A Model-Based Investigation of Learner Attitude towards Recently Introduced Classroom Technology

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Executive Summary

The major aim of this study was to uncover the influence of recently introduced classroom technology on a student's learning attitude. Research was conducted in a Gulf Cooperation Council (GCC) region university where classroom technology was being implemented for the first time. Hence specific attention was being given to the careful management of this educational innovation. The study was a part of this initiative where emphases were on relevance and appropriateness of technology to set-up and create user-driven learning and teaching environment.

The antecedents that were considered relevant in the early implementation phase (taken as first year of classroom technology implementation) were experience with Information and Communication Technologies (ICTs), enhanced communications, learner independence, and ease of technology use. The selected antecedents were socially, culturally, and educationally suitable as they were extracted from the students themselves by involving them in exploratory research. The original concept for this research was derived from the Technology Acceptance Model (TAM) which has been a source of numerous studies exploring user attitude towards technology.

In general, data analysis involved descriptive (to include mean and standard deviation) and reliability analysis (based on Cronbach's α). This was followed by bivariate correlation giving evidence of discriminant validity. As all the items were developed by the authors, exploratory factor analysis was conducted to establish their fitness for research use. Finally multiple regression analysis was carried out to test the modular pathways.

The study outcome implied that use of classroom technologies, in the introduction stage, does increase with the degree of perceived and encountered ease of use and extended capacity for self-directed learning by utilizing channels that enhance communication and information flows. Therefore, the flexibility to control and manage the speed and scope of learning through technology was seen to be having a conducive and positive impact on learner attitude. However prior experience of ICTs did not impact the learner attitude. Finally, practical implications for the implementation of classroom technologies were

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provided and avenues for future research were outlined.

Keywords: Classroom technology, learner attitude and independence, enhanced communications, ICT, TAM.

Introduction

Recent technological advancements have provided educators and learners with new tools to support in-class instruction and coursework. Hence integrating technology into classrooms is a growing initiative that is becoming an important and growing part of educational culture and university life (Bratina, Hayes, & Blumsack, 2002; Wiley 2001). For instance, California's educational budget provided a total of $433 million in 2003 to increase the use of technology in schools and universities. In 2008 the United States provided $273 million funding to secondary and high schools to support the deployment and integration of educational technology into classroom instruction. Classroom Technology is the collection of software, hardware and, processes that facilitate learning (and teaching) and thus impact (mostly positively) the learner's attitude and performance (Govindasamy 2002; Khan 2000). Similarly, learner attitude is defined as the impact or influence of classroom technology on a student's disposition towards learning and this can be positive, negative, or neutral (meaning no change).

From September 2007 to September 2008, a University in Qatar (a country in the Middle East Gulf region) was fitted with classroom technology with the prime aim of creating an interactive and conducive learning environment. Within this context the issues that were considered pertinent in initial post-implementation stage, as far as learner attitude was concerned, were:

- experience with basic Information and Communications Technologies ICTs) and their effect on learner (Liaw, Huang, & Chen, 2007).
- broadening of classroom technology initiated communications channels and its impact on learning and absorbing abilities of students (Urden & Weggen, 2000).
- level of learning independence created through use of classroom technologies (Cuban, 1993).
- level of difficulty related to both the operational (know how to use) and situational (in working order) aspects of classroom technologies (Bannan-Ritland, Dabbagh, & Murphy, 2000; Singh, 2000).

Consequently the prime focus of this study is on the introduction of an assortment of classroom technologies (i.e., a combination of audio-visual equipment and online systems) within a university (i.e., higher education) and their impact on the learners' attitude. According to a number of academics in the educational technologies field, through the implementation of educational technology student attitude tends to improve, and the students are also better prepared to enter and succeed in the digital workplace (Chen, Lee, & Chen, 2005; Liaw, 2004). Similarly, many collaborative learning theories argue that human interaction is a vital ingredient to learning and classroom technologies tend to increase the bandwidth of face-to-face (especially written and gestural) communication avenues, which creates an exchange environment where information is shared and enriched through application of classroom technologies (Bharati, 2003; Liaw & Huang, 2003). These views raise a number of questions; namely, Do classroom technologies create a platform for enhanced communications? Do classroom technologies provide new channels for information acquisition and exchange? Do classroom technologies help learner with self-directed learning by accessing relevant materials on their own? With these questions in mind and forming the research objective, the investigation examined the impact of classroom technology (which included a combination of laptop, overhead projector, document camera, DVD player, speakers, video-conferencing facility, and in-class wireless internet access) on learner attitude.

As exploratory research, two focus groups (one for male and one for female students) were conducted to identify the key variables of classroom technology-related learner attitude (see Table 1). The university student population is segregated into males and females. Hence genders are divided into two distinct campuses and are not allowed to mix. In order to obtain a balanced and representative view of the learners it was considered appropriate to conduct separate focus groups for male and female students. As the final data collection was done through a broadcasted survey (i.e., an e-mail, with attached questionnaire, was sent to the respondents) there was no need for the physical separation of male and female students (see Appendix, Audiovisual Technology Survey).

Exploratory research helped with the selection of key antecedents (i.e., ICT experience, Learner Independence, Enhanced Communications and Ease of technology use) and consequence (Individual learner attitude) that constituted the research model (see Figure 1).

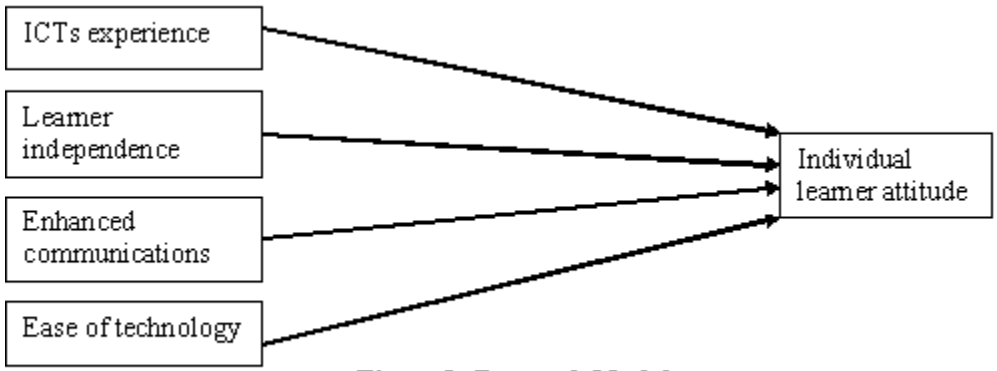


Figure 1: Research Model

Literature Review

Classroom learning within higher education involves different instruction contexts, practical activities, and variety of course assessments coupled with guidance and direction in the form of mentoring and teaching. Within this specific learning context, simulated and virtual environments (partly based on and driven by classroom technologies) provide the capability and means to create problem-solving groups and communities in which participants can gain knowledge and skills through interacting with other participants and different sources of relevant information. The use of classroom technologies tend to improve the quality of learning by involving learners in virtual and face-to-face exchange environments and by facilitating better access to educational resources such as internet and electronic library (Saade & Bahli, 2005). Hence, university learning in digital space (and classroom technologies are part of it) can lead to enhanced learning experience largely due to opening up of student's environment (Mun & Hwang, 2003).

Among many factors that can influence the extent of individual learning include factors such as student learning style (independent or dependent), learner channels of information acquisition and exchange, familiarity with information technology, and learner motivation (Buch & Bartley, 2002**).** As far as learning is concerned, there are two major competing theories - objectivist (behavioral) and constructivist (cognitive) theory. Objectivists believe that knowledge exists outside the learner's mind and can be transmitted from teacher to student, whereas constructivists emphasize that knowledge is constructed in the mind of the learner as a consequence of working through real-world situations (Honebein, Duffy, & Fishman, 1993). There is a belief that ICTs, particularly the Internet, support the constructivist environment. Hence researchers believe that classroom technology facilitates project-based, cooperative, interdisciplinary, and thematic learning

(Manochehri & Young, 2006). Furthermore educational technology tends to minimize the isolation of classrooms, thus breaking down traditional models of privacy. According to Massy and Zemsky (1995) technology enables self-paced learning with sensitivity to different learning styles and continuous assessment of student's progress.

Classroom technology can offer focused and clear instruction and hence can target specific needs of the learner. Furthermore, positive user attitude and user acceptance (based on previous experience of and interaction with ICTs) have been considered as critical factors that contribute to the successful application and implementation of classroom technologies (Venkatesh, Speicer, & Morris, 2002). A common problem with implementation of new technologies is that sometimes in order to reflect an illusion of advancement and modernization, organizations jump on the bandwagon (without much thought) to show that they are keeping abreast of the technological progression (Govindasamy, 2002). This could result in waste of resources and disappointing outcome in terms of technology related performance. Hence the key question "How is technology going to impact the user?" needs to be asked so that efficient use of resources and effective use of technology is made. The proposed research will address this 'influence/impact' of classroom technologies on the user (attitude). The 'learner disposition' in terms of how he/she behaves within this 'technical environment' is the fundamental research premise of this study. Hence the evaluation and analysis of 'learner attitude' and how it is influenced and shaped by educational technology (i.e., control and adjustment of learning pace, amount of dependence on the instructor, utilization of remote learning technology and methods, levels of virtual and online interaction, etc.) will be investigated.

In context of Qatar, students represent a major part of the society, as individuals under the age of 25 forms around 45% of the total population. Within the last five years, these students have been exposed to ICTs, through initiatives such as digital government, public remote internet access, smart classrooms in most higher education institutions, and broader use of laptops in universities. This explosion of ICTs is changing a traditional and socially-centered nation at a tremendous rate. More specifically 'electronic and remote learning' is rapidly spreading in Qatar where (due to a very high GDP/Capital of over $90,000) state-of-the-art educational and learning technologies are gracing primary and secondary schools, vocational and further education colleges, and universities. New equipment, latest software, premium hardware is being introduced rapidly. Government is actively driving this movement with a sizeable budget. But the question still remains, "How is the technology being utilized and how is it transforming the attitude of the learner?" Hence personal, social, and educational attitudinal elements need to be understood in order to create a conducive and appropriate learning environment where technology is one (although main) part of it.

Agreeing with Wang (2003) and Liaw (2004), learning behavior (and attitude is important part of this) needs a careful and detailed scrutiny to design and create socially, culturally, and educationally suitable environments. Furthermore, as per Rosenberg (2001), to develop a conducive e-learning ambience, it is nearly essential to monitor and chart the attitude (e.g., motivations, distractions, likes, frustrations) of the learner. Through this 'analysis' educational technologies can be better directed to provide appropriate opportunities for enhanced learning through optimal consumption of implemented technologies. Additionally, one major misalignment as far as 'educational technology' and 'learner attitude' is concerned is the notion of 'practical and actual use' gap. Expectations are usually high in terms of benefits that should be provided by ICT's charged learning environments. However actual outcomes (in particular within different cultures) can be all together a different matter (Lowyck, Lehtinen, & Elen, 2005). Hence this study endeavors to analyse this 'gap' through the lens of 'learner attitude.'

In addition, educational research argues that classroom technologies provide learners with elaborate and faster access to information, allow for more individualized and personalized instruction, and accommodate different learning styles. It is also reported that classroom technologies not

only promote greater student involvement in learning but also generate more individual responsibility for learning (Wang, 2003). Appropriately used, classroom technology can help students acquire the skills they need to flourish and develop in complex and increasingly technical and knowledge-based economies (Ocker & Yaverbaum, 2002; Shroff & Vogel, 2009). Effective technology integration, into the classroom, should happen across the curriculum in such a way that it deepens and enhances the learning process. In particular, it should support three key components of learning: active engagement, participation in groups, and frequent interaction and feedback (Rosenberg, 2001). Effective technology integration is achieved when the use of technology is routine and transparent and when technology supports course objectives. For instance, learning through field projects while equipped with technology (such as a laptop, loaded with SPSS, for data collection and analysis) allows students to be intellectually challenged while providing them with a realistic experience and a snapshot of what the modern workplace looks like, which is where most students will end up eventually.

Hence a primary goal in utilizing a new medium of communication for educational delivery should be the identification of its impact on learning. A number of theorists (including Bostrom, Grant, Davis, & Einerson, 1990; Brown, Collins, & Duguid, 1989; Hmelo, 1993) have argued that the structure of typical traditional classrooms discourages the kinds of learning necessary for the 21st century. It is time to reengineer the educational field by adopting new and innovative ways of creating effective and efficient teaching and learning atmospheres that will better prepare the human resource to enter the professional arena of the 3rd millennium. To achieve this transformation, a growing number of courses in higher and further education are being delivered using a variety of educational technology. These progressive approaches are found to be effective in positively impacting an increasing numbers of learners (Chang, Sung, & Chen, 2001).

Several researchers (including Alexander, 1995, Fenwick, English, & Parsons, 2001) argued that while implementing a new technology, educators should evaluate how and why students learn via the new technology in order to help with curriculum and instructional designs. Additionally, Manochehri & Young (2006) stressed the importance of understanding how the new technology can affect learning. Hence another important reason for doing this research was perceived scarcity of research focusing on learner's attitude when dealing with new and sometimes unknown classroom technology. This research investigates issues (mainly techno-behavioral) that are likely to influence learner's disposition towards newly introduced classroom technologies.

Research Model and Hypotheses

In this section, we will first describe the research model, followed by the hypotheses. Two focus groups, one including 10 male students and one including 10 female students, were conducted to collect the perceptions of learners as far as initial utilization of classroom technologies and its impact on their learning attitude was concerned (see Table 1). Consequently a model was conceptualized that had four antecedents and one consequence. The research model is partially grounded in and reflects some components (i.e. ease of technology use and learner's attitude towards technology) of Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warsaw, 1989), which has been widely utilized to explain technology adoption within education (Jong-Ae, 2005). Especially TAM has been widely used in surveying user attitudes related to information technologies, which include classroom and educational technologies (Ma & Liu, 2004; Saga & Zmud, 1994).

Table 1: ***Perceptions of learners regarding classroom technologies***

Statements	% **respondents**
Enhances visual and verbal experience	54
Clarity in teacher's explanation	35
Creates a virtual student	28
Integration of multiple learning sources	22
Helps with illustration of complex examples	20
Students can work at their own pace	17
Improves level of interest in the subject	13
Students can prepare lesson in advance and do extra research	9
Helps students to express themselves more clearly in presentations	7
Helps create an interactive learning environment	4
Helps concentration as lecturer is not writing and speaking at the same time	3
Lecturer's body language becomes more expressive	3

H1: There is a positive relationship between ICTs Experience and Individual Learner Attitude

ICTs Experience is defined as frequency and depth of interaction with basic software, such as MS Office, and internet search engines, such as Google and Yahoo, used for surfing and web browsing. Technology-driven individual learning is defined as the impact and influence of utilization of classroom technologies on student's attitude. Furthermore interaction with technology (in terms of frequency and diversity of use) can influence the attitude of students due to a potential positive (or non-negative) stance towards adoption of technology to support, supplement, enrich, and enhance their learning quantity and quality. Boghikian-Whitby and Mortagy (2008) found that students with prior ICTs experience performed better than those with no experience. Furthermore, positive user attitude and user acceptance (based on previous experience and interaction with ICTs) have been considered as critical factors that contribute to the successful application and implementation of classroom technologies (Venkatesh et al., 2002). Therefore, a positive relationship between ICTs experience and individual learner attitude is expected.

H2: There is a positive relationship between Learner Independence and Individual Learner Attitude

Independence is defined as self-management of studies by working on one's own initiative. Where a student takes more responsibility for his or her learning, technology can further complement this attitude by providing remote and ubiquitous access to learning resources (such as e-library and Blackboard) and connecting students to other interest groups (such as fellow students, teachers, etc) to exchange information and discuss ideas. This freedom and flexibility (largely enabled and facilitated by omnipresent educational technology) when supplemented by face-to-face communications and classroom teaching and consultation is likely to result in favorable learner attitude. Hence self-regulated learning where technology is one of the driving forces has a high probability of affecting the learner attitude positively (De Corte, 1990). In addition, educational research argues that classroom technologies provide learners with elaborate and faster access to information, allow for more individualized and personalized instruction, and accommodate different learning styles. It is also reported that classroom technologies not only promote greater student involvement in learning but also generate more individual control and responsibility for learning (Wang, 2003).

H3: There is a positive relationship between Enhanced Communications and Individual Learner Attitude

Enhanced communications is defined as widened scope of information exchange through various ICTs-based and personal channels such as use of video and audio equipment, increased use of body language by instructor, face-to-face communication by the instructor by using voice projection and improved eye contact and body language. If we focus on technology induced communications, there are a number of examples of multimedia technologies (such as interactive animations and simulations, interactive environments for inquiry based learning, and virtual reality tools and programs) that can increase the 'sensory tenacity' of the user by enabling communication in various auditory and visual forms. Hence experiencing different types of electronic and non-electronic interactivity allows for a more active, flexible, self-controlled learning (Van Merrienboer & Paas, 2003). Hence wide participation and utilization of various communication sources (vocal, animated, graphic, etc.) is likely to generate positive learner attitude. As a learner gets further involved in 'collaborative work' through utilization of different types of communications, this provides ample learning opportunities created through social linkages and knowledge sharing bonds. Hence involvement of different forms of communications channels (technology and non-technology based) are likely to amplify the individual learning by broadening the scope of information exchange. Hence a positive relationship between enhanced communications and learner attitude is proposed.

H4: There is a positive relationship between Ease of Technology use and Individual Learner Attitude

In using the classroom technology, 'operational' difficulty relates to know-how in terms of using the technology whereas 'situational' difficulty relates to the 'fitness status' (i.e., ready for use/in working order) of the equipment. Hence ease of use can be associated with two states: i) the learner is not ready and able to use the technology due to lack of experience and operational knowledge; ii) the technology (the equipment, the system) is not in a fit state for use. State (ii) could be due to permanent or transient faults such as loose connection, open circuit, faulty component, network down, or disturbed setting. Ease of use has a strong correlation with time window when it comes to in-session or in-class use of technology. In-class learning is temporally constrained (i.e., session of limited duration), and if the technology does not work 'right away' then the 'session plan' is disturbed and confidence and reliance on technology is shaken. Hence ease of technology use is expected to show a positive link with learner attitude.

Research Methodology

Sample

The sample was based on the QU students, both male and female, from different colleges and departments. The questionnaire was broadcasted, using the university e-mail network, to the students. Eight hundred (800) questionnaires were sent out for self-completion with clear instructions. A total of 178 questionnaires were returned. This represented a response rate of about 22% which is comparable to similar studies (Klass, McClendon, & Gainey, 2002).

After taking out the unusable questionnaires, a total of 161 questionnaires were deemed suitable for further analysis. The test of non-response bias (i.e. comparing early and late respondents) was not necessary as all the data was collected in one phase.

Measures

Table 2 lists all the items (seventeen in total) that formed the antecedents and consequence used in the research model.

Table 2: Measures and item details

Measure	Items
ICTs Experience	Item 1 - Knowledge and ability of the learner to use basic ICTs Item 2 – Use of internet and e-mails to supplement learning
Learner Independence	Item 3 - Proactive course involvement of learner as a result of utilizing classroom technologies Item 4 - Classroom technologies aiding learner with lesson preparation Item 7 - Classroom technologies helping learner to do more work on its own Item 8 - Classroom technologies helping learner to control its pace and speed of learning
Enhanced Communications	Item 9 - Classroom technologies are further stimulating learner's problem solving ability through enhancement of visual (image based) communication Item 10 - Classroom technologies are further stimulating learner's problem solving skills through enhancement of audible (sound based) communication Item 12 - Learner becomes more involved and interactive, during sessions, when classroom technologies are used
Individual Learner Attitude	Item 5 - Classroom technologies help learner understand course materials through multiple sources Item 6 - Classroom technologies help (lecturers/teachers) with clear explaining of the subject materials through different forms of communication (verbal, written and non-verbal i.e. body language becoming more expressive) Item 11 - Classroom technologies improve the learning process of the individual through multiple sources of stimulation Item 13 - Classroom technologies create an effective classroom environment through which concepts and ideas can be grasped and exchanged more effectively and easily
Ease of technology use	Item 14 – I have no problem in operating the class room technologies Item 15 – If there is something wrong with the equipment than technical support is immediately available Item 16 – I do not need any training to teach me how to use the classroom technologies Item 17 – I find classroom technologies in full working order whenever I want to use them

Reliability, Validity and Regression Analysis

Prior to being used for final data collection, all the measures were reliability and validity tested. Refer to Tables 3 (Descriptive statistics and reliability analysis), 4 (Correlation matrix) and 5 (Exploratory Factor Analysis). In addition, regression analysis (Table 6) was performed to evaluate the model pathways (i.e., proposed hypotheses). The regression analysis indicated a stable model with acceptable goodness of fit. All the items were based on 5-point Likert scales. The research model was tested using a self-completion questionnaire in English and Arabic.

Table 3: Descriptive statistics and reliability analysis

Construct	Mean	SD	Cronbach's α
IT Experience	3.71	0.965	0.631
Learner Independence	3.70	1.020	0.803
Enhanced Communications	3.69	1.000	0.746
Individual Learning Attitude	3.98	0.939	0.791
Ease of classroom technology use	3.86	0.923	0.815

Table 4: Correlation matrix

Construct	Individual Learning Behavior	IT Experience	Learner Independence	Enhanced Communications	Ease of classroom technology use
Individual Learning Behavior	1				
IT Experience	0.218	1			
Learner Independence	0.599**	0.352**	1		
Enhanced Communications	0.716**	0.317*	0.578**	1	
Ease of classroom technology use	0.621**	0.458**	0.598**	0.361*	1

Note: **Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

From the information presented in Table 3 we can see that the Cronbach's α value for all constructs is above 0.60 which is considered as a threshold value indicating acceptable reliability (Fornell & Larcker, 1981; Hair, Anderson, Tatham, & Black, 1998). The bivariate correlations (i.e., correlation matrix) of the constructs are presented in Table 4. The fact that none of the correlations approached the reliability values of the constructs is an indication of the discriminant validity. On the strength of the above evidence we are satisfied with the overall validity and reliability of the measures.

Table 5: Exploratory Factor Analysis

	Components				
	1	2	3	4	5
Item 1	.275	**.491**	.660	.008	.772
Item 2	.472	**.540**	.383	.330	.136
Item 3	.714	-.026	**-.124**	.407	.698
Item 4	.642	.151	**-.293**	.283	.251
Item 5	**.664**	-.472	-.090	.217	.639
Item 6	**.672**	-.537	.069	-.042	-.352
Item 7	.648	.332	**-.262**	.214	-.264
Item 8	.719	.244	**-.333**	.074	.129
Item 9	.660	.246	-.144	**-.547**	.224
Item 10	.663	.245	-.060	**-.418**	-.119
Item 11	**.721**	.063	-.077	-.315	.308
Item 12	.761	-.373	.318	**-.153**	.672
Item 13	**.709**	-.381	.403	.062	.280
Item 14	.296	-.451	-.437	.063	**.526**
Item 15	.340	.596	.706	.213	**.481**
Item 16	.197	.453	.138	.459	**.572**
Item 17	.390	.112	.281	.127	**.502**

Component 1: Individual Learner Attitude
Component 2: ICTs Experience
Component 3: Learner Independence
Component 4: Enhanced Communications
Component 5: Ease of classroom technology use

It was considered useful to perform Exploratory Factor analysis (EFA) to test the fitness of items in terms of their association to a construct. Hence EFA was run in order to let the items load onto the constructs statistically. As a result of the EFA (as shown in Table 5 above), five components (constructs) were identified (represented by bold figures) and formed the exogenous and endogenous variables for the research model.

Results

Demographics

Demographics related to the study included the gender, age, and college split are given in Table 6.

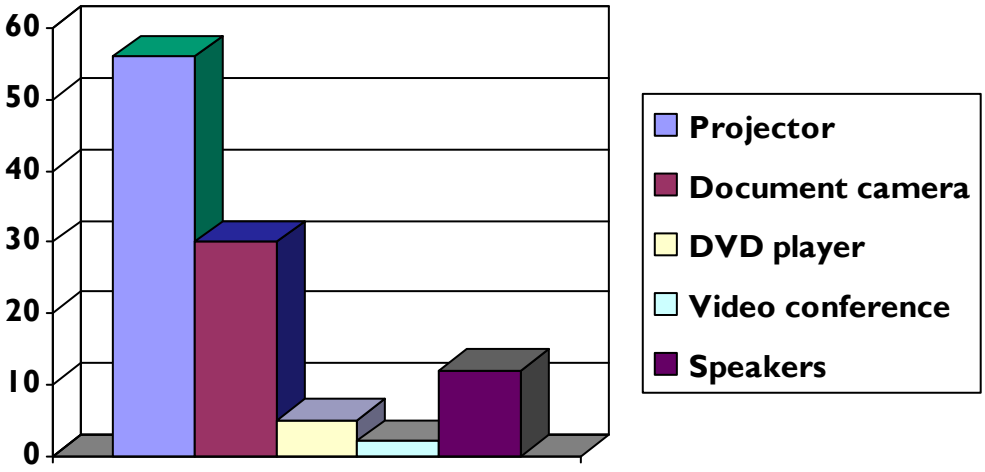
Table 6: Sample breakdown (n-161)

Gender split	Female: 103 Male: 58
Age split	71 (17-20 years); 87 (21-25 years); 3 (26-30 years)
College split	Business & Economics 87; Engineering 44; Arts and Sciences 21; Sharia and Islamic Studies 6; Pharmacy 3

Table 6 clearly indicates that there were far more female respondents than male respondents (i.e., ratio of almost 2:1). Similarly most of the respondents belonged to 17 – 25 years old age group, displaying a rather young population. In terms of the college representation, a majority of the respondents came from College of Business and Economics followed by Engineering and Arts and Sciences.

Frequencies

The data related to frequencies of use are given in Figures 2, 3 and 4.



(Vertical axis represents number of users)

***Figure 2*: Classroom technologies used by faculty**

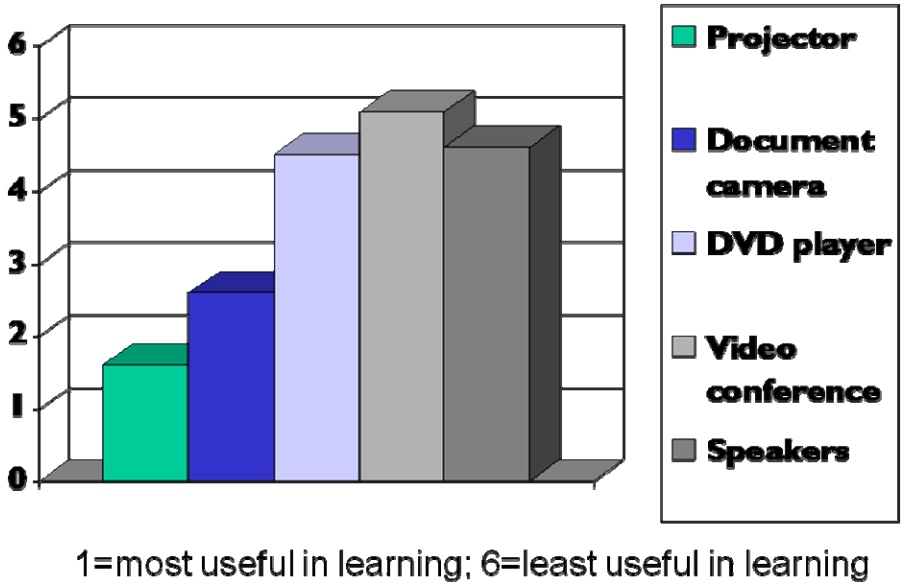


***Figure 3*: Student perception of usefulness of classroom technologies**

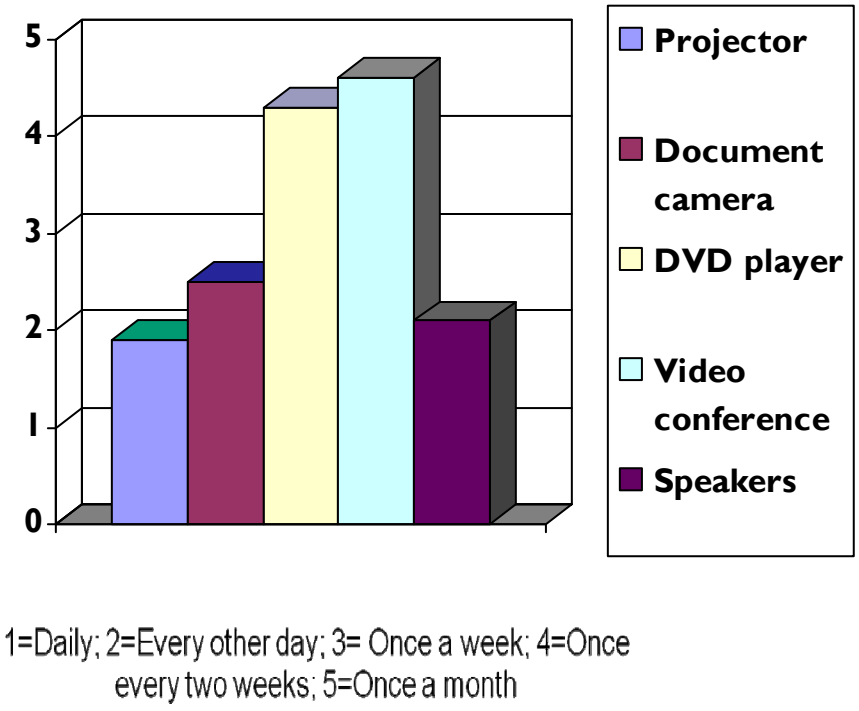


***Figure 4:* Classroom technology use by students**

A common thread related to usage (both by faculty and students) and usefulness (students perception) seems to be that projector and document camera (basic technologies) are predominantly

used with higher perceived usefulness whereas DVD and Video Conferencing are less frequently used and considered to be less useful.

Hypotheses Testing and Pathway Analysis

The outcome of the regression analysis is presented in Table 7.

Table 7: Regression Analysis

Model	t-value	Sig.	Standardized Coefficients	Standard Error
(Constant)	3.538	.001	-	0.371
ICTs Experience	-.713	.479	-0.065	0.082
Learner Independence	2.759	.008	0.294	0.097
Enhanced Communications	5.381	.000	0.566	0.095
Ease of classroom technology use	4.973	.000	0.513	0.086

Dependent variable: Individual Learner attitude

The research model was subjected to Multiple Regression Analysis (MRA) using SPSS 15. R-Square value (Co-efficient of variance) was .567 which implied that 56.7% of the model variation was explained by the three independent variables (i.e., ICTs experience, Learner Independence, and Enhanced Communications). In terms of the studied pathways, the MRA showed significant and positive relationships between Learning Independence, Enhanced Communications, and Ease of classroom technology use (t-values of 2.759, 5.381,and 4.973 respectively) and Individual Learner Attitude. However the association between ICTs Experience and Individual Learning Attitude was non-significant (t-value = -.713). With this outcome, in terms of the 'Outcome of the hypotheses' (Table 8), following can be concluded:

Table 8: Outcome of the hypotheses

Proposed Hypotheses	Statistical Outcome	Hypotheses Status
IT Experience ? Individual Learning Attitude (+)	Non-significant	Rejected
Learner independence ? Individual Learning Attitude (+)	Significant and positive	Retained
Enhanced Communications ? Individual Learning Attitude (+)	Significant and positive	Retained
Ease of classroom technology use ? Individual Learning Attitude (+)	Significant and positive	Retained

Discussion

The major contribution of the study is that it is the first attempt to investigate the impact of classroom technologies in the initial phase of their implementation. This type of early analysis can help identify the developing attitudes of users, which can be an important finding as far as the future utilization of the classroom technologies is concerned.

The study outcome implied that use of classroom technologies, in the initial stages of introduction, does increase the capacity for self-directed learning through the availability, and creation, of further interaction and communications channels. However, prior ICTs experience seemed to have no impact on use of classroom technologies.

As instructors cannot always accommodate each student's need, it is important that several learning opportunities are provided. In this respect classroom technologies do present additional avenues through which learning can be generated and exchanged (e.g., accessing electronic library through laptop via wireless network anywhere and anytime, retrieving and placing learning materials on Black Board, etc). Furthermore, it is expected that when the learning experience is more relevant to the student, an increased level of individual user acceptance of information systems will result. Therefore, independence in learning (i.e., increased efficacy towards self managed and self-directed learning) is likely to occur (Compeaux, Higgins, & Huff, 1999). The results also supported the findings of Barron and Orwing (1997) who indicated that technology enabled learners to learn at their own pace with continuous assessment, in contrast to the traditional way of teaching and learning.

In terms of enhancements of communications, it is likely to be enhanced (partly) due to the projection and display of information (mostly typed or written) by the classroom technologies (such as overhead projector, document camera, speakers, and DVD player). When this support is provided by the technology, the teacher has more time to concentrate on explaining and clarifying the material through gestures, eye contact, and such other body language displays. When interaction with peer groups, teachers, and online sources is improved it opens up the learner communication (at individual and group level) which facilitates opportunities for independent learning. Furthermore, the work of Romanov and Nevgi (2007) showed similar results. They reviewed the relationship between the use of multimedia equipment such as video clips and collaborative communication devices with learning attitude. They concluded that students who utilized multimedia were more energetic in using e-learning tools and achieved better course performance.

Ease of use in terms of equipment in a ready state of fitness during the class time affects the learner's attitude positively (Moon & Kim, 2001). If learner is unable to operate the equipment (whether it is due to lack of operational knowledge or unavailability of timely technical support) the likely attitude towards classroom technology use will be negative.

It seems that previous experience with general ICTs does not impact uptake and utilization of classroom technologies for educational purposes. The probable reason for this (also supported by Passerini & Granger, 2000) could be interest and motivation as a fundamental condition for technology-based learning rather than experience with ICTs.

Practical Implications, Limitations, & Future Research

Training should be organized for the students to bring them to the same level of competence. It is quite probable that some students may be encountering difficulty in using the new classroom technology or technologies.

Technical support should be prompt and comprehensive especially during the early stages of classroom technology implementation as most of the problems are likely to occur during the introduction of new technology.

In terms of limitations:

- Study is restricted to one institution therefore results should not be generalized.
- Quantitative research design may have created information gaps through which some of the relevant information may have slipped.
- Sample is unbalanced (i.e. more female than male respondents).

As far as the future research is concerned, research model needs to be expanded by including the following variables and investigating their impact on individual learner attitude:

- Relevant training
- Technical and maintenance support

Group analysis should be performed by cutting the data using the following variables:

- Gender of the learner
- College/department of the learner
- Age of the learner

The study should be replicated in a different learning environment to give it further validity.

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Appendix: Audiovisual Technologies Survey

January 2009

Section 1: Demographics

*(Please highlight **bold** your answer/option)*

Gender: Male Female

Age: 17-20 21-25 26-30 31-35 35+

College ……

Department……..

Section 2: Confidence with technology

*(Please highlight **bold** your answer/option)*

1. How often do you use a PC?

   …….Every day

   …….Every other day

   …….Once a week

   …….Once every 2 weeks

   …….Once a month

   If option not covered above please state your response:

   ……

2. How often do you connect to Internet?

   …….Every day

   …….Every other day

   …….Once a week

   …….Once every 2 weeks

   …….Once a month

   If option not covered above please state your response:

   ……

3. Which application do you use on a regular basis?

   …….Word

   …….Excel

   …….Power Point

   …….Web browser

   …….Email

   …….Black Board

   If option not covered above please state

   ……

Section 3: Use of classroom technologies

*(Please highlight **bold** your answer/options)*

4. When did you notice that new classroom technologies have been introduced in classrooms?
   ……..Not noticed yet

   ……..1 year ago

   ……..6 months ago

   ……..3 months ago

   If option not covered above please state

   ……

5. Which classroom technology(ies) do your teachers use?
   …….Projector

   …….Screen

   …….Document camera

   …….DVD player

   …….Video conference

   …….Speakers

6. Please rank these classroom technologies from 1 (most useful in learning) to 6 (least useful). Please give a brief reason for why you find a particular technology useful in learning?

   …….Projector

   …….Screen

   …….Document camera

   …….DVD player

   …….Videoconference

   …….Speakers

   Reason for being useful in learning

   ……..

   In your course work, how often have you use the following classroom technologies?
   a. Projector:

   …….Every day

   …….Every other day

   …….Once a week

   …….Once every 2 weeks

   …….Once a month
   Other……

b. Document camera

…….Every day

…….Every other day

…….Once a week

…….Once every 2 weeks

…….Once a month
Other…….

c. DVD player

…….Every day

…….Every other day

…….Once a week

…….Once every 2 weeks

…….Once a month
Other……

d. Videoconference

…….Every day

…….Every other day

…….Once a week

…….Once every 2 weeks

…….Once a month
Other……

7. On a scale of 1-5, how would you rate the 'ease of classroom technology usage'?

    1- Very Easy

    2- Easy

    3- Some difficulties

    4- Difficult

    5- Very difficult

If you have selected options 3, 4 or 5 in the above question, which classroom technology/technologies do you find difficult to use and why

……

Section 4: Impact on learning

Please indicate your response for each of the following statements by writing **X** in the rectangle.

1- Strongly Agree **2- Agree** **3- Neutral** **4- Disagree** **5- Strongly Disagree**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I know how to use Classroom Technologies available in my class					
I have used Classroom Technologies in enhancing my learning experience					
Classroom Technologies helped me in getting proactively involved with learning on the course					
Classroom Technologies helped me in preparing for the lesson/lecture					
Classroom Technologies helped me to understand the course material through multiple sources of learning					
Classroom Technologies help explaining the subject more clearly					
Classroom Technologies help me to become independent learners by doing more work on my own					
Classroom Technologies help me to control my pace of learning by going fast or slow					
Classroom Technologies help me to stimulate my problem solving skills through visual experiences					
Classroom Technologies help me to further develop and stimulate my communications skill					
My learning process has improvement since the implementation of Classroom Technologies					
Students are more interactive as the result of using Classroom Technologies					
Students can understand and grasp the concepts more easily and effectively as result of using Classroom Technologies					
I have no problem in operating the class room technologies					
If there is something wrong with the equipment than technical support is immediately available					
I do not need any training to teach me how to use the classroom technologies					
I find classroom technologies in full working order whenever I want to use them					

Please save in your local disk and e-mail the completed doc file to me at:

Thank you for your support and co-operation.

Biographies

Nick-Naser Manochehri received his Ph.D**.** in Applied Technology from the University of North Texas, USA - 2001. His Ms. in Software Engineering and bachelor degree in Computer Science. He has several years of industrial experience as a software developer and senior instructor in the area of IT at SBC Communications Inc. in Dallas Texas. He also worked as an assistant professor in the department of IS at SQU in Oman. He is currently an assistant professor in the college of Business and Economics, department of Accounting & Information Systems at the Qatar University. His research area of interest includes: IT, TQM, e/mobile Commerce, e-learning & educational Technology.

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