

A Model of User Acceptance of E-learning Technologies: a Case Study of a Polytechnic in New Zealand

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Abstract: Digital technologies are revolutionizing the practices of teaching and learning at colleges and universities all around the world. With the emergence of internet and web technologies, tertiary institutions are increasingly exploring the potential uses of e-learning technologies to cater for the ever growing demands of flexible teaching needs in distance education. Teaching institutions are making significant efforts in e-learning development and investing significantly in associated information technology infrastructure with the expectation of high return of their investment. However, in spite of this effort and investment the teachers and faculty do not always use the technology as expected and often e-learning systems continue to be underutilized.

This paper introduces a model which integrates the findings from previous research into the factors which affect the attitude of academic staff towards the adoption of e-learning technologies. Factors were classified into three key categories: individual, system and organizational, which were then divided into sub-categories. The model presents a detailed analysis for factors relating to: (a) individual characteristics; (b) individual perceptions; (c) e-learning system characteristics; (d) external system characteristics; (e) organisational support and (f) organisational characteristics.

The model has been validated by a case study which investigated the factors that influence or inhibit the adoption of e-learning technologies in a polytechnic in New Zealand. A group of teaching staff at a polytechnic were interviewed to ascertain their views on adopting e-learning technologies in their teaching process.

The results show that whilst individual and system factors have a strong influence on users' attitudes to system adoption, the organisational factors are most crucial for user acceptance in e-learning technologies. The users ranked that lack of institution strategy, lack of time and lack of training support as the three most critical barriers for user adoption of e-learning technologies.

1. Introduction

Economic, social and technological forces are placing enormous demands on tertiary educational institutions and call for increasingly flexible and diverse systems to cater to an ever-growing range of learning needs. Flexible approaches aim to provide learners with greater choice over when, where and how they learn by adopting various flexible

delivery strategies such as distance education, online learning, mixed mode delivery, self paced or self directed learning strategies.

Traditionally, tertiary institutions delivered their flexible teaching programs to students with the aid of print based course material and with limited information technology support such as email and electronic discussion lists. However, with recent advances in the digital technologies, institutions are increasingly seeking the potential use of information and communication technologies (ICT) to facilitate their flexible teaching needs. In particular, with the emergence of internet and web technologies, tertiary institutions around the world have been seeking to exploit the use of e-learning technologies to support their distance teaching. Smith and Rupp [SR04] assert that with response to growing needs of the student population, online education is increasingly common in tertiary education.

For some time now the tertiary sector in New Zealand has been investigating the potential use of e-learning medium for distance education. Over the past few years the institutes and polytechnics in New Zealand have been investing in e-learning technology development and associated Information Technology infrastructure to embrace this new online delivery medium in their institutions. The preliminary survey conducted within Association of the Polytechnics in New Zealand (APNZ) in 2003 confirms that all ten institutions participating in the survey used an e-learning application – a Learning Management System (LMS) to facilitate online teaching [Ni03]. There are government strategies to influence uptake of e-learning technologies within the sector and there is a special collaborative e-learning development fund for New Zealand Universities and Polytechnics pursuing e-learning development [Ne03]. Whilst studies have shown that e-learning technologies extend the quality of face-to face teaching [Ba00], the introduction of e-learning technology in teaching institutions has often been complex and teachers and faculty do not always use technology as expected. With regards to online teaching, the US National Centre for Education Statistics (NCES) reported that during Fall 1998, only 6% of faculty staff taught at least one distance education class [NC02]. In Australia, statistics from the National Centre for Vocational Education Research (NCVER) [NC00] student outcomes study showed that only 2.2% of all graduates completing their studies had experienced some form of online delivery [NC00]. In New Zealand, a preliminary survey by Nichols [Ni03] within ten Institutes and Polytechnics confirmed that only 8% of their face to face courses had some form of online support.

The purpose of this research is to study the factors that would influence or inhibit the adoption of e-learning technologies in teaching and learning environments and to find out how such factors are significant when adopting this technology in a New Zealand tertiary institution. This study considers two facets of e-learning during its adoption by organisations: content development and content delivery. Each aspect will have different stakeholders, cultures and technologies and the study seeks to answer the following questions:

1. What are the barriers that tutorial staff see for the online content development process?
2. What are the barriers that tutorial staff see for the online content delivery process?

3. Does flexible administration support systems influence staff adoption of e-learning technologies?
4. Does individual perception and organisational culture towards e-learning influence staff adoption of e-learning?
5. Does the institutional strategy and direction influence individual uptake in e-learning?
6. What are the most critical barriers that staff see for e-learning adoption?
7. What measures should institutions take to address such barriers?

The study was carried out in a medium sized polytechnic in North Island in New Zealand. A total of ten tutorial staff from a cross section of different academic programs were interviewed to ascertain their views on adopting e-learning technologies in their teaching practice. The interview schedule was prepared based on the factors contributing to e-learning adoption that were identified during a literature review from the various journals and publications by well known practitioners and researchers in the field.

The findings from this research will assist to determine the critical factors for e-learning adoption and will provide an insight for educators and institution leaders to address any barriers to its successful implementation. It is noted that there has been no comprehensive study done to-date to identify the factors leading to staff adoption of e-learning systems in tertiary institutions in New Zealand. Therefore it is envisaged that the findings of this study would be useful for the wider communities in the tertiary sector in New Zealand.

2. Current practices in adopting e-learning technologies

Institutions are adopting e-learning technologies for two purposes: 1) to enhance the flexibility of traditional classroom based face to face courses with web access to syllabi, materials and discussions or 2) as a sole channel of distance education modality that eliminates or reduces “on-ground” classroom time [Gr01].

Educators rarely have all the technological skills needed to develop custom web sites for online classes. Therefore, many educational institutions have adopted online course-building applications, or Learning Management Systems (LMS), such as Blackboard or WebCT to facilitate online learning [Vr04]. The two major functionalities associated with LMS are the course administration and management and course pedagogy, teaching and learning [Vr04]. A review of previous research into the adoption of e-learning systems indicated that the following issues have a significant influence on staff attitudes.

2.1 Institution Strategy in e-learning

Institutions are investing large amount of money in e-learning development and with little progress towards organisational outcomes, [Gr01]. Organisations lack enterprise-wide strategic approach for e-learning development across the organisation. There are random acts of progress or “pockets of excellence” within various faculty units by those

who are keen on this technology. Graves [Gr01] claims “Far too often the idea is to throw technology onto the playing field and cheer for those who pickup the ball and run with it. Relatively few institutions take a strategic approach to ensure a pay off at the institutional level”. He points out that to achieve real progress, e-learning development should tie back into the institution mission, and that institutions must have strategies that enterprise in scope.

2.2 Staff Development

All staff involved in flexible and online learning require a wider scope of knowledge. However the literature suggests that relatively few institutions have organisation wide staff development programs in place to provide for varying skill development needs for their staff [NC00]. Well developed skills in writing, communicating, interpreting, conveying and providing logical concise information, are just as important as technological skills such as ability use email, internet and presentation applications [Ne04]. In addition staff require organisation and administrative skills to design and develop online courses. More importantly, faculty need to understand new pedagogy for teaching online, that is, most effective practices for teaching when much of the learning environment is online [ILL99].

2.3 Information and Communication Technology Infrastructure

Sound information and communication infrastructure play a key role in successful delivery of online content to distance students. Lack of reliability, performance and timely support of infrastructure could inhibit both tutors and the students from accepting this technology. More often institutions have at least the core IT infrastructure needed to support distributed learning [HH02]. However, developing online courses will require additional equipment and specialised software— for example, additional servers and a course management system. Student access requires network bandwidth and modem pools or internet service provider connections. These facilities need to be well managed and maintained to achieve a high degree of reliability.

2.4 Access to flexible Administration systems and Services

With more courses being delivered fully online, students today expect much more than online access to course material or to courses. They expect access to both academic and administrative services [Gr01]. Graves [Gr01] asserts that most institutions have adopted e-learning technologies, however, they lack sufficient integration to other administrative systems within the organisation. He stresses the importance of integrating academic and administrative services on the web through a single and personal point of contact for students, instructors and other stakeholders.

2.5 Staff time for distance teaching

While distance learning provides a host of teaching and learning practices that may be convenient for students, it is far more labour intensive than traditional face to face teaching practice; creating courses, maintaining discussion forums and responding to e-mails from students around the clock requires far more time than effort from educators [LS03]. Educators point out lack of time to design, develop, maintain and support online classes is a major barrier in adopting e-learning systems.

2.6 Individual perception and Faculty culture

Individual perception and faculty culture plays an important role for tutors' acceptance or rejection of e-learning systems. Faculty express much apprehension towards online education [OBH01]. In particular, they perceive that online dialogue will replace face to face interaction. There is also a concern that online teaching would be a mandated rather than a supplementary option for faculty and students.

3. Models of User Acceptance

The successful use of information technologies is dependent on many factors of end users. There has been considerable research on the factors that predict whether individuals will accept and voluntarily use information systems. The literature in user acceptance of technology identifies various theoretical models and frameworks which attempt to explain how users come to accept and use a technology. The commonly cited models in the literature are: (1) Technology acceptance model (TAM) by Davis [Da93; VD00] and (2) Diffusion of Innovation by Everett Rogers [Ro83; Ro03].

These models express that there are various social and organisational factors influencing the user acceptance of technology and they signify that such factors should not be considered in isolation from technical aspects. This is particularly important when deploying complex inter-organisational systems, such as e-learning systems or distributed systems which cut across various user groups and units within the organisation.

A major weakness of these common technology acceptance models is that they simply investigate the user perception of system characteristics or social influence on user acceptance and that they fail to consider contextual or organisational factors that may influence the user uptake. In contrast, the literature into the factors leading to e-learning technology adoption suggests that there are multiple factors including individual, system and organisational factors influencing user acceptance. Therefore, this study did not adopt the published models but developed a new framework for user acceptance in e-learning systems.

Analysis of the literature review suggests that all e-learning adoption factors could be framed around three key factors: individual, system and organisational factors. Further,

each key factor could be further framed around sub factor groupings. The sub factors under the individual factor are individual characteristics and individual perception. The individual characteristics highlighted in the literature are the skills and knowledge needed to develop and deliver online courses. The aspects relating to the individual perception are: influence on colleagues, system relationship to quality of teaching, its relationship to face to face teaching and the effects of school culture for e-learning technologies.

The sub factors under system factor are LMS system characteristics and external system characteristics. The LMS system characteristics identified as limitation on LMS system functionalities, flexibility, its usefulness and its user friendliness. The external system characteristics are: the capacity of ICT infrastructure, reliability of ICT infrastructure and availability of other administrative systems to complement the delivery of online classes.

The sub factors for organisational factor are organisational support and organisational characteristics. The organisational support factors are: training and support for content development, time allowances, incentives and rewarding mechanisms, IT training and helpdesk support. The organisational characteristics factors identified are: faculty culture, school wide e-learning strategy, institutional leadership and institutional strategy.

The framework for user acceptance in e-learning system is summarized in Figure 1 below.

4. Methodology

The research into the factors that influence or inhibit the adoption of e-learning system was carried out using staff at the Polytechnic. A cohort of ten staff was selected for the sample group. The structured interview approach was used as it suited the exploratory nature of the research and an interview schedule was developed which was based on the factors which were identified in the model. The interview schedule that it could be completed within one hour was developed.

The research sample was selected from participants of the on campus Blackboard e-learning program, conducted by the e-learning co-coordinator at the Polytechnic. At the time of this study 60 Polytechnic staff members had completed the initial Blackboard training and the list provided participants' details such as their name, job title and school name.

It was decided that the research sample should comprise different adopter groups such as non adopters, partial adopters and full adopters to ascertain the wider issues regarding adoption of e-learning. To facilitate this, with the assistance from the e-learning coordinator, each listed participant was ranked based on their adoption level. All participants were grouped into these three adopter groups. The final sample was

randomly selected incorporating staff from all three adoption categories identified above. Potential participants were contacted via email with a covering letter and a summary of the questions to be raised.

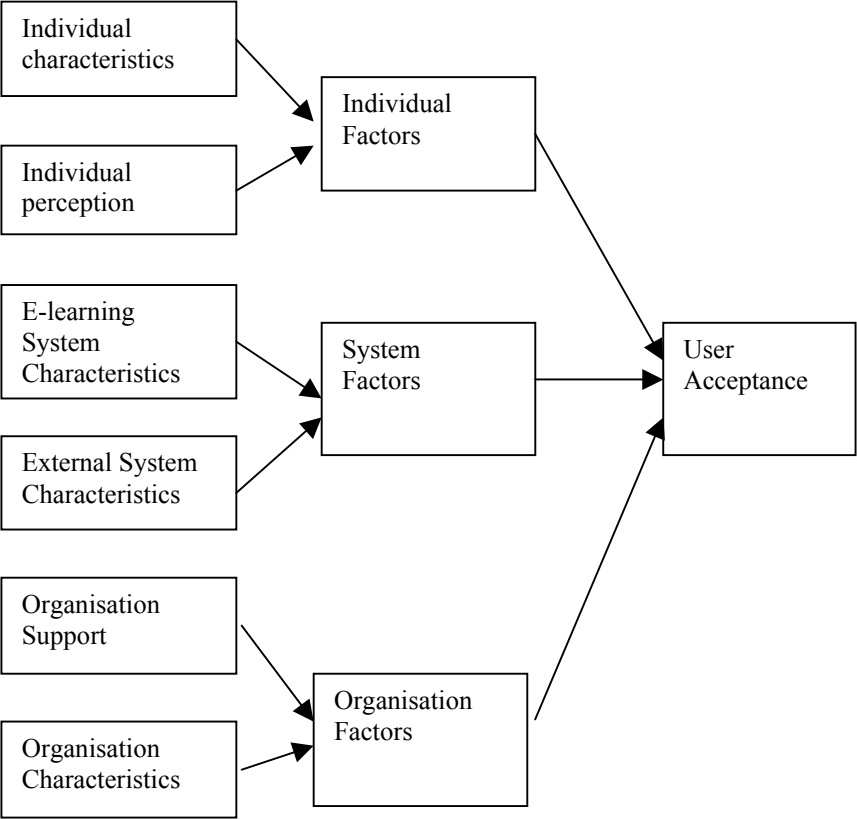


Figure 1: Framework for User Acceptance of E-Learning Technology

To facilitate administration of the interview, the interview schedule was organised to follow the process course development and delivery and focused on a series of key issues. The overall structure of the interview examined aspects of e-learning such as content development, content delivery, system characteristics, individual perception and organisational factors. The schedule therefore did not directly follow the order in which the factors appear within the framework illustrated in Figure 1.

The interview schedule was divided into six parts. The first part asked questions relating to demographic details such as staff job title, teaching experience, age, gender, qualification, subjects currently taught, computer literacy rate and their current knowledge in e-learning technologies. The second part investigated the current teaching delivery practice and the use of Blackboard LMS for their current teaching process. The third part asked a series of questions relating to barriers to online content development and delivery process. The fourth section investigated their perceived need for flexible administrative systems to complement e-learning adoption. Each of the areas examined in the interview questions contained several questions and used response categories anchored to a five point Likert scale. The fifth section investigated individual perception of e-learning technologies, organisational support, institutional leadership and strategy on e-learning development. Finally, in Section 6 staff were asked to list and rank the most critical barrier to adopting e-learning technologies in their teaching process.

5. Results and Conclusions

The study identified key factors that would influence or inhibit the adoption of e-learning systems by teaching staff. While the research was carried out within a small group of staff, the results present a good insight of the wider range of issues that an academic institute would need to address when adopting e-learning technologies.

The small sample size means that it is not possible to undertake sophisticated statistical analysis of the results and only some descriptive statistics are presented here. However, the findings do enable the most salient findings to be identified and they will be used to inform our future research into the topic.

The study identified two facets of e-learning development: content development and content delivery. It highlighted the fact that institutions embracing e-learning systems would need to deal with multiple factors if the system was to be successfully adopted by its target groups. The multiple factors that needing to be dealt with during each facet of e-learning development are: individual, system and organisational factors. The study introduces an integrated framework incorporating the key factors for user acceptance in e-learning. The results indicate that each of the features that were identified in the framework are likely to have a strong influence on user adoption.

At the individual level, the study revealed that the degree of knowledge and skills in online content design and development would strongly impact on the decision of academic staff to embrace this technology. 60% of respondents indicated that they felt they lacked the knowledge needed to develop and deliver content, despite the fact that they had been on a training course. This result signified the need for adequate training and support during the system implementation stage. The study indicates that the failure to provide extensive training will result in high level of user apprehension in accepting this technology.

The results also indicated that there was a strong relationship between the IT literacy rate of staff and system adoption. The study found that the respondents with higher IT literacy are more confident in adopting this technology and that they would adopt the technology from the early stages of its implementation.

The study identified that individual perception towards e-learning is a significant factor for system acceptance. In particular, the study found that influence from colleagues would strongly contribute to their decision to adopt this technology (70% of respondents). Further, results revealed that the majority of the staff see that an e-learning system would have positive impact on quality of learning and would also enhance the traditional teaching with improved flexibility for distance students.

In terms of system level, it is clear that blackboard LMS lacks desired functionality and flexibility to adopt into varying teaching situations. In particular the study found that the Blackboard was seen to have limitations to create specialised interactive training materials and tools to create course simulations (60% of respondents). Due to such limitations the study found that Blackboard is not suitable to deliver specialised interactive online courses. Blackboard was, however, suitable to be used as complementary tool for face-to-face teaching practice.

The study revealed that external systems characteristics such as capacity and reliability of IT infrastructure are significant factors for user adoption (100% of respondents). It was found that establishing wide range of distance administrative systems such as distance library services and distance student support services would significantly enhance the staff adoption in e-learning technologies (90% of respondents).

At the organisational level, the faculty support for staff release time (80% of respondents), incentives and rewards (60% of respondents), IT training and help desk services (90% of respondents) are key contributory factors for system adoption. It was also revealed that institutional leadership needs to lead the e-learning development and should facilitate the infrastructure and training support for staff adoption. The need for the Polytechnic to invest in a strategic plan for e-learning development across the institute is critical to the successful adoption of e-learning. Any strategic plan developed needs to incorporate an investment plan for redevelopment of organisational administration and support systems to meet the distance learning needs.

Overall, the study identified that while individual factors and system factors have a significant impact on user adoption, the organisational factors (such as institutional strategy, release time for staff and training and support) are essential factors for user adoption of e-learning technologies.

It is recommended that a similar study to be conducted on a larger-scale to determine the factors that influence wider academic groups within New Zealand. While respondents of this pilot study ranked organizational factors as the most critical for their adoption, a larger scale study would helpful to confirm this outcome or identify whether this was unique to this Polytechnic. The recommended large scale study would provide the opportunity for a more comprehensive analysis of the factors under investigation. This

would in turn be highly useful for the academic community in New Zealand tertiary institutions.

6. Bibliography

- [Ba00] Bates, T. (2000). *Managing technological change*. San Francisco: Jossey-Bass.
- [Da93] Davis, F. D. (1993). User Acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *Int. J. Man-Machine Studies*, 38, 475-487.
- [Gr01] Graves, W. H. (2001). The New Challenges of E-Learning. *Ubiquity*, 1(43). *Communications of ACM*. Retrieved 30 August, 2004, from: <http://portal.acm.org.ezproxy.massey.ac.nz/citation.cfm?id=359429&coll=portal&dl=ACM&CFID=32263271&CFTOKEN=96032385>
- [HH02] Hitt, C., & Hartman, L. (2002). Distributed learning: New challenges and opportunities for institutional leadership. *Educause Quarterly*, 25(4).
- [ILP99] Inglis, A., Ling, P., & Loosten, V. (1999). *Delivering digitally: Managing the transition to the knowledge media*. London: Kogan Page.
- [LS03] Levine, A., & Sun, J. C. (2003). Barriers to Distance Education. *American Council of Education/EDUCAUSE*, 5(2).
- [NC02] NCES [National Centre for Educational Statistics]. (2002). *Distance education instruction by post secondary faculty and staff* (Vol. Fall 1998). US: Department of Education.
- [NC00] NCVER [National Center for Vocational Education Research]. (2000). Student outcomes survey.
- [Ne04] Neil, T. (2004). Guiding principals for staff and student support (Unpublished document).
- [Ne03] New Zealand Ministry of Education. (2003). *Interim e-learning framework*. Wellington, New Zealand.
- [Ni03] Nichols, M. (2003). APNZ e-learning forum survey preliminary analysis (Unpublished document).
- [OBH01] Oblinger, D., Barone, C., & Hawkins, B. (2001). Distributed Education and Its Challenges: An Overview. *Educause Quarterly*, 5(31).
- [Ro83] Rogers, E. (1983) *Diffusion of Innovations 3rd ed*. New York : Free Press
- [Ro03] Rogers, E. (2003) *Diffusion of Innovations 5th ed*. New York : Free Press
- [SR04] Smith, T., & Rupp, F. (2004). *Innovation in Open & Distance Learning*: Kogan Page London.
- [VD00] Vankatesh, V., & Davis. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46.(2), 186.
- [Vr04] Vrasidas, C. (2004). Issues of pedagogy and design in e-learning systems. *Communications of ACM*. Retrieved 31 August, 2004, from: <http://portal.acm.org.ezproxy.massey.ac.nz/citation.cfm?id=968086&coll=portal&dl=ACM&CFID=32263271&CFTOKEN=96032385>