E-Learning Innovations at a B-School: An assessment of their Diffusion

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Abstract: This research reports the preliminary findings of a major study of faculty and students' adoption of high technology equipment in a management education programme offered by a premier business management institute in the twin cities of Hyderabad and secunderabad. Studies in the west focused only on the faculty's responses. In this study, the students' responses along with faculty's responses are also included. Data collected through a survey questionnaire was used to examine faculty and students' perceptions regarding various attributes of the high technology equipment as a tool in both lecture preparation and delivery. Our analysis of the data suggests that the innovation adoption variables of relative advantage, compatibility, visibility, ease of use, results demonstrability, and trial ability are perceived differently by faculty and students. Implications are drawn for administration seeking to increase the rate of adoption of e-Learning within their organization. How to development strategies for e-Learning diffusion are also discussed.

Introduction

The era of information technology has influenced phenomenally the lives of pupils in the school and the graduating students in professional courses. Consequently, strategies for facilitating the adoption and effective utilization of eLearning are an issue of importance to eduprenuers and academic administrators around the world. The 'information revolution' has forced most developed economies into an era, which demands effective utilization of information and communication technologies (ICT) in universities and institutions to prepare 'knowledge workers' for the 'knowledge economy' (Drucker, 1998; Maeir & Warren, 2000). As a result, educational institutions are placed in a situation that requires reassessing their methods of practice, and necessitating adapting and improving teaching and learning for the changing needs of a global, digital, and networked economy. While global spending on ICT in educational institutions is increasing at unprecedented rates (OECD, 1998), the pressing problem for educational administrators is that the rate of adoption by faculty across different sectors of education has lagged significantly behind that of industry (Leidner & Jarvenpaa, 1995).

From our personal experiences with the academicians it was observed that most teachers are only performing basic tasks such as e-mail and undertaking research via search engines mainly for lecture preparation. This may be because of the fact that a lack of online content and advanced faculty training means that many are still struggling to incorporate Internet applications such as publishing on line (for teaching delivery) with traditional lecture methods.

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In this study we examine factors affecting the diffusion of the high-tech tools into the lecture/presentation preparation and lecture/presentation delivery activities of faculty and students in a private management institute offering business management education at post graduate levels. We provide a framework for academic boards to consider when formulating strategic plans for the diffusion of high technology throughout the teaching and learning context.

Specifically, we utilize Rogers' (1995) diffusion of innovations (DOI) theory to examine factors affecting the adoption and utilization of the high technology by faculty and students for purposes of lecture/presentation preparation and lecture/presentation delivery. Operationalising these factors in a business school setting will assist academic administrators in strategic planning for ICT implementation including: the design and planning of educational technology courses; ICT resource and infrastructure planning; and in the design of improved methods of professional evaluation and assessment (Stefl-Mabry, 1999).

High Technology Intensive Instruction

Two years ago, the study area – Siva Sivani Institute of management, a non-university affiliate, non-government and AICTE approved, 12 years old, and rated number one for intellectual capital in the state of Andhra Pradesh has implemented high technology intensive instruction using parallel networking technologies in each of its classrooms. There are two major equipments used to deliver the learning components while extending it to e-learning using web based instructions. Firstly, the hardware components include a *smartboard* (a patented touch board which is connected to a computer and operated through software activation). Normally, it functions like a traditional white board over which four colour impressions can be used to write the content of the lecture. Later the content written on the board could be stored on the computer in the form of a softcopy document in formats like pdf, html and simple text. Secondly, presentations using an LCD projecter can also be projected on the smartboard. Furthermore, additional writings, and marking also could be made on the presentation content online on the board. Further, the audio and video integration equipment could be utilized to record the audio and video lessons (not implemented yet).

The faculty and the students were introduced to the technology followed by demonstrations and hands-on training. And now, utilizing this high-tech equipment has become daily chores for both the faculty (even visiting, guests) and the students.

The Present Study

Over the last two decades considerable research has been conducted into individuals' adoption of new technology in a variety of settings (Bradley, 1997; Davis, 1989, 1993; Moore & Benbasat, 1991; Taylor & Todd, 1995; Warshaw & Davis, 1985; Venkatesh, 1999; Venkatesh & Davis, 1996; Venkatesh & Morris, 2000). Much of the research in this field draws on Fishbein and Ajzen's (1975) theory of reasoned action (TRA). TRA posits that an individual's behaviour is a function of both the individual's attitude toward a specific behaviour and the social influences and norms surrounding that behaviour.

Consistent with the TRA, Rogers' (1995, pp. 15-16) DOI theory defines five attributes or characteristics of innovations, which influence an individual's attitude towards an innovation during the adoption process. These attributes include relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and media of potential adopters. Complexity is the degree to which an innovation is perceived as difficult to understand and use. Trialability is the degree to which an innovation may be experimented with on a limited basis. Observability is the degree to which the results of an innovation are observable to others. Drawing directly on DOI theory and TRA, Moore and Benbasat (1991) developed an instrument to measure an individual's perceptions concerning the attributes of an information and communication technology innovation. Moore and Benbasat renamed Rogers' complexity construct ease of use, consistent with Davis (1989), reflecting the dominant measurement paradigm in ICT research. They also developed the image construct that was defined as "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore & Benbasat 1991, p. 195). According to Moore and Benbasat, Rogers included the essence of the image construct in his definition of relative advantage. However, research indicating that it was separate from relative advantage was strong enough for Moore and Benbasat to decide to measure it as a separate construct. Also, during the process of developing the instrument, Moore and Benbasat found that the construct of observability separated into two constructs: results demonstrability and visibility. Results

demonstrability "concentrated on the tangibility of using the innovation, including their observability and communicability" (1991, p. 203). Visibility, on the other hand, focused on the physical presence of the innovation in the organizational setting.

Rogers' (1995) suggests that the Moore and Benbasat instrument will be a valuable tool for future research in the diffusion of technology innovations. Rogers further recommends that the use of consistent instruments or measures of innovation attributes across various settings will provide a significant contribution to innovation diffusion research. Rogers (1995, p. 204) discusses the importance of utilizing this approach in various settings and points out that while much effort has been spent in studying people related differences in innovativeness, relatively little effort has been devoted to analyzing innovation differences (that is, in investigating how the attributes of innovations affect their rate of adoption). In summary, the ICT adoption variables measured by the Moore and Benbasat instrument were utilized in this present study and include relative advantage, compatibility, image, ease of use, results demonstrability, visibility, and trialability.

The high technology as an Innovation in universities and institutions

As regards the understanding of innovation, Rogers defines an innovation as "an idea, practice, or object that is perceived as new by an individual…" (1983, p. 11). He points out that 'newness' is not an objective measure based on time lapsed since its first use or discovery, rather, it is a subjective perception, if the idea, practice, or object seems new to the individual, it is an innovation.

Rogers defines rate of adoption as "the relative speed with which an innovation is adopted by members of a social system." (1995, p. 250). DOI theory posits that the rate of adoption of an innovation is influenced by the following sets of factors: (1) the individual's perception of the attributes of the innovation; (2) the nature of the communication channels diffusing the innovation; (3) the nature of the social system; (4) the extent of change agents' efforts in diffusing the innovation.

Research on the adoption of innovations is concerned with an individual's behaviour during the innovation diffusion process, as opposed to diffusion research per se, which focuses on the social system as a whole. Consequently, adoption can be viewed as a subset of the diffusion process, but one that takes place at the individual level rather than at the social group level. Of relevance to this present investigation is that Moore and Benbasat (1991) designed their

instrument to capture user perceptions about using the innovation, which differs from Rogers' (1995) framework which focuses on the user perceptions of the innovation itself. According to Moore and Benbasat "…it is not the potential adopters' perceptions of the innovation itself, but rather their perceptions of using the innovation that are key to whether the innovation diffuses" (1991, p. 196). Therefore in this present study we are not concerned with teachers' perceptions of the Web per se, but we are concerned with teachers' perceptions of using the Web in a variety of work-related contexts. The hypotheses tested in this study are therefore as follows:

Hypothesis 1: The seven ICT adoption variables (relative advantage, compatibility, image, visibility, ease of use, results demonstrability, and trialability) will predict the dependent variable, faculty and students' future use of the high-technology for the purpose of lecture/presentation preparation; and

Hypothesis 2: The seven ICT adoption variables (relative advantage, compatibility, image, visibility, ease of use, results demonstrability, and trialability) will predict the dependent variable, faculty and students' future use of the high technology for purposes of lecture/presentation delivery.

The Method

All 20-faculty members of different disciplines and 75 students from the participating institute completed a questionnaire survey, which included the items from the modified form of the Moore and Benbasat (1991) instrument and some demographic questions.

The demographic data revealed that the sample comprised a balanced spread in terms of gender (51% male), and age (30% <29 yrs, 40% 30-44yrs, 30% > 44yrs). The sample also demonstrated that the majority (80%) of teachers had completed at least 4 yrs of post-graduation studies. Finally, the sample represented all nine key learning areas offered by the school. In order to test the hypotheses, the hypothesised linear relationships were modelled with a multiple regression model.

The questionnaire items measuring faculty's perceptions relating to each of the seven ICT adoption variables were adapted from the suggestions of Moore and Benbasat (1991). Each of the seven dimensions was measured with a single item, 10-point response pattern in order to assess the extent to which the ICT variables were perceived. The alpha coefficient of reliability of the ICT assessment scale value was 0.89. This indicates that the scale is highly reliable. Two single item measures asking faculty and students about their intended future use of the high

technology, for (a) lecture/presentation preparation and (b) lecture/presentation delivery, were utilized to measure the dependent variables in this study. All items were measured on a five point Likert scale with polar anchors “strongly agree” and “strongly disagree”. Multiple regression analysis was computed in order to test the hypotheses. Results regarding hypotheses testing are presented in the following sections.

Data Analysis and Results

Hypothesis 1: High technology Use for lecture/presentation Preparation

A multiple regression analysis (with entre method) was conducted of all seven ICT adoption variables on the dependent variable high tech use for lecture/presentation preparation (LPP) separately for both faculty and students. The results indicate strong support for Hypothesis 1 (see Table 1). The regression equation was statistically significant for both samples ($p < .000$) explained approximately 84% of the variation in LPP ($R^2 = .843$) in case of faculty members and 30 percent in case of students. More so the beta coefficients in case of faculty reveal that all the ICT variables except ease of use and results demonstrability emerged as the dependable variables in predicting the change in the lecture/presentation preparation by the faculty. Whereas only ‘relative advantage’ emerged as the significant determinant of their preparation by students. It is quite surprising to understand this fact. This may be due to the reason that the students preparation for the use of high tech equipment is relatively lesser than the faculty members who use is on a continual bases. The students use it only during their class room presentations. All such predictive relationships are positive and statistically significant.

Table 1: Results of multiple regression of ICT adoption variables on Lecture/Presentation Preparation

VARIABLES	Faculty			Students		
	Beta	t	P - value	Beta	T	p – value
Relative Advantage	.053	1.484	.139	.451	4.841	.000
Compatibility	.325	8.658	.000	-.035	-.316	.752
Image	.277	6.028	.000	.058	.595	.553

Visibility	.285	6.203	.000	-.102	-1.075	.285
Ease of use	.055	1.263	.208	.160	1.522	.131
Results demonstrability	-.037	-1.124	.262	.171	1.293	.199
Trialability	.272	7.332	.000	.065	.557	.579
Variance (R^2)	.848			.353		
Adjusted R^2	..843			.305		
Significance of F p-value	.000			.000		

Hypothesis 2: High technology Use for lecture/presentation Delivery

A multiple regression analysis was conducted of all seven ICT adoption variables on the dependent variable high-tech use for lecture/presentation delivery (LPD). The results indicate strong support for Hypothesis 2 for the faculty sample and to a large extent in case of students (see Table 2). The regression equation was statistically significant in both cases ($p < .000$) and explained approximately 86% of the variation in LPD ($R^2 = .75$) incase of faculty and 62% of the variation in LPD ($R^2 = 59$) for the students. Furthermore, for the faculty sample, all the ICT variables emerged as significant predictors of the lecture/presentation delivery. As regards students' sample, except relative advantage, visibility and results demonstrability, all other ICT variables emerged as significant predictors of the lecture/presentation delivery by the students. All such predictive relationships are positive and statistically significant.

Table 2: Results of multiple regression of ICT adoption variables on LPD

VARIABLES	Faculty			Students		
	Beta	t	P - value	Beta	T	p – value
Relative Advantage	.327	7.223	.000	-.036	-.506	.614
Compatibility	.160	3.360	.001	.289	3.433	.001
Image	.131	2.239	.026	.464	6.247	.000
Visibility	-.111	-1.902	.059	.110	1.530	.129
Ease of use	.321	5.767	.000	-.244	-3.036	.003
Results demonstrability	.129	3.067	.002	.187	1.852	.067
Trialability	.240	5.118	.000	.210	2.378	.019

Variance (R^2)	.869	.623
Adjusted R^2	.755	.594
Significance of F p-value	.000	.000

Implications for E-Learning Diffusion

As hypothesised our empirical results show that DOI theory as operationalised in this study was successful in predicting the future high tech use by faculty for purposes of lecture/presentation preparation and lecture/presentation delivery, though the results in case of students have not yielded dependable conclusions.

An interesting aspect of the results was that in each case of high tech use by faculty three different DOI factors emerged as significant namely, Compatibility, Image, Visibility and in case of students factor namely Compatibility, Image, Ease of use, Results demonstrability, Trialability. All these are very interesting for the administration of such services and facilities in the classrooms.

Of further interest to board of the b-schools is the fact that image did emerge as a significant factor in either of the cases. This finding indicates that strategies that promote the status (or image) of faculty and students (for placements) who are currently advanced in their use of the high tech is likely to have effect on the adoption behaviours of other faculty/students. Administrators seeking to increase the rate of adoption of the high tech by faculty/students will be better served adopting strategies that address the attributes of the high tech found to be significant in this study.

In the case of high tech use for lecture/presentation preparation the four most important factors affecting faculty in our sample were compatibility, image, visibility and trialability. In case of students, only relative advantage was the most important factor affecting them.

This finding suggests that in the context of our sample, strategies to increase the adoption of faculty/students use of the high tech for lecture/presentation preparation should specifically address these attributes. While in the case of high tech use for lecture/presentation delivery, strategies should focus on all the attributes of ICT for faculty and compatibility, image, ease

of use, results demonstrability, trialability for students. The following discussion provides some examples of how this may be achieved.

Strategies for increasing high tech use for lecture/presentation Preparation

Compatibility is concerned with the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and media of potential adopters by the faculty. Thus in order to increase the adoption in this context is to encourage the existing values and the past experience of the faculty. This may be manifested through meetings and gatherings during institutional festivals.

Image concerned with the degree to which use of an innovation is perceived to enhance one's image or status in one's the faculty perceived social system for themselves and also for the institute. This should be kept in mind while encouraging the faculty to adopt use of high tech facilities.

Visibility is concerned with the focus on the physical presence of the innovation in the organizational setting. The very presence of such faculties encourages the faculty members to adopt and use high tech facilities. Therefore, there is a need to ensure that such facilities are visible and also maintained so that it is not merely visible but functionally visible.

Ease of use is concerned with the extent to which less learning is need to operate the high tech equipment by the faculty. There, adequate measures should be taken to ensure that the faculty members do feel that it is easy to operate such equipment so that better learning takes place in the classrooms.

Relative advantage was concerned with the degree to which using the innovation is perceived as being better than using the present method by the students. The term better relates to factors such as quality, efficiency, and effectiveness. Thus, one strategy to increase adoption in this context is to organize professional development programs that require faculty and students to prepare their lectures on the same topic using the present method followed by a lesson using the high tech. students, could then be asked to evaluate each presentation in terms of efficiency (ie. time spent), and the quality and effectiveness of the lectures.

Results demonstrability represents the extent to which use of the high tech facilities provide students with clear, measurable, and observable results. In the case of presentation preparation the results are evident in the final content and the reaction of other students. Therefore in the context of our sample, students should be encouraged to formally evaluate presentations that have been prepared with and without the use of the high tech. In addition, academic directors could provide students with the additional input on student adapting to such technology rich environments.

Trialability represents the extent to which faculty and students can trial the use of the high tech in lecture/presentation preparation prior to adoption. One strategy for increasing the trialability of the high tech for lecture/presentation preparation is to provide faculty/students with convenient access to the facilities in places where they are most likely to perform this activity. It is also common for faculty/students to prepare at home and therefore any scheme that encourages faculty/students would increase opportunities for trialing the high tech equipment. Good quality peripheral devices, such as colour laser printers and functional screen projectors, should also be available for teachers to trial when using the facilities to prepare for sessions. Trial agreements with vendors of e-Learning related products and services could also be utilized to assist in this process. Finally, professional development days providing opportunities and advice for faculty and students to trial the high tech for sessions would be beneficial in this context.

Strategies for increasing high tech use for teaching Delivery

Compatibility represents whether or not the innovation is perceived to fit teachers' existing values, needs, and past experience. In the context of our study, the move to lecture/presentation delivery through the high tech represents a dramatic shift from the traditional face to face presentation methods familiar to presenters. Organizational strategies will need to target this problem in order to increase presenters' perceptions regarding the compatibility of this non-traditional teaching mode within their context. Faculty and students could be supported in this regard through professional development regarding the pedagogical implications of e-Learning. Radical structural changes may also assist increasing the compatibility of technology-based presentation in the traditional college environment. For example, institute policy currently requires students and faculty to attend each class in the traditional mode. This policy creates an inherent structural limitation for the diffusion of technology-based teaching delivery. That is, any technology-based delivery will need to be conducted in tune the current workload of both groups.

Visibility examines how apparent or visible the use of the innovation is in the organization or school context. In the context of our sample, technology use for lecture/presentation delivery is a relatively more recent innovation than technology use for lecture/presentation preparation. At this early stage, increasing the rate of adoption of this innovation will require strategies that promote the physical presence of the innovation throughout the institute. For example, vendors of technology-based delivery products could be invited by the institute to promote their products at staff meetings. The administration of the institute could also identify faculty and students in other institutes involved in best practice in this area and invite them to the institute to share their experiences.

Ease of use is concerned with the ease of using, learning, and implementing the innovation. In the context of our sample, technology-based lecture/presentation delivery is relatively new to faculty and students and at this stage they may be unfamiliar with the technologies supporting this mode of learning owing to its integration with the web-interface. As such, the management may adopt a number of strategies to assist the users' perceptions during this initial phase including increased time for professional development, the employment of competent e-Learning resource developers, and the provision of adequate user-friendly infrastructure to facilitate the implementation process. Another important strategic consideration is the identification and acquisition of existing e-Learning resources suitable to the teaching and learning context of the institute. This process will allow faculty and students to build on existing modules thereby reducing difficulties of implementation.

Conclusions and Future Research

The findings in this study indicate that managements seeking to increase the rate of technology use by faculty and students should consider the various activities being supported by the Web and develop separate strategies for each situation. When developing these strategies management can utilize DOI theory and specifically consider users' perceptions regarding the attributes associated with using the facilities in various teaching and learning contexts. The discussions above provide various examples and suggestions of how this framework may be utilized in the development of strategic plans for the integration of e-Learning in B-schools including: the design and planning of educational technology courses; e-Learning resource acquisition; and ICT infrastructure planning.

While this study investigated the adoption of the high-tech from the perspective of faculty and students, future research utilizing the same methodology could consider comparisons across

various b-schools. Future studies could also utilize the same methodology employed in this study to investigate other applications of ICT in b-schools or even other applications of the Web such as use of the Web for assessment purposes.

Also, future studies incorporating a longitudinal design may provide deeper insight into the complex underlying interactions involved during the e-Learning diffusion process. For example, the introduction of a new e-Learning technology into a b-school could be examined at various stages throughout the implementation process to ascertain the stability or otherwise of teacher perceptions regarding the innovation attributes examined in this study.

In summary, the theoretical framework utilized in this study provides a rich and potentially fruitful area for further research and has practical implications for faculty, managements, and vendors concerned with the diffusion of e-Learning in traditional educational institutions.

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