range of issues relevant to online discussions. The key sections of the survey addressed: instructor behaviors and attitudes, the structure of discussion assignments, types of discussion rubrics and their use, facilitation style, and comparisons between online discussions and face-to-face discussions.

Several key issues of the survey investigated the range of ways in which instructors attempt to stimulate and shape student discussions. Factors such as the nature of prompts, scoring criteria and frequency of scoring are of central concern to the researchers. Therefore, the survey inquired about the time commitment instructors found necessary to score online discussions, extent to which complete discussions are read, as well as the assumptions about learning and teaching that lead to such instructor decisions. Survey responses were analyzed by demographic features such as academic program, graduate, undergraduate or combinations, class size, and instructor years of experience.

The survey was distributed to two quite different institutions, a large public southern university with a well-established online undergraduate and graduate program (designated here as SU) and a small New England university with a new but rapidly growing online graduate education program (designated here as NE). As a metropolitan research university SU matriculates more than 50K students, with 17 degree and 12 certificate programs. The SU faculty teaching online have all participated in a formal online instructor development program. NE online courses are entirely graduate teacher or administrator education. Few of the instructors at NE had participated in a formal online instructor development program.

The survey was emailed to 358 faculty from SU and 47 from NE. Survey responses were received from 126 faculty, 67 percent responded from SU (34 graduate, 52 undergraduate) and 21 percent from NE (27 graduate). SU respondents were primarily full time faculty, a notable contrast to the high percentage of part-time NE faculty. Teacher or Administrator Education courses were most prominent, accounting for 44 percent of all courses. Health professions represented 15 percent of the course, with Humanities at 9.5 percent. (Unidentified academic disciplines accounted for 24 percent.)

The respondents reported a balanced range of years of teaching in higher education. The overwhelming numbers of SU faculty were experienced, reporting 12 percent undergraduate and 37 percent graduate teaching from one to five years. In contrast, 54 percent of NE faculty (54 percent) had only taught for one to five years.

SU graduate courses were considerably larger (50% between 26-40) compared to NE (14% between 26-40).

Results

We will first address the pattern of the results for the whole set of respondents. Comparisons between undergraduate and graduate courses as well as a more fine tuned analysis of responses will follow.

Discussions played a major role in the online courses. Ninety-five percent of respondents used online discussions, with 87 percent requiring discussion participation. They believed that having online discussions was a very important (72 percent) or a somewhat important (18 percent) integrative feature in their course. Faculty strongly believe (64 percent) or somewhat believe (24 percent) that online discussions positively impact student learning.

Eighty-eight percent supplied written expectations to students on how they were to conduct themselves apart from any written scoring criteria (e.g. “Netiquette” or “Protocols”). The question on faculty engagement indicated that 82 percent provided specific written prompts, 95 percent supplied students with written scoring criteria, 86 percent used explicit scoring criteria of online discussions (even if they did not share the criteria with students), and 84 percent scored individual contributions to each online discussion. Seventy-five percent scored discussions at the end of each discussion

The question about faculty involvement indicated that 73 percent read all discussion postings, 84 percent posted at least one message, and 37 percent posted multiple messages each discussion.

The faculty facilitated 43 percent of the course discussions whereas students facilitated 35 percent of discussions. The proportion of the course's online discussions facilitated by students was only 3 percent leading more than half of the discussions, 6 percent leading less than half of the discussions, and 1 percent leading all discussions. Teaching Assistants were only used to facilitate 5 percent of discussions.

Faculty considered themselves very skilled (28 percent) or somewhat skilled (48 percent) in facilitating discussions. They learned their skills in numerous ways: trial and error (54 percent), read about discussion (29 percent), participated in online discussion as a student (21 percent), or completed faculty development training (41 percent).

As noted above, the faculty in the study had considerable higher education teaching experience and online teaching experience. Table 1 reports responses to: *Please rate the AMOUNT of interaction in your online course compared to a comparable face-to-face section.* The columns in the table and subsequent tables indicate the following: All (entire set of data), UG (undergraduates from SU), G (graduate faculty from both SU and NE), SU (all SU faculty), NE (all NE faculty). Table 2 presents responses to: Please rate the QUALITY of interaction in your online course compared to comparable face-to-face sections. Table 3 indicates responses to: Please rate your overall feeling of "CONNECTEDNESS" to or "DETACHMENT" from students in online discussions.

Table 1
Amount of Interaction Online Compared to Face-to-Face Instruction

	All	UG	G	SU	NE
Increased	38.1	30.8	45.5	58	37
Somewhat increased	17.5	19.2	17.7	6	33
About the same	19	17.3	17.7	19	19
Somewhat decreased	8.7	9.6	8.1	6	11
Decreased	11.9	21.2	4.8	10	0

Table 2
Quality of Interaction Online compared to Face-to-Face Course

	All	UG	G	SU	NE
Increased	28.6	23.1	30.6	29	37
Somewhat increased	21.4	15.4	30.6	26	41
About the same	24.6	26.9	21	29	15
Somewhat decreased	11.9	19.2	8.1	10	8
Decreased	9.5	13.5	3.2	6	0

Table 3
Feeling of Connectedness or Detachment from Students in Online Discussions

	All	UG	G	SU	NE
Very connected	28.6	23.1	35.5	26	52
Somewhat connected	37.3	38.5	33.9	35	37
Neither connected nor detached	10.3	9.6	9.7	13	7
Somewhat detached	11.9	9.7	9.7	16	3
Very detached	7.9	9.6	4.8	10	0

Statistical correlations that were conducted found that the higher the rated connectedness, the higher the quality of interaction ($r = .77$, $p < .001$), with a greater facilitation skill ($r = .33$, $p < .001$) and the degree of instructor posting ($r = .20$, $p < .05$).

Facilitation skill was also associated with degree of instructor posting ($r = .30$, $p < .05$), quality of interaction ($r =. 29$, $p < .05$) and the time commitment for scoring discussions ($r = .28$, $p < .05$).

The extent to which instructors believe that discussions are an important integrated part of their course, the greater the feel connected to the students ($r = .75$, $p < .001$). Rated importance is also associated with facilitation skill ($r = .54$, $p < .001$), and the quality of course interaction ($r = .37$, $p < .001$).

Faculty judged student learning to be related to connectedness ($r = .56$, $p < .001$), quality of interaction ($r = .51$, $p < .001$), facilitation skill ($r = .40$, $p < .001$). In contrast, but as one may expect, connectedness was negatively associated with class size ($r = -.24$, $p < .05$).

Comparisons between graduate and undergraduate courses revealed several differences. Given the respondents, the data compares SU undergraduate with combined SU and NE graduate courses and SU undergraduate with SU graduate. The best prompts used to launch online discussions reported were "complex statement/question framing the context for discussion of the topic" were similar for overall graduate (40), SU graduate (45) an SU undergraduate (46). However, selecting a "simple statement indicating what topic students should discuss" was much favored much more by overall graduate (32), SU graduate (38) compared to SU undergraduate (17).

Discussion

Despite significant institutional differences, graded discussions with specified evaluative criteria are widely used at both the undergraduate and graduate level. Faculty are significantly involved within these discussions, expressing by their behavior that discussions are an integral means for integrated learning, connections between students, and connecting themselves to their students. They report being considerably skilled in using online discussions while acknowledging a significant demand upon their time.

Faculty teaching graduate courses believe that online discussions result in more and better interaction compared to face-to-face courses. In contrast, undergraduate faculty found online courses as having decreased interaction and quality of interaction compared to face-to-face courses.

Faculty teaching online courses regularly report the significant demands upon their time. Quite often, faculty consider online teaching much more demanding than face-to-face teaching. They wish to be effective and maintain their sustained commitment to online instruction. A central question is whether faculty should be posting within each or even most discussions or whether there is an alternative role that may improve student learning as well as reduce faculty time demands. Would both students and faculty be better served if courses were designed so that students learned how to facilitate discussions while faculty assumed the role of "guide on the side" throughout the discussions? There are several reasons why professor participation directly in the discussion may inhibit the discussion. Students undoubtedly will attend to the professor's comments more readily than comments of their peers. Insertion of the professor's comments, although unintended, may also communicate to those who have most recently posted their ideas that there are some problems with their postings.

This study demonstrated very similar discussion patterns between a university with a well-developed faculty development program and one without a program. It found that trial and error learning was a major source for all faculty. Future research should consider the quality and nature of faculty development related to online discussions. Of particular importance is recognizing that faculty teaching undergraduate courses may face a considerably different set of discussion challenges compared to faculty teaching graduate courses given the differences in social and career development between undergraduates and graduates.

Whereas the amount of interaction may be objectively assessed, the quality of interaction and the sense of connectedness is an affective perception that is integrally related to both one's role and the nature of the students in the course. Faculty who have enjoyed working with undergraduate students face-to-face will presumably sense a loss of connection with online instruction. Traditional age undergraduate students are socially, psychologically and developmentally very different from the adult learners. Traditional undergraduates find value in the personal classroom interactions (even if it is before and after class), whereas adult learners are more likely to value the time and convenience of online learning over the missed opportunity to make new friends. This suggests that a future research study should compare faculty and student responses across undergraduate and graduate courses.

Clearly faculty development that focuses on ways to engage students is important at all levels of instruction. This study suggests that faculty teaching online undergraduate courses should receive a wide range of pedagogical instruction that fosters cohesion and student engagement. The range of cooperative learning strategies with documented positive affective and cognitive effects should be integrated into the online environment (Slavin, 1991). These include the Jigsaw II technique (Aronson, Blaney, Stephen, Sikes, & Snapp, 1978), and Reciprocal teaching (Palincsar, Ransom & Derber, 1988/1999). Additional suggestions are provided by Lynch (2010). Gerbic (2009) discusses the impact of adding online discussions to on-campus undergraduate classes.

In addition, for the course to engage undergraduates, faculty and course designers may wish to develop sections of courses that are case study based, or utilize problem based learning. Both practices have been shown to foster high levels of motivation and engagement with face-to-face instruction. There are numerous issues that call for further investigation. Issues addressed here are the nature and use of discussion instructions and evaluation rubrics, instructional efficacy of faculty posting, and implications for online faculty development. All three issues should be considered from the perspective that what matters most is to optimize student learning and engagement while supporting faculty so that they have the personal and institutional resources to become more effective instructors.

The quality of online discussions is significantly affected by posted expectations as well as evaluative feedback. Further investigation should identify whether there are essential elements of guidelines, samples of effective questions, examples of cohesive, in-depth discussions that may be provided before discussions start to foster high quality online conversations (see Al-Shalchi, 2009; Scott, 2010; Vonderwall, Liang & Alderman, 2007). Similarly, are there evaluative criteria or elements of rubrics that help students and faculty alike to recognize different discussion qualities with reliable and valid judgment? For example, there has been some research concerning analytical versus wholistic approaches to grading discussion postings (Grant, 2007; Spatariu, Hartley, & Bendixen, 2004). Such criteria should provide formative feedback that results in improved future discussions and enhanced learning.

Conclusions

Whereas the most immediate implications of this research relate to program and faculty development, the study presents some implications for empirical and theoretical discussions associated with the Community of Inquiry (CoI) model of asynchronous learning.

Garrison and Arbaugh (2007) reviewed the CoI approach that was initially presented by Garrison, Anderson, & Archer (2000). The model suggests that three essential interrelated factors that influence the quality of asynchronous learning are social presence, cognitive presence, and teaching presence. Social presence refers to the students' sense of social and emotional safety online, being seen as "real people" within a cohesive environment (Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Rourke, Anderson, Garrison, and Archer, 2001; Walther, 1992). Social presence is also closely associated satisfaction with an online learning environment (Arbaugh & Benbunan-Fich, 2006; Benbunan-Fich & Hiltz, 2003).

Garrison, Anderson, and Archer (2001) described cognitive presence as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse." (Garrison & Arbaugh, 2007, p. 161). The CoI model identifies cognitive presence in diverse ways as the levels of thinking, understanding, and constructing meaning throughout the course. Cognitive presence has many dimensions with varied levels of cognitive processing (e.g. recall to critical and creative thinking), private compared to shared communication, and metacognitive reflection. Walker (2005) and Wickersham & Dooley (2006) discuss critical thinking in discussion forums.

Garrison et al (2001) "described teaching presence as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes." (Garrison & Arbaugh, 2007, p. 163.)

Anderson, Rourke, Garrison and Archer (2001) postulated three teaching components 1) instructional design and organization, 2) facilitating discourse (originally called building understanding, and 3) direct instruction. The study reported here relates directly to facilitating discourse, certainly a challenging role for faculty. Garrison and Arbaugh (2007, p. 164) emphasize this major teaching role: "Facilitating discourse requires the instructor to review and comment upon student responses, raise questions and make observation to move discussions in a desired direction, keep discussions moving efficiently, draw out inactive students and limit the activities of dominating posters when they become detrimental to the learning of the group."

It is suggested that the CoI model may be a useful framework to conduct further studies of how faculty make use of discussions in online courses and the factors that influence effectiveness of student learning. This study has identified a number of issues that could be investigated further in this context.

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Editor's Note: This paper reviews "ad hoc" definitions of technology users in search of more exact terminology. This excellent paper is intriguing, thoughtful and amusing.

"Digital Nerds" and "Digital Normals": Not "Digital Natives" and "Digital Immigrants"

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Abstract

The designations "digital immigrants" and "digital natives" have become quite popular among educators in the United States and perhaps other countries. However, the two designations are not based on research. A survey of 359 college students who were born in the digital age showed that participants exhibited both "native" as well as "immigrant" behaviors. The authors discuss the findings of the study and propose the two alternative designations "digital nerds" and "digital normals."

Introduction and Purpose of the Study

The designations of "digital natives" and "digital immigrants" that were originally proposed by Prensky (2001a) have been widely accepted as being true, with practically no data to support the designations or much research being conducted to test the validity of the two designations. In fact in the first paper in which Prensky (2001a) proposes the designations of "digital natives" and "digital immigrants," he cites no research to support his ideas.

The primary purpose of this study is to explore whether or not designations of digital natives and digital immigrants are valid ways of categorizing those who were born in the digital era.

Study Methods, Findings, and Discussion of the Findings

Sample of Subjects

Participants of this study were drawn from two freshmen year classes in taught in a large, public, urban university that has been nationally classified as a research university. An application package was prepared and submitted to the Institutional Review Board (IRB) at the university and the application was approved. After such IRB approval was obtained, the instructor for the two classes was approached and his permission obtained to administer the survey in two sections of a course that he taught in the same classroom but on different days, during the semester of Fall 2010. Two days, one for each section of the course, were scheduled for data collection, and on these designated dates, the researchers visited both the classes about twenty minutes before the end of each class period.

The survey, with a copy of the consent statement attached, was distributed to all students in the classroom. A copy of the consent statement was also projected on the large screen that was available in the classroom. Students were requested to read the consent statement and to ask questions before they started completing the surveys, A few students did not participate in the survey because they were not yet 18 years old and were therefore considered to be minors. When the application was submitted to the IRB to conduct the study, the researchers specified that data will be collected only from students who were 18 years of age or older.

Analyses of Data and Discussion of Findings

Sample of Participants

The sample of participants was drawn from a university that offers more than 200 degree programs at the undergraduate, graduate and doctoral levels in numerous disciplines. The number of students currently enrolled in the university exceeds 44,000, and is expected to grow in the future. At the time this paper was written, sixty percent of the enrolled students were of Hispanic origin. Other ethnic groups represented at this very diverse university included non-Hispanic Whites (14%), Blacks (13%), Asian or Pacific Islanders (4%). Minority students belonging to other groups accounted for nine percent of the student population.

Data show that a total of 359 students participated in the study. Of these 359 participants, 122 or 49 valid percent were males and 127 or 59 valid percent were females. Data regarding sex was missing for about 10 or 3.9 percent of students.

Survey Results that Support the Designation of 'Digital Natives'

Some aspects of the two designations may be true, but some of the assumptions made by Prensky (2001a; 2001b) are definitely not valid. First, let us look at some of the assertions made by Prensky (2001a; 2001b) that are supported by the data collected for this study. When asked the question, "Given the choice, would you take an exam online or on campus?", 103 or 39.8 percent of the study participants selected the choice "online" as opposed to 62 or 23.9 percent who chose "face to face (paper)" as their preferred way of taking an exam. Table 1 shows the percentages of respondents who chose other options.

Table 1
Students' preferences for taking exams

	Frequency	Percent	Valid percent	Cumulative percent
Online	103	39.8	40.1	40.1
Face to face (Paper)	62	23.9	24.1	64.2
Face to face (Computer)	1	.4	.4	64.4
Both (online or face to face)	44	17.0	17.1	87.1
Depends on the type of exam	47	18.1	18.3	100.0
Missing	2	99.2	100.0	
Total	259	100.0		

A very large number and percentage of participants (226 - 87.3%) also reported that they multitask, or engage in various tasks at the same time. However, as the data in Table 2 shows, the different tasks in which large percentages of the participants engaged seem to be routine tasks, such as browsing the Internet and sending and receiving text messages, that do not require serious focus and concentration to accomplish. Psychologists think that multitasking often only results in people performing more poorly on different tasks that they attempt to do at the same time than if they do each task separately (Willingham, 2010).

Table 2
Things students do while they watch TV.

	No	Yes	Total
Browse internet	17.0%	83.0%	100.0%
Talk on the phone	42.9%	57.1%	100.0%
Study for school	44.0%	56.0%	100.0%
Play video games	83.4%	16.6%	100.0%
Send and receive text messages	10.8%	89.2%	100.0%
Chat online with friends	40.5%	59.5%	100.0%

More than ninety-one percent of college students of the digital age also own tools of the digital age, as shown in Table 3. Two hundred and twelve participants (82.2%) also reported that they use Google every day to search for information. This is shown in Table 4. As shown in Table 5, an overwhelmingly large percentage (95.7%) of the respondents reported that they read documents on the computer compared to less that five percent who print the documents and read them. The data in Table 6 shows that more than seventy five percent of the respondents also check their email messages and the updates on social networking sites at least once a day. More than forty-five percent check their messages at least two or three times a day. These are all certainly behaviors that can be expected of "digital natives."

Table 3
Do students own laptops?

	Frequency	Percent	Valid percent	Cumulative percent
No	23	8.9	8.9	8.9
Yes	236	91.1	91.1	100.0
Total	259	100.0	100.0	

Table 4
Using Google to search for information.

	Frequency	Percent	Valid percent	Cumulative percent
Every day	212	81.9	82.2	82.2
Two or three times a week	42	16.2	16.3	98.4
A few times a month	4	1.5	1.6	100.0
Total	258	99.6	100.0	
Missing 9	1	.4		
Total	259	100.0		

Table 5
Reading documents on the computer.

		Frequency	Percent	Valid percent	Cumulative percent
Read it on your computer		247	95.4	95.7	95.7
Print it to read it		11	4.2	4.3	100.0
Total		258	99.6	100.0	
Missing	8	1	.4		
Total		259	100.0		

Table 6
How often do students check email messages and updates on social networks

		Frequency	Percent	Valid percent	Cumulative percent
	Two or three times a day	118	45.6	45.7	45.7
	Once a day	78	30.1	30.2	76.0
	Once a week	14	5.4	5.4	81.4
	Any time I get a notification	46	17.8	17.8	99.2
	Rarely	2	.8	.8	100.0
	Total	258	99.6	100.0	
Missing	8	1	.4		
Total		259	100		

Survey Results that Disprove the Designation of ‘Digital Natives’

Prensky (2001b) states in his paper:

> Someone once suggested to me that kids should only be allowed to use computers in school that they have built themselves. It’s a brilliant idea that is very doable from the point of view of the students‟ capabilities. But who could teach it? (p. 4).

The results of this study do not support such enthusiasm or optimism. An overwhelming majority of the students who responded to this question answered in the negative. Two hundred and ten or more than eighty percent of the participants indicated that they do not know how to build a computer using parts. More than 60 percent of the participants also indicated that they did not always take their computers to school. Table 7 and Table 8 show details of this non-native behavior.

Table 7
Building a computer from parts

		Frequency	Percent	Valid percent	Cumulative percent
	Yes	47	18.1	18.3	18.3
	No	210	81.1	81.7	100.0
	Sub-Total	257	99.2	100.0	
Missing		2	.8		
Total		259	100.0		

Table 8
Taking a computer to school.

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Yes	99	38.2	38.2	38.2
	No	160	61.8	61.8	100.0
Total		259	100	100.0	

Prensky(2001a) also stated that "Our students today are all "native speakers" of the digital language of computers, video games and the Internet" (p. 1). Based on this statement it is reasonable to expect that digital natives should prefer to read books online. However, results of this study shows that more than 90 percent of the respondents reported that they do not own a "Kindle or other e-book reader." Equally interesting is the fact that more than eighty percent of the respondents chose the "printed book" over an "electronic book," or "Book published in the form of web pages" in response to the survey question "If a class textbook is published in different formats and all formats cost the same, which format would you prefer?" Table 9 contains this data.

Table 9
Preference for purchasing and reading a textbook

	Frequency	Percent	Valid percent	Cumulative percent
Hardcopy (printed book)	217	83.8	84.1	84.1
Electronic book	20	7.7	7.8	91.9
Doesn't matter	21	8.1	8.1	100.0
Sub-Total	258	99.6	100.0	
Missing	1	.4		
Total	259	100		

Table 10 shows participants' responses to a related question that asked them if they owned a Kindle or some other e-book reader.

Table10
Do you own a Kindle or other e-book reader?

	Frequency	Percent	Valid percent	Cumulative percent
No	243	93.8	93.8	93.8
Yes	16	6.2	6.2	100.0
Total	259	100.0		

If an overwhelming majority of modern digital students prefer to read printed textbooks as opposed to reading them in electronic format, then it makes sense to ask how they prefer to present their class assignments. Nearly seventy-five (193 students or 74.5%) indicated that they preferred to present their assignments face-to-face and not digitally, using tools of modern technology.

Table 11
Preference for presenting an assignment.

		Frequency	Percent	Valid percent	Cumulative percent
Face to face		193	74.5	75.4	75.4
Video (via YouTube)		14	5.4	5.5	80.9
Audiotape		3	1.2	1.2	82.0
Online (via a discussion forum, IR or chat)		46	17.8	18.0	100.0
Total		256	98.8	100.0	
Missing	9	1	.4		
Total		259	100		

According to Prensky (2001a) digital immigrants have 'accents'

> The importance of the distinction is this: As Digital Immigrants learn – like all immigrants, some better than others – to adapt to their environment, they always retain, to some degree, their "accent," that is, their foot in the past. The "digital immigrant accent" can be seen in such things as turning to the Internet for information second rather than first, or in reading the manual for a program rather than assuming that the program itself will teach us to use it. (p. 2)

Why would someone have turned to the Internet first in the year 2001? When Prensky (2001a; 2001b) wrote his papers, not all information that the average person or a researcher in a specialized field of study needed was available on the Internet. Due to copyright restrictions, or other considerations, much of the scholarly literature was still outside the purview of the Internet during the year 2001. Nor was the Internet as easy and friendly to use until after the visual interface of the Web became the dominant way of searching and viewing information on the Internet. The same people who, ten years ago would have turned to the Internet as second choice, now search the Internet first before searching elsewhere. Such behavior is dictated by availability of information, convenience, and ease of use.

The same argument can be used for “reading the manual for a program” (Prensky, 2001a, p.2). Programs that were designed, developed and marketed years ago are not as user friendly as more recent versions of the same software packages. Software packages of the past did not “teach” their users. It was usually the other way around. Users had to “learn” how to use software packages. Because online help was not as sophisticated as it is these days, users had to resort to reading manuals in the past, in spite of the fact that such manuals were very technical in nature and hard to read for the average users of the software. It may be true that more people could be using online help features to learn how to use software packages. But is such behavior out of choice or because printed manuals are not being shipped with software packages that can be downloaded using the Web?

Prensky (2001a) claims

> There are hundreds of examples of the digital immigrant accent. They include printing out your email (or having your secretary print it out for you – an even “thicker” accent); needing to print out a document written on the computer in order to edit it (rather than just editing on the screen); and bringing people physically into your office to see an interesting web site (rather than just sending them the URL (p. 2).

The person who prints out an email may be doing so to read it later when he or she is not connected to the Internet. Or it could be a matter of choice or preference. A person who asks a secretary to print out an email does not necessarily have a thicker accent. He or she may not have the time to log into a computer and an email account and to read it online. It also makes perfect sense to ask someone to come into your office to look at a web site together and exchange ideas and opinions about the content of the site face-to-face if the other person has an office in close proximity.

The authors of this paper think that what Prensky (2001a) calls an ‘accent’ is actually a matter of ‘choice’ or ‘preference,’ or ‘convenience.’ We would like to point out that people do things in certain ways because it is either convenient to do so or because for some reason or the other they prefer to do so. As noted earlier, an overwhelming majority of participants in this study reported that they preferred to buy printed textbooks. This is a choice, not an accent. Also, at least one of the authors of this paper viewed the results of the data analysis that was conducted for this study on a computer monitor for a few hours. Then he printed the results on paper and took them home to review them over the weekend. He printed out the results because it is very convenient and easy to jot down ideas on paper as they come to mind.

Conclusion

At the very outset it must be made very clear that the authors of this paper are not opposed to the use of technology to facilitate teaching and learning. They are very much interested in determining effective ways to use technology to improve teaching and learning in schools, colleges, universities, and other formal and informal educational settings. However, they are also concerned about using un-researched theories and designations to advocate and promote large scale educational reform.

Data from this study suggests that not all people use all the digital tools available in society. Large numbers of the general population as well as participants of this study do use social networking sites, and use them for many hours during any given week. However, over the course of time, preference for one networking site or service has given way to preference for another networking site or service. For example, a few years ago, MySpace.com used to be the most popular social networking site. At the time this paper is being written, Facebook.com is the most favored social networking site. Now Twitter, started as a micro-blogging site, is not slowly being transformed into a social networking site as well, and its popularity and usage are growing considerably. What tool or service is going to become the next king of social networking? Your guess is as good as ours.

Tools and services for social networking that are available to the general public come and go, and people do use them to meet their need to connect, communicate, network, and interact with each other, but they do not necessarily use such sites for purposes of learning content taught in educational settings.

Left to themselves, kids will play games for hours and hours, not just digital games. In many parts of the world, including some parts of the United States, kids have always played real games (as opposed to digital games) with other kids in their neighborhood. Parents have always had to ask kids to stop playing late in the evening so they can eat dinner or finish their school work and go to bed so they can get up early and go to school the next day.

The idea that there are digital natives and digital immigrants is yet to be proven by research. Other authors have also raised some doubts about the two designations (see for example Bennett, Maton, and Kervin, 2010; Brown, and Czerniewicz, 2010; and Salajan, Schonwetter, and Blaine, 2010). All educators should be wary of calls for educational reform that are not based in research, but on pure speculation. Yes, there are some aspects of the two designations that may hold true. Society has always recognized that some people tend to be more techno-savvy than others and that some use technological tools more obsessively and excessively than most others. Society has used terms such as “nerds,” and “geeks” to refer to such people. We therefore boldly propose that the designations of “Digital Nerds,” and Digital Normals” be used to replace the designations of “Digital Natives” and “Digital Immigrants.” We also conclude our paper by suggesting that, at this point in time, the types of educational reforms that Presnky (2001a and 2001b) advocates may be more suitable for the small proportion of ‘digital nerds’ rather than the larger proportion of ‘digital normals’ in modern society.

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Editor's Note: Marshall McLuhan's concept of tools as an extension of man's capabilities is illustrated by this research, where technology short-circuits a time consuming manual procedure and improves conceptual learning and problem solving.

The Effect of Technology on the Classroom Discourse in a College Introductory Course in Jordan

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Abstract

This present study investigated the extent to which classroom discourse was or was not influenced by the availability of a specific technology device, the graphing calculator. Classroom observations were conducted at a community college introductory mathematics course using the graphing calculator. Overall findings of data analysis of classroom observations revealed a different classroom discourse. The technology device (the graphing calculator) could be considered an important tool in the classroom that changed the classroom instruction from teacher-centered to student-centered. Also, the focus of classroom discourse shifted from procedural works associated with graphing functions by hand toward conceptual understanding of functions. Therefore, the class became more engaged in the problem-solving situation after the graphing calculator carried out the tedious and time-consuming manipulation of drawing functions associated with real-life problems. Classroom implications and suggestions for further research are included.

Keywords: Technology, graphing calculator, classroom discourse,

Introduction

Many researchers indicate that classroom instruction could be characterized as teacher-centered instruction (Bellon, Bellon and Blank, 1996; Cazden, 2001; Good and Brophy 2003; and Mesa, 2008). Within this context, the lecture style is used most of the time during the class period and teachers' talk mainly dominates students' talk with only short segments of the class period allotted for mutual discussions between teachers and their students.

Educational reform documents in the field of mathematics education, such as the Professional Standards for School Mathematics (NCTM, 1996) and Principles and Standards for School Mathematics (NCTM, 2000) call for constructivist learning environment that switches classroom discourse from teacher-centred instruction to student-centred learning. These documents indicate that the teacher's role in discourse should focus on posing questions, listening to students' thoughts, and asking students to justify their ideas orally and in writing. Whereas, the students' role should focus on raising questions to the teacher and to each others, stating justifications, and presenting solutions.

Qualitative methodology was used by mathematics education researchers such as (Ackles, Fuson, and Sherin, 2004; Marrongelle & Larsen, 2006; Knott, Srirman, & Jacob, 2008; Mesa, 2008) to provide insight regarding classroom discourse recommended by the above two NCTM documents. Overall findings indicate that this type of teaching significantly changed the classroom climate by making investigation time more available for the students with less focus on lecture time by teachers.

The present study, based on the NCTM (1996, 2000) documents, takes the position that the use of technology such as graphing calculators can be conceptualized as constructivist tools if they are used to encourage students to be active participants in building their mathematical understanding.

In this learning environment, the teacher presents problem situations and tasks to help students understand and discover mathematical concepts and to pose questions to the teacher and one another, make justifications, and present solutions. Instructors of mathematics courses at the college level and mathematics education researchers may benefit from findings of this study.

Methodology

Purposes of the Study

The overall purpose of this study was to gather information regarding classroom discourse associated with the use of graphing calculators. However, this information was not obtained by paper-and-pencil tests. Therefore, this study used qualitative methodology of data collection and analysis. The methodology was used to get in-depth information concerning the extent to which classroom discourse was or was not influenced by the availability of the graphing calculator.

Subjects and Procedures

The subjects participated in this study consisted of a group of students enrolled in an introductory mathematics course offered at a community college in Jordan. The sample size for the study consisted of 20 students taking the above mentioned course which was offered for non-math-major students. The instructor of this class first helped the students in how to use the TI-85 (Texas Instrument-85) graphing calculator. Students know that graphing calculators can help in graphing of functions and making this task easier. For example, with graphing calculators, students can produce a graph of a function by entering the scales of the axes and the rule of the function. Then, the students may change the axes scales until they are able to see the graph on the screen. By using the "zooming in" facility, the students can view smaller parts of the graph. In this study, the students started using this calculator to set up a graph of a given function, glean information from the graph, and use this graph to solve real-life problems.

The students met for fifty-minute sessions three times a week for one whole semester. The instructor observed the classroom discourse on this research site over six different days, with each session lasting the whole classroom period. Observations were made by the instructor as a participant observer in which he was a part of the interaction of the classroom discourse. Also, over the course of the study, the whole classroom sessions were video taped in order to capture the classroom discourse and interaction between the students themselves and with the instructor.

Limitations of the study

Before the study started, the instructor and the students who voluntary participated in this study were trained on the operations and functions of the TI-85 graphing calculator; therefore, the generalizations of the results of this study are limited to this specific technology device. Moreover, the students who participated in this study were from the College of Educational Sciences pursing their education to get a degree in the field of classroom teacher specialization. Therefore, their knowledge about and usage of graphing calculators was not as good as students in the Math Departments.

Open Coding and Data Analysis

Initial coding of data was done after transcribing the video-taped observations. The transcription process involved several writing remarks about the overall information of the observations in addition to the notes that the researchers made during observations. A second round of coding was done to look for emerging themes and evidence regarding the extent to which classroom discourse was or was not influenced by the availability of the graphing calculator.

To address this issue, and based on the emergent themes across settings of classroom observations, the following three analytical questions that served to guide the analysis were used:

1. Is there a pattern of classroom discourse taking place in a college introductory graphing calculator mathematics course?
2. How does the class of the college introductory mathematics course use the graphing calculator to study mathematical concepts?
3. How does the class of the college introductory mathematics course use the graphing calculator to solve real-life problems?

Credibility Issues of Results

According to Rubin and Rubin (2004), "Most indicators of validity and reliability do not fit qualitative research. Trying to apply these indicators to qualitative work distracts more than it clarifies. Instead, researchers judge the credibility of qualitative work by its transparency, consistency-coherence, and communicability" (p.85).

The three phases of credibility as defined by Rubin and Rubin (2004) are considered satisfactory for the report of the qualitative data of this study. In the first phase of credibility, transparent reports allow readers to see the procedures of data collection and analysis. In the present study, the researchers described the purpose of the study, the sampling techniques, the observation sessions, and the data analysis. The researchers did not go beyond this data when writing up their report. This report includes examples from classroom discussions to support the conclusions made.

The second phase of credibility considers coherence across observation sessions. The main themes that emerged from the data regarding the extent to which classroom discourse was influenced by the availability of the graphing calculator were found consistent across sessions.

In the third phase of credibility, increasing communicability within the participants, the observations were made in actual classroom settings where the instructor and the students used graphing calculators as a part of the course requirements. Therefore, the instructor and the students had, as Rubin and Rubin (2004) stated "firsthand experiences, rather than informants acting on the experience of others" (p. 91).

Results of Data Analysis

Regarding the first research question "Is there a pattern of classroom discourse taking place in a college introductory graphing calculator mathematics course?", overall findings of data analysis uncovered that the majority of classroom discourse was embedded within the three-part sequence of classroom discourse (Cazden, 2001). This sequence was as follows: teacher's initiation of classroom discourse by posing a question, students' responses to this question, and teacher's reaction to students' responses (IRE pattern). The teacher's questions (the first sequence of the classroom discourse) positively effected the students' interaction in the discourse. Some of these questions were used by the teacher to initiate a classroom discussion between the teacher and the students. For example, in one situation the teacher started by reading the problem, then he asked the question: "What are we combining here ….. to get what?" The question from the teacher, followed by the answer from a student: "We are combining five percents with twenty percents to get ten percents", opened the door for successful classroom discussions that helped students solve the problem. A second type of teacher's question was used to introduce new mathematical concepts, or to resolve students' mathematical misconceptions. For example, Table 1 gives transcripts of selected segments of teaching horizontal shifting. The transcripts show how the sequence of questions posed by the teacher introduces the concept of horizontal shifting.

The second sequence of the classroom discourse is students' answers to the teacher's questions. The teacher did not call on students to respond to his questions. Instead, the teacher asked for volunteers. As a result, students became actively and intellectually engaged in the discussion.

Students were given a wait time to respond. Each time, the volunteer student paused before responding to the teacher's questions. Table (1) shows that the wait times were usually followed by correct responses from the volunteer student.

Table 1
Transcripts of Selected Segments of Teaching Horizontal Shifting.

The Teacher's Initiation (I)	The Students' Responses (R)	The Teacher's Reaction (E)
What happens to Y1 when we add three to ex?	(Pause)The graph is shifted to the left three units	What happens to Y1 when we subtract three units from ex?
	(Pause)The graph is shifted to the right three units	What do we call this type of shifting?
	(Pause) We call it horizontal shifting because it shifts Y1 three units in the horizontal direction	

The third sequence of the classroom discourse is the teacher's reaction to students' answers. For most of the class period, the teacher reacted to the students' answers by posing other questions. These questions were used effectively by the teacher to guide the students toward understanding the mathematical concepts or resolving their mathematical misconceptions.

In one case, the teacher discovered that the students were misled by using the visual representation of functions. The teacher and students solved the problem analytically to verify whether the function $Y = X^4 + X^3 + 3$ is odd, even, or neither, and said "The calculator here is a tool to show, not to verify".

From the data analysis of classroom discourse, one came to realize that the lecture's pattern did not dominate the class that used the graphing calculator and the teacher's talk did not dominate the students' talk.

In order to investigate the source of classroom discussions between the teacher and students in this research site, the researchers visited another section which studies the same course without using the graphing calculator. In that classroom, the teacher was talking most of class period while the students were taking notes. The following paragraph represents segments of classroom talk in this course. The teacher introduced the concept of graphing functions by talking to the students while writing on the board:

> "We are going to approach graphing by learning various basic shapes ..... Some of the basic shapes are:
>
> Lines / X and Y both have power 1.
>
> Parabolas / One variable has power 2, and the other has power 1.
>
> Cubic/ One variable has power 3, and the other has power 1.
>
> Circles / both variables have power 2.
>
> Once you recognize the basic shape of the graph of a function, you can obtain detailed information about it. For instance, you can find X- and Y-intercepts."

Despite the fact that the research interest lies only in classroom discourse in a graphing calculator college introductory mathematics course, the information that was collected from the research site could help to reach the conclusion that the graphing calculator was an important agent in creating a departure from teacher-centered instruction to student-centered instruction.

Regarding the second analytical research question "How does the class of the college introductory mathematics course use the graphing calculator to study mathematical concepts?", the analysis of observations data indicated that the graphing calculators were used to display graphs by entering the scales of the axes and the rule of a function. Students may change the scales until they are able to see the graph on the screen. Then, by using the "zoom in" facility, the students were able to view smaller parts of the graph. These features of the graphing calculator were used effectively to study different functional concepts, such as even and odd functions, symmetric functions, and vertical and horizontal shifts of graphs of given functions.

In one situation, the teacher gave different examples to introduce the concepts of vertical and horizontal shifts. For example, in teaching horizontal shifting, the teacher and the students used their graphing calculators to graph the following three graphs on the same coordinates: $Y_1 = X^2$, $Y_2 = (X + 3)^2$, and $Y_3 = (X - 3)^2$.

The teacher moved around in the classroom to check students' graphs and help anyone who needed it to set up his or her calculator to graph these functions. In addition, the teacher's graphs of these functions could be seen clearly on the overhead projector.

> T: What happens to Y_1 when we add three to X?
>
> S1: (Pause) The graph is shifted to the left three units.
>
> T: What happens to Y_1 when we subtract three from X?
>
> S2: (Pause) The graph is shifted to the right three units.
>
> T: What we call this type of shifting?
>
> S3: (Pause) We call it horizontal shifting because it shifts Y_1 three units in the horizontal direction.

An interesting issue raised by the teacher about the reasoning behind the horizontal shifts was "Why does the function shift to the left when we add a number to X, and to the right when we subtract a number from X?" This part of the classroom discourse could help to see the benefit of using graphing calculators to resolve students' misconceptions about the horizontal shifting. This misconception is embedded in students' beliefs that the function would be shifted to the right when one adds a number to X and to the left when one subtracts a number from X.

The results of this study showed that the effective use of graphing calculators requires a solid understanding of the mathematical concepts involved. Otherwise, visual representation of the graph of a given function generated by the graphing calculators becomes misleading. Therefore, the instructors who teach functions by the use of graphing calculators should be aware of this issue. In this situation, the instructor introduced the concepts of even and odd functions as follows: First, the teacher and the students graphed $f(X) = X^2$ as an example of an even function. This function is called an even function because its graph is symmetric with respect to the y-axis, and satisfies the condition: $f(-X) = f(X)$. For example, $f(-2) = f(2) = 4$.

Second, the teacher and the students graphed $f(X) = X^3$ as an example of an odd function. This function is called an odd function because its graph is symmetric with respect to the origin, and satisfies the condition: $f(-X) = - f(X)$. For example, $f(-2) = -8$, but $f(2) = 8$. Therefore $f(-2) = -f(2)$.

Also, among the questions that the teacher asked was whether the function $f(X)= X^4 + X^3 -2$ is even, odd, or neither. The teacher and the students used their graphing calculators to graph this function. The teacher said: Now, is this function even, odd, or neither? Some students said it was even, others said it was odd, others said it was neither. The teacher, therefore, found that it was time to tell the students the importance of solving this problem analytically and not to rely on the visual representation of the function only. The teacher, thus, told the class “the calculator in this case is a tool to show, not to verify” and then he discussed the analytical solution of this problem with the students.

Finally, regarding the third research question, “How does the class of the college introductory mathematics course use the graphing calculator to solve real-life problems?”. The analysis of observations data indicated that the features of the graphing calculator were used effectively by the class in solving real-life problems; the teacher provided the students with real-life problems and encouraged them to solve such problems using their calculators.

In one situation, one could enjoy listening to the teacher and the students discussion while solving the following real-life problem, “Book Value Problem”:

A photocopying machine was sold for $3,000 dollars in 1988 when it was purchased. Its value in 1996 had decreased to $600.

1. If X = 0 represents 1988, X = 8 represents 1996. Express the value of the machine y, as a function of the number of years from 1988.
2. Graph the function for part (a) in a window [0,10] by [0,400]. How would you interpret the y-intercept in terms of this particular problem situation?
3. Use your calculator to determine the value of the machine in 1992 and verify this analytically.

After posing the problem, the teacher asked how many of the students were majoring in business. Three of the twenty students raised their hands, which pleased the teacher because this type of problem is important to them; it introduces what is called book value in the field of business. The teacher states that BV (bookvalue) = mX + b, and asked “what is m and what is b? One student indicated that m is the slope, and b is the y-intercept.”

T: What is the book value when X equals zero years?

S1: (Pause) Three thousand dollars.

T: What is the book value when X equals eight years?

S2: (Pause) Six hundred dollars.

T: I want you to find the slope.

One student talked and the teacher wrote the following on the board:

m = (3000-600)/(-8) = -300.

T: What does it mean to have a negative slope?

S3: (Pause) The value of the machine decreases its value three hundred dollars each year.

T: How can we find the y intercept?

S4: (Pause): If we plug in X equals zero in the book value equation, we get b equals three thousand, which is the y intercept.

T: What does that mean?

Nobody answered!

T: This is the original price of the machine.

T: Now, what is the book value function?

S5: (Pause) Y = minus three hundred X plus three thousand.
the teacher wrote the following formula on the board:

The teacher wrote "-300X + 3000".

Now, the teacher and the students were ready to graph the book value function. Therefore, they used the information in the problem to set up their calculators as follows:

Y_1 = - 300X + 3000

X min. = 0. (The minimum value on the X-axis).

X max. = 10. (The maximum value on the X-axis).

X scl. = 1. (The distance between 0 and 10 is divided into tick points with a length of 1 unit each).

Y min. = 10. (The minimum value on Y-axis is 10).

Y max. = 4000. (The maximum value on Y-axis is 4000).

Y scl. = 100. (The distance between 10 and 4,000 is divided into tick points with a length of 100 units each).

T: How would you interpret the y intercept?

S6: (Pause) The original cost, which is three thousands.

T: What does the X intercept mean?

S7: (Pause) X intercept means how old the machine is when it is worth zero dollars.

T: How can we determine the book value of the machine in nineteen ninety-two?

All Students and the teacher used their graphing calculators to find the value of y when X = 4, and they got the result y = $1,800.

T: What does this mean?

S8: (Pause) It is four years old when its worth is eighteen hundred dollars.

T: How can we verify this analytically?

S9: (Pause) We can use the book value formula and plug in X equals four to get y "equals minus three hundred times 4 plus three thousand".

The teacher wrote the following on the board:

y = - 300 (4) + 3000 = 1800.

T: Now, we get the same result graphically and analytically.

From the above mentioned real-life situation, one could understand the importance of solving the problems analytically and supporting the solution graphically.

Discussions of Findings and Conclusions

This study was conducted to gather information regarding classroom discourse associated with the use of graphing calculators. Overall findings of data analysis of classroom observation revealed a different classroom discourse. The graphing calculator could be considered an important agent in creating a departure from teacher-centered instruction to student-centered. Three possible reasons could be given as evidences to support this conclusion: First, the teacher's role shifted from producing a graph of a given function to questions of what the graph is saying about. Also, the students' role shifted from plotting of points and drawing a graph of a given function to gleaning information from the graph. As a result, neither the lecture's pattern dominated the climate of the class that used the graphing calculator nor the teacher's talk dominated the students' talk. This result is consistent with findings of other research conducted by Wheatley (1994), Yates (1995), Wood (1999), Herbst (2002), Ackles, Fuson, and Sherin, 2004, Marrongelle and Larsen (2006), and Mesa (2008) in which they indicated that the constructivist learning environment could help students to become more engaged in classroom discussions.

Second, the graphing calculator provided students with graphical representations of functions freeing them from burden of plotting and drawing functions; thus, providing them with more time to focus on conceptual understanding of function. As a result, the focus was shifted from procedural works associated with graphing functions by hand toward conceptual understanding of functions and study important features of functions such as vertical and horizontal shifting of functions and whether the function is odd, even, or neither. This finding is consistent with findings of other research such as Shore (1999), Knott, Srirman, & Jacob (2008), and Mesa (2008) which indicted that teaching functions with graphing calculators offers teachers and students opportunities to shift the emphasis away from procedural-oriented toward conceptual-oriented.

Third, accurate graphs obtained quickly with the graphing calculator help the teacher and students to focus on problem-solving processes. As a result, students become more engaged in the problem-solving situations until the solution of the problem is reached after the calculator carries out the tedious and time-consuming manipulation of plotting points and drawing functions associated with real-life situations. This finding is consistent with findings of other research such as Dunham and Dick (1994), Wheately (1994), Yates (1995), Shore (1999), and Mesa (2008) which raveled that teaching functions with graphing calculators offers teachers and students more time to focus on problem-solving processes.

Classroom Implications and Suggestions for Further Research

Based on the results of this study and the discussions made, many classroom implications and suggestions for further research could be made. Some of these are:

1. The instructional strategy associated with the use graphing calculators in an introductory college mathematics was successful in helping students to be actively involved in their learning of mathematics. Therefore, instructors of mathematics at a college level are encouraged to create a constructivist learning environment through the use of graphing calculators.
2. The analysis of classroom observations revealed that instructional strategy in the graphing calculator class may help students to become more engaged in classroom discourse as compared with instructional strategy in the non-graphing calculator class. But studying the differences between the two groups with instructional strategy as a variable was beyond the scope of the present study and could be appropriate for further research.
3. As the results of the study showed that there was an effect for the technology (graphing calculator) on the classroom discourse in a college introductory course for non-math-major students, it would be appropriate for other researchers to replicate the study on math-major students and non-math-major students in other colleges and universities of the country in order to find out whether similar or different results might be revealed.

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Editor's Note: Computer technologies have the ability to emulate almost any environment. It is not surprising that for distance learning we simulate the familiar aspects of the classroom for presentations and discussions. Of course, the computer can enhance what we do in regular classrooms by adding additional communication channels (chat and video) and the ability to download files, share screens and keyboard controls, and access other internet resources. What used to require an expensive studio and team of technicians can now be accomplished from your home or office computer.

Challenges in Synchronous Virtual Classrooms Adoption by Faculty

Chandra Roughton, Florence Martin, Jennifer Warren, Courtney Gritmon
USA

Introduction

There has been a major transformation in education especially with technological advancement. The breakthrough of the internet and other new technologies has forced traditional colleges and universities to employ alternative methods of instructional delivery. Conventional ways that instructors teach and students learn continue to be impacted by innovative strategies. One delivery method that is becoming popular is synchronous virtual classrooms. This study investigates why so few faculty members at a southeastern university in the United States use the synchronous virtual classroom, specifically Horizon Wimba, to teach their online classes.

Online Education

Online education can be defined as an approach to teaching and learning that utilizes Internet technologies to communicate and collaborate in an educational context (Blackboard Inc, 2000). Online education has become increasingly more popular due to its flexible access to content from any place at any time. Different technology applications are used to support different models of online learning. Asynchronous communication tools (e.g, e-mail, threaded discussion boards, newsgroups) allow users to participate in an online course at their convenience. They can participate at any time and from any place. Synchronous technologies (e.g. webcasting, chat rooms, desktop audio/video technology) allow the instructors to maintain the synchronous interaction in their online courses. Students are expected to login at the same time but can participate from any place (Means, Toyama, Murphy, Bakia and Jones, 2010).

Students seeking to take online classes or earn a degree online may do so for several reasons. For students with jobs and families, time is a factor. Online courses offer adult learners the opportunity to further their education and to acquire relevant job skills without having to spend time traveling to a campus or to a workshop site. The flexibility of many online courses also allows students to take control of their learning by working it into their busy schedules when it is convenient. Online courses are often less expensive than face to face courses, so the financial aspect of distance learning is attractive to students, because they not only save on fees and tuition but they also save on expenses like transportation and housing.

Blackboard Inc. (2000) listed the following as some of the educational advantages of supplementing a course with web-based tools.

- Enhancing student-to-student and faculty-to-student communication.
- Enabling student-centered teaching approaches.
- Providing 24/7 accessibility to course materials.
- Providing just-in-time methods to assess and evaluate student progress.
- Reducing administration around course management.

Online education opens a lot of doors for students who reside in rural regions or whose local universities and colleges do not offer courses that they are interested in. For some, fully online programs are the only way that they can take the classes that are required for a certain degree or enter a program that they desire.

What are Virtual Classrooms?

Virtual classrooms allow instructors and students to interact online synchronously. Most virtual classrooms support audio, video, application sharing, and content display. They enable instructors to add vitally important interactive elements such as text chat, audio chat, and instant polling that simply cannot be provided in an asynchronous course. The best elements of synchronous online instruction is that faculty and students can talk to each other, express emotion, participate in group activities in the break out rooms, and feel that they can still interact as if they were face to face. Some of the common virtual classrooms available in the market today are Elluminate, Adobe Connec, Webex, and Horizon Wimba.

Horizon Wimba, commonly known as Wimba, is the synchronous tool that the university where this study is conducted would like utilized more efficiently and effectively. Wimba online classroom utilizes instant messaging, file sharing, streamline video, breakout classrooms where students can work within groups even though they are not physically sitting in the same classroom, etc. (Wimba, 2009b). According to the website, Wimba Classroom is the "cornerstone of the Wimba Collaboration Suite, [it] is a live, virtual classroom environment with robust features that includes audio, video, application sharing and content display, polling, whiteboarding, presenter on-the-fly, resizable chat areas and participant lists, usage analytics tools, and now both MP3 and MP4" (Wimba, 2009a). Between the two Wimba products, a professor can do just about anything in the virtual classroom that can be done in a regular classroom.

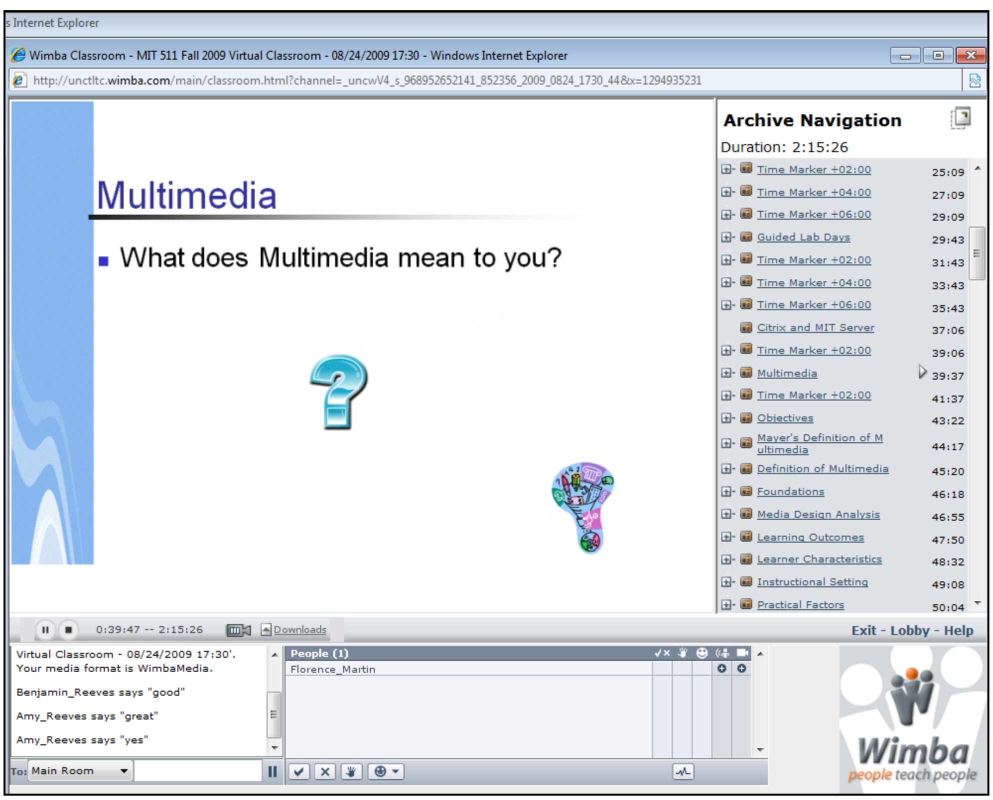

Figure 1. Screenshot of the archive of the Horizon Wimba Virtual Classroom

Importance of Synchronous Communication

Researchers have explored on the importance of synchronous communication. Kock's (2005) media naturalness hypothesis predicts that synchronous communication increases psychological arousal with the ability to convey and observe facial expressions and body language. Robert and Dennis's (2005) cognitive model of media choice predicts that synchronous communication increases motivation. Hrastinski's (2008) interviews revealed that many e-learners felt that synchronous communication was "more like talking" when compared to asynchronous communication. It appeared more acceptable to exchange social support and discuss less "complex" issues.

Motteram (2001) argues that synchronous tools are more effective for the 'social' side of education and that asynchronous tools are better at dealing with the 'academic' aspects of the course. Cao, Griffin and Bai (2009) suggest that improving student satisfaction with synchronous interactions will effectively raise overall student satisfaction with course Web sites. Computer-aided instruction that is exclusively asynchronous cannot possibly convey any kind of immediacy. Many students will lose the intellectual thread and the urge to follow the information exchange if it takes days or even hours for students to get a response to a question (Haefner, 2000).

Collis (1996) identified four significant advantages of synchronous over asynchronous systems:

- Motivation - synchronous systems focus the energy of the group
- Telepresence - real time interaction builds a sense of social presence and involvement and helps to develop group cohesion
- Feedback - synchronous systems provide quick feedback on ideas and support consensus and decision making
- Pacing - synchronous events encourage people to keep up-to-date and provide a discipline to learning which helps people to prioritize their studies

Corbeill (2006) added two additional advantages to the list.

- Spontaneity - synchronous events make it easy to add new ideas to the conversation, brainstorming or decision making is well supported.
- Familiarity - synchronous systems can simulate a more traditional environment.

Thus synchronous technologies are important for online education.

Online Courses at the Southeastern University

This southeastern university began offering online courses in 1998. Currently, the professors who opt to teach these courses have a variety of resources to choose from including asynchronous tools such as Blackboard Learning System, faculty websites, and Taskstream; in addition, the synchronous systems of Horizon Wimba and Second Life are also available to instructors. The most commonly used asynchronous system is the Blackboard Learning System. An online course shell is created for every class, whether it is face-to-face, online, or a hybrid class. It is up to the professor's discretion whether s/he uses that resource. The faculty websites are used mostly for information regarding the classes including class descriptions, syllabi, and schedules.

Table 1 below shows the total number of classes as well as the number of online classes offered by the university during the Spring/Summer of 2010. Approximately 6.8% of all spring classes and 10.9% of all summer classes were offered as online courses. These numbers limit the number of faculty members who would require the use of synchronous tools to teach their students in an online classroom environment.

Table 1
Classes offered in Spring/Summer 2010

Undergraduate and Graduate courses	Spring 2010	Summer I and II 2010
All courses	3,624	1,533
Online courses	245	167

Purpose

The purpose of this research is to determine why so few faculty members at the university use synchronous tools, specifically Horizon Wimba (Wimba) to teach their online classes. Specifically, this study answers the following questions.

1. What are the main reasons why faculty do not use synchronous tools?
2. Would the faculty be willing to adopt synchronous tools in the future?

Method

Instrument

A survey was distributed to all instructors who taught online in the Spring 2010 or Summer I and II 2010 semesters at this university. Using Survey Monkey, a web-based survey application, participants were asked questions regarding their attitude towards and experience with synchronous tools. The survey was sent through the universities' email system as a link. Survey Monkey's simple template and immediate reporting allowed for immediate feedback and prompt analysis of the survey results.

Participants

The participants who responded to the survey were from various disciplines at this southeastern university, including but not limited to chemistry, physics, sociology, criminology, anthropology, communications, environmental studies, and foreign languages. The respondents were all instructors who taught an online class in either the Spring 2010 or Summer I and II 2010 semesters. The participants were selected based on a list generated by the registrar's office. The participants had varying degrees of online teaching experience; while some instructors only taught one online course, there were 10 respondents who indicated they taught three or more online courses in their disciplines. Of the 149 professors surveyed a total of 53 responded (35% response rate) to the questionnaire.

Results

Reasons for not using Wimba

A total of 39 responses were received to the question on the survey which focused on why faculty do not use synchronous tools.

Upon completion of the analysis it is evident that there are several reasons as to why faculty are reluctant to use synchronous tools in their online courses. However, survey results demonstrate overwhelmingly that professors do not use it mainly because of its lack of flexibility. When asked why they did not use synchronous tools in their online instruction, out of the 39 individuals who responded to the question, 19 indicated that they did not use Wimba, because they believe students prefer asynchronous online classes. The professors stated that the reason students sign up for an online course is because they have jobs and family obligations and they like choosing when and where they complete their work. In addition, some students live in different time zones and some students are service members who are on deployment overseas, so participating in a synchronous class would be impossible for many students.

Table 2
Reasons for instructors not using synchronous tools.

Reason	# of respondents
Lack of flexibility for the student. The instructor believes that students prefer asynchronous courses to synchronous courses, because they want to learn when and where they choose.	17
Instructors' lack of knowledge in how to use the tool and frustration with the complexity and time commitment in learning how to use it.	16
Believes that synchronous classes are not necessary to teach the required content.	5
The instructor has a personal preference for teaching online courses asynchronously.	4
Technology issues for both students and instructors.	4

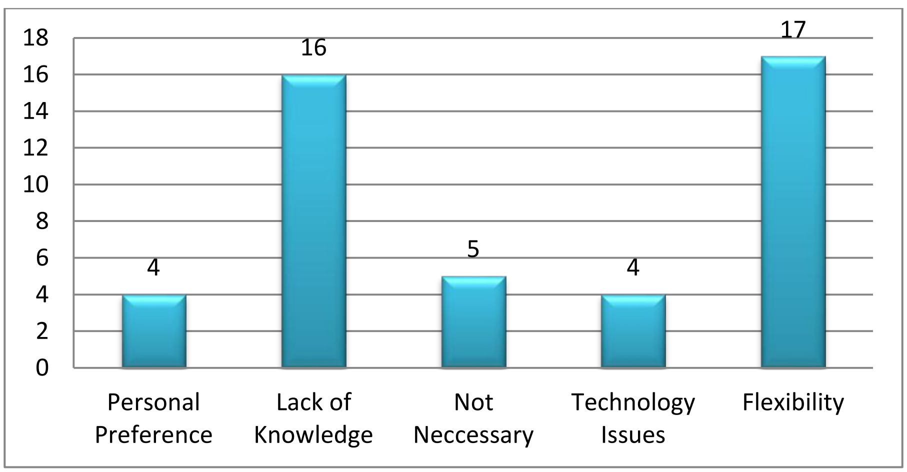

Figure 2: Reasons for not using Synchronous tools.

The second reason professors identified that they are not using synchronous tools is because they are not comfortable with the technology and feel that they lack the necessary training to conduct synchronous classes. Wimba is integrated into the Blackboard system and requires all participants to have at least a microphone/headset, but preferably a webcam, as well. Instructors expressed frustration in not only learning how to use the tools, but also in managing a class discussion synchronously. They also question whether or not their students are comfortable using the technology themselves. Some feel that synchronous interaction hinders communication and makes discussions less compelling. Furthermore, they feel that students are more comfortable with asynchronous methods, because they are used to communicating in social networking environments such as Face Book.

The third reason instructors indicated that they did not use synchronous tools is because they felt that synchronous meetings were not necessary to teach the required content of their courses.

The survey results also revealed that there is no motivation or incentive for professors to use synchronous tools or to take the time to learn to use them. However, instructors feel most encouraged by their colleagues, their department leaders, and the Office of e-Learning, to use synchronous tools. Some professors feel that there are more important professional matters that need immediate attention. For example, one professor said: "If it doesn't count for RPT, it doesn't exist. I'm hearing in my RPT committee work that only research publications matter now."

Willingness to use Synchronous Tools

There was another question on the survey that focused on the respondents' willingness to use Wimba for synchronous classes in the future if they were not currently doing so. A total of 20 respondents answered the question. The main reason instructors are reluctant to adopt synchronous tools, such as Wimba, in the future is due to their own lack of knowledge in how to use the tool and in how to use the tool effectively in their classroom.

Table 3
Willingness to use synchronous tools.

Willingness	# of respondents
If you are not using Wimba for synchronous meetings now, would you be willing to adopt it in the future?	20
Instructor's lack of knowledge about how to use the tool and how the tool would be useful in the classroom.	7
No time to learn a new tool.	5
Believe that asynchronous is better, because students want to attend class on their own time.	3
Not necessary to teach required content.	2
Other	2
Lack of students' skills and knowledge to use the tool.	1

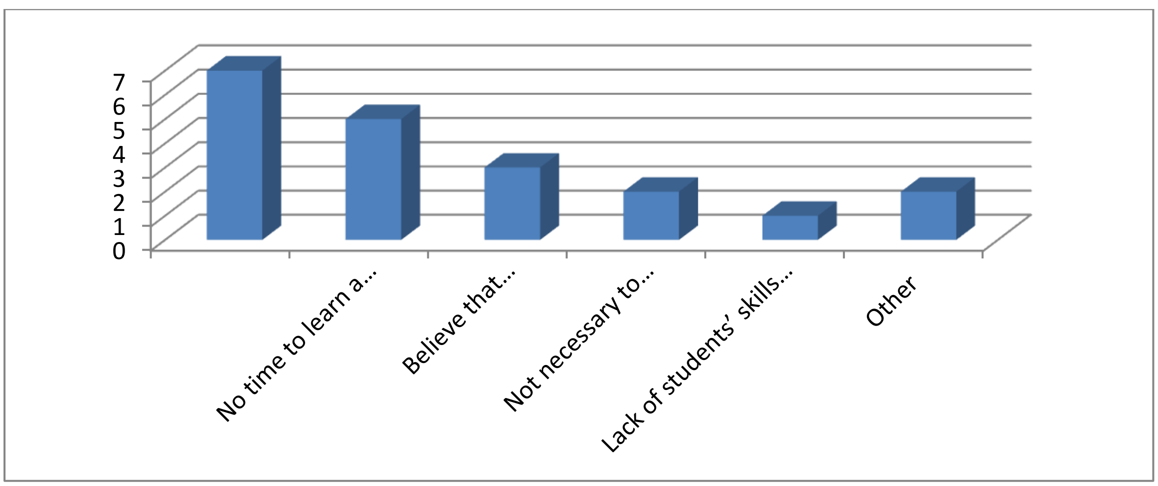

Figure 3. Willingness to adopt Wimba in the future but reluctant now

Upon completion of the analysis, instructors indicated that they are not willing to adopt Wimba as a synchronous tool, because they feel that they lack the overall knowledge not only to use the tool, but also to use the tool effectively in an online course. The tool is viewed as being difficult to learn and difficult to use on a regular basis, presenting technology issues for both students and instructors. The second reason instructors indicated that they were not willing to adopt the tool was because they felt that with other responsibilities there was simply not enough time to learn how to use a new technology tool. Lesson planning, publications, service, and committee work were cited as higher priorities.

Discussion

Reasons for not using Wimba

There were three main reasons why instructors at this southeastern university do not use synchronous tools, such as Wimba, in their online courses: synchronous meetings lack the flexibility that attracts students who want to attend class on their own time; instructors lack the skills and knowledge to use synchronous tools; and synchronous meetings are not necessary in order to teach the content required in the course.

Flexibility

The lack of flexibility is the most difficult of the three causes to address with interventions. Online instructors who choose to teach synchronously will experience a decrease of flexibility in their schedules. However, assuming that there are instructors who have schedules that would accommodate this situation, there are interventions that could increase the number of instructors who use synchronous tools to deliver their online classes.

Instructors' attitude and aptitude towards technology and synchronous teaching have an impact on whether they chose to teach synchronously and therefore should be considered in the application process and included in the job description and specification. The Office of e-Learning should have an integral hand in staffing the right instructors for the job, keeping in mind the lack of flexibility that they will face.

To increase their ability to address the performance gap, the Office of e-Learning will need to document and preserve data in regards to online instructors, their use of synchronous tools, and the impact that synchronous teaching has on learning. This information will be valuable when trying to inform and persuade instructors that synchronous tools, such as Wimba, are worth the extra time constraints.

Knowledge

Some instructors are not using synchronous tools because they do not know how or because they are intimidated by the cumbersome technical issues that may arise. The Office of e-Learning can empower instructors to use synchronous tools through activities such as: interactive training, collaboration, scheduled practice, job-aids, and suggestions.

A significant amount of online instructors have reported attending training on Wimba but still feel uncomfortable using the tool. It is essential that instructors attend training for Wimba that is interactive, just-in-time, and supplemented by electronic or print job-aids. The Office of e-Learning should continue to encourage continuous growth and development for instructors and should require that instructors follow up training with feedback and suggestions.

To maximize the impact that the Office of e-Learning has on novice users, they should encourage the sharing of knowledge amongst instructors and across departments. The Office of e-Learning can look to the School of Nursing and the School of Education for expert Wimba users and utilize their expertise. Creating a network of experts and learners will increase the amount of instructors that use synchronous tools.

Content

The third reason instructors indicated that they did not use synchronous tools is because they felt that synchronous meetings were not necessary to teach the required content of their courses. Depending on the various subjects that the instructors taught, some instructors thought that synchronous meetings were not needed for their particular subject area.

Instructors willingness to adopt Wimba as a synchronous tool

There are three main reasons why instructor's indicated that they are not willing to adopt Wimba as a synchronous tool.

Using the tool

The first reason is because they feel that they lack the overall knowledge not only to use the tool, but also how to use the tool effectively in an online course. The tool is viewed as being difficult to learn and difficult to use on a regular basis, presenting technology issues for both students and instructors.

Most of these synchronous tools have a number of features which can be beneficial if mastered well. It is challenging at times for instructors to learn all the different features of the tool so that it can be used successfully in their courses.

Lack of time

The second reason instructors indicated that they were not willing to adopt the tool was because they felt that with other responsibilities there was simply not enough time to learn how to use a new technology tool, especially one that is already perceived as being difficult and complex. Lesson planning, publications, service, and committee work were cited as higher priorities.

Faculty are on a busy schedule all through the year, and taking time from teaching, research or service is not possible. They need to somehow make time in order to learn to use the tool successfully. If the department or the university offers incentives for them to learn the tool, that might be a motivation for them to make the required time.

Prefer Asynchronous Technologies

The third reason instructors indicated that they were reluctant to adopt Wimba in the future is because they believe that asynchronous online learning is more preferable to students because of its flexibility.

In the case of synchronous tools, online instructors may need additional encouragement and motivation in order to adopt synchronous tools such as Wimba. Instructors can be energized and guided by mentoring, coaching, and incentives. Getting department leaders and expert Wimba users involved in the performance improvement will increase the impact and scope of the desired performance improvement. Through mentoring programs or coaching sessions, instructors will have the advice, knowledge, and support needed to confidently conquer synchronous tools. Leaders outside of the Office of e-Learning department will be a useful resource and an undeniable asset during implementation. Creating a social network of Wimba users on campus will foster an environment of collaborative learning and information sharing.

Implications and Recommendations

In order to enable professors to effectively teach synchronous online courses, it is important to have open communication between the professors and the Office of e-Learning to show there is support within the university that can be utilized to develop synchronous online classes. By including the professors in the implementation process, they will have a voice in the who, what, when, where, why, and how questions regarding synchronous learning. It will also form an interuniversity network of professionals who all understand the shared goals of the Office of e-Learning and the university related to synchronous learning.

In addition to communication, there should be adequate employee development available to the professors who teach synchronous classes. Some examples of these would include training (possibly in addition to the training already available), job aids, tutorials on the Office of e-Learning webpage, mentoring and coaching. By communicating that there are several resources to help with synchronous classes, more professors may follow in the footsteps of 21st Century learners and utilize the phenomenal resources that are available to them.

Lastly, it is important for Office of e-Learning to establish clearly defined and understandable policies, procedures, and guidelines for online instruction with regards to synchronous tools. This will prevent any need for interpretation as to who should be conducting synchronous online classes and how these classes should be developed. The Office of e-Learning needs to complete their website with all of the necessary forms and instructions needed in order to have the developed synchronous online course reviewed and approved by the appropriate committee. By making this process easier and more understandable, more professors may see the appeal to teaching their courses synchronously.

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