

A Model of User Acceptance of Learning Management Systems: a study within Tertiary Institutions 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 use of e-learning technologies to cater for the ever growing demands of flexible teaching needs in distance education. The teaching institutions are making significant efforts in e-learning development and investing significantly in associated information technology infrastructure with the expectation of high return on their investment. However, in spite of this effort and investment the teachers and faculty do not always use the technology as expected and more often e-learning systems continue to be underutilised.

This research investigates the factors that influence or inhibit the adoption of e-learning systems in the universities, institutes of technology and polytechnics in New Zealand. A cross section of teaching staff from different tertiary institutions was surveyed to ascertain their views on adopting learning management systems (LMS) in their teaching process. The survey questionnaire is based on factors that are being advocated by well known practitioners and academics, which were identified through a literature review.

The study reveals three key groups of factors: individual, system and organisational, affecting the adoption of e-learning systems in the tertiary institutions. The report introduces a theoretical framework for user acceptance of e-learning systems and presents a detailed analysis for factors relating to: (a) individual characteristics (b) individual perceptions (c) LMS system characteristics (d) external system characteristics (e) organisational support and (f) organisational characteristics.

The results show that whilst individual factors have significant contribution to the LMS adoption, the system and organisational factors are most crucial for user acceptance in e-learning systems. The users ranked that release time for staff, the ease of use of LMS, perceived usefulness of LMS, training and support to develop online content and the reliability of information and communication technology infrastructure are the five most essential factors for staff uptake in e-learning systems.

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 programmes 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. Among the diverse e-learning technologies, the learning management system (LMS) is a popular e-delivery medium within institutions. Smith and Rupp (2004) 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 uses of the e-learning medium for distance education. Over the past few years the universities and polytechnics in New Zealand have been investing in e-learning technology development and associated ICT infrastructure to embrace this new online delivery medium in their institutions. The preliminary survey conducted within the Association of the Polytechnics in New Zealand (APNZ) in 2003 confirms that all ten institutes of technology and polytechnics (ITP's) which participated in the survey used an e-learning application or a LMS to facilitate online teaching (Nichols, 2003). There are government strategies to influence the 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 (Ministry of Education, 2003). Whilst studies have shown that e-learning technologies extend the quality of face to face teaching (Bates, 2000), 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 reported that during Fall 1998, only 6% of faculty staff taught at least one distance education class (US Department of Education, 2002). In Australia, statistics from the National Centre for Vocational Education Research (NCVER) 2000 student outcomes study showed that only 2.2% of all graduates completing their studies had experienced some form of online delivery (NCVER, 2000). In New Zealand, the preliminary survey conducted in 2003 within ten ITP's confirmed that only 8% of their face-to-face courses had some form of online support (Nichols, 2003). A 2005 study within all ITP's, facilitated by the Ministry of Education e-learning research fund, found that over half (51%) of the 817 survey respondents were not involved in any e-learning course development. The study further found that, of the 49% staff that were involved, 20% were either developing or delivering only one online course (Mitchell, Clayton, Gower, Barr & Bright, 2005).

This research aims to achieve two objectives. Firstly, the study intends to identify the factors that are significant for e-learning system adoption, in particular the LMSs, in New Zealand universities and the polytechnics. The research results will assist to determine the most significant factors, including the most essential, for e-learning system adoption which in turn will provide an insight to New Zealand academic communities and institutional leaders to address any barriers to user uptake.

The second objective of the study is to introduce a theoretical framework for user acceptance in e-learning systems. The study intends to build a framework integrating the factors that are directly relevant for e-learning adoption as well as the factors from recognized information systems user acceptance models. It is therefore anticipated the

proposed framework, embedded with theories from information systems acceptance, would provide a credible source for academic institutions to understand all key drivers for user acceptance in order to proactively design interventions (including system characteristics, training and support) targeted at populations of staff that may be less inclined to adopt, resulting in higher uptake and higher return on their e-learning technology investment.

This study considers two facets of e-learning during its system adoption by institutions: 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 is the current organisational setting in relation to e-learning development in New Zealand tertiary institutions?
2. What is the current degree of e-learning technology, including LMS adoption rate within the tertiary sector in New Zealand?
3. What are the key determinant factors for LMS adoption?
4. What could be the appropriate framework for LMS system acceptance?
5. What are the individual characteristics that staff see as important for online content development and delivery process?
6. Does individual perception and organisational culture towards e-learning influence the staff uptake in e-learning systems?
7. Could the degree of flexibility and functionality attributes within LMS have an impact on staff uptake?
8. Do flexible student administrative and learning support systems within the institution influence the staff uptake in LMS?
9. What are the organisational support factors that could influence the individual uptake in LMS?
10. What are the organisational characteristics that could influence the individual uptake in LMS?
11. What are the most significant factors that staff see as essential for their e-learning system adoption?
12. What conclusion could be reached on the validity of the LMS acceptance framework introduced?

The study was carried out within universities and ITP's in New Zealand. A total of ninety five teaching staff from a cross section of different academic programmes were surveyed to ascertain their views on adopting a LMS in their teaching practice. The survey questionnaire was based on the factors contributing to e-learning adoption as well as the factors from information systems user acceptance models that were identified during a literature review from various journal articles and publications by well known practitioners and the researchers in the field.

2. Current practices in adopting e-learning technologies in tertiary institutions

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 (Graves, 2001).

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 a LMS to facilitate online learning (Vrasidas, 2004). The popular LMS systems in use are Blackboard, WebCT and Moodle applications. Vrasidas (2004) described that two major functionalities associated with LMS are course administration and management and course pedagogy, teaching and learning (Vrasidas, 2004).

2.1 Staff development

All staff involved in flexible and online learning requires a wider scope of knowledge. However the literature suggests that relatively few institutions have organisation wide staff development programmes in place to provide for varying skill development needs for their staff (NCVER, 2000). Well developed skills in writing, communicating, interpreting, conveying and providing logical concise information, are just as important as technological skills such as ability to use email, internet and power point applications. In addition staff need to acquire 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.

It is common in large institutions to establish a well developed learning technologies unit to assist staff in teaching online. These units provide instructional development services including training faculty members to use e-learning software, assisting them in understanding online pedagogy, assisting them with instructional design, helping them develop courses and so on.

2.2 Individual perception and faculty culture

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

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 on infrastructure could inhibit both tutor and the student from accepting this technology. More often institutions have at least core ICT infrastructure needed to support distributed learning. 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 the increase in 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. Graves (2001) 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.

In addition to providing online courses, the institutions needs to provide electronic access to student services such as distance library services, course enrolment, student advice and support services, financial aid and the book store. Britin, Liber, Perry and Rees (2004) assert that many current student support systems in teaching institutions are designed to support the on-campus students and that organisations shifting to deliver online courses need to revamp their existing administrative systems to support students with single sign-on to all learning and administrative resources.

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. 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 Institution strategy in e-learning

Institutions are investing a large amount of money in e-learning development with little progress towards organisational outcomes (Graves, 2001). Organisations lack an 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 (2001) 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 are enterprise-wide in scope.

3. Models of user acceptance

The literature into the user acceptance of information systems identifies various technology acceptance models and frameworks for factors influencing user adoption. The four frequently cited models in the literature are: (1) Technology Acceptance Model (TAM) (Davis, 1993) (2) TAM2 (Venkatesh & Davis, 2000) (3) The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al, 2003) and (4) Diffusion of Innovation by Everett Rogers (1983).

Davis' TAM model 1993 proposes that perceived usefulness and perceived ease of use are fundamental factors influencing the user acceptance as they influence the user's attitude towards the system. He defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use as "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).

In 2000, Venkatesh and Davis extended the original TAM model to explain perceived usefulness and usage intentions in terms of social influence process and cognitive instrumental processes. The extended model is referred to as TAM2 (Venkatesh and Davis, 2000).

In TAM2 the social influence process highlights the impact of three inter-related social forces impinging on an individual facing the opportunity to adopt or reject a new system: (a) subjective norm, defined as a "person's perception that most people who are important to him think he should or should not perform behavior in question" (b) voluntariness and (c) image factor for user acceptance.

In cognitive instrumental process, the TAM 2 highlights the individual's job relevance and output quality. Results demonstrability and perceived ease of use are other fundamental determiners of user acceptance.

In 2003, Venkatesh et al assessed the similarities and the differences of eight prominent technology user acceptance models. With the outcomes of this analysis, they formulated the Unified Theory of Acceptance and Use of Technology (UTAUT) based upon the conceptual and empirical similarities across models. The eight models reviewed are: theory of reasoned action, the technology acceptance model, the motivational model, the theory of planned behaviour, a model combining the technology acceptance model and the theory of planned behavior, the model of personal computer utilisation, the innovation diffusion theory, and the social cognitive theory.

The UTAUT theory presented by Venkatesh et al (2003) states that four constructs play a significant role as direct determinants of user acceptance and usage behavior. They are: performance expectancy, effort expectancy, social influence, and facilitating conditions. The authors defined the performance expectancy as the degree to which an individual believes that using the system will help him or her to attain gains in job performance. The effort expectancy is defined as the degree of ease associated with the use of the system. The social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system. Facilitating conditions are defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system (Venkatesh et al, 2003).

Diffusion of Innovation framework published by Everett Rogers (1983), states that an innovation was conceived of as an object with five perceived attributes: relative advantage, compatibility, complexity, trialability and observability. These attributes help one to explain its adoption.

The literature review of the factors relating to e-learning adoption suggests that all factors could be framed around three key factors: individual, system and organisational. Analysis of these factors suggests that 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 of colleagues, the system relationship to the quality of face to face teaching, the system relevancy to face to face teaching and the effects of school culture for e-learning technologies.

The sub factors under the system factor are LMS characteristics and external system characteristics. The LMS characteristics identified are: the availability of appropriate functionalities, flexibility and content design tools of the LMS, its usefulness and its user friendliness. The external system characteristics are: the availability and capacity of ICT infrastructure, reliability of ICT infrastructure and availability of other administrative systems such as online enrolment, distance library services, distance student support services, online assessment and a secure medium to post student results to complement the delivery of online classes.

The sub factors for the organisational factor are organisational support and organisational characteristics. The organisational support factors are: training and support to design and deliver online content, staff time allowances, incentives and rewarding mechanisms, ICT training and helpdesk support. The organisational characteristics factors identified are; the need for faculty wide e-learning strategy, organisation culture towards e-learning, institutional leadership and institution wide strategy and funding priority for e-learning development.

The study assessed the established information technology user acceptance models to identify their suitability to adopt in the study. A conclusion of this analysis was that while the established models had elements that are relevant to e-learning user acceptance, none of the models consist of all factors - individual, system and organisational, that have been identified for e-learning system acceptance. This study therefore did not consider using the established IT user acceptance models; instead the study developed a new unified framework for e-learning user acceptance (Figure 1), incorporating the factors that are directly relevant for e-learning as well as the appropriate information systems user acceptance elements from published technology acceptance models such as TAM, TAM2 and UTAUT.

The factors from TAM, TAM2 and UTAUT models were included into all three factor groupings of the proposed e-learning framework. The social influence aspect from TAM2, individual perception, is included into the individual factor grouping of the framework. The user perception of system characteristics, ease of use and the usefulness of the system from TAM, are included in the system factor grouping. The facilitating conditions from UTAUT, organisational support factors such as staff training and time incentives are included in the organisational factor groupings. The overall framework for user acceptance in e-learning system is summarized in Figure 1.

4. Methodology

The research into the factors that influence or inhibit the adoption of an e-learning system was carried out using a study sample comprising tertiary staff in New Zealand. A total of 95 teaching staff from eight tertiary institutions (two universities and six institutes of technology and polytechnics (ITP's)) took part in the study giving their opinion on the

factors for LMS system adoption. In order to gather a large volume of data from dispersed locations the survey approach was selected to collect the data.

The research survey was conducted using an online questionnaire via the web medium. It was decided that the survey questions should be developed based on the factors identified in the theoretical framework introduced (see Figure 1). The questions followed the order of the e-learning framework with questions clustered into individual, system and organizational factor groupings.

The questionnaire was structured into three parts. The first part asked questions relating to demographic details such as, the name of the institution, staff job title, subject area, teaching experience, highest qualifications, age and gender. This section further included questions relating to computer literacy rate, current knowledge in e-learning, level of LMS training attended and the types of teaching methods adopted to deliver current course modules or papers. The second section investigated the factors for LMS adoption. The section was divided to sub sections, incorporating questions pertaining to different aspects of system adoption. The sub sections were: individual characteristics, individual perception, LMS characteristics, the external system characteristics, organizational support and organisational characteristics. All questions in these sub sections contained response categories anchored to a five point Likert scale to ascertain staff opinion on LMS adoption factors. Finally, in part three, all e-learning adoption factors that were investigated in part two were presented to identify the most critical factors for LMS adoption. In this section the respondents were asked to select the five most critical factors for system adoption and asked to rank them (one to five) in their order of significance.

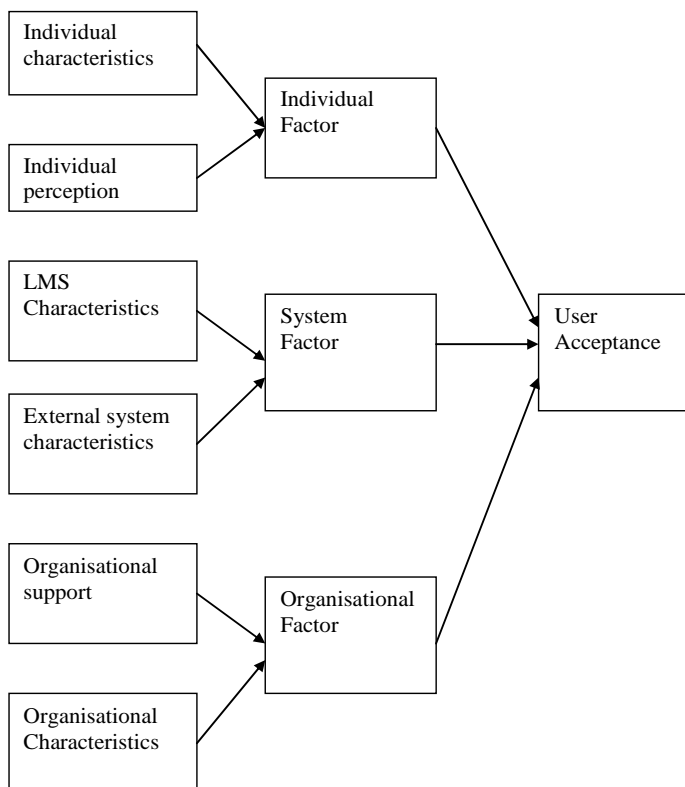


Figure 1: Framework for user acceptance of Learning Management Systems

In order to enhance the credibility of the research, it was decided to invite a wider group of teaching staff from many New Zealand universities and ITP's with different e-learning adopter groups: non adopters, partial adopters and full adopters. In particular it was highlighted that more participation from non adopter or partial adopter groups would be useful to ascertain their barriers for system adoption.

5. Results and Conclusions

The study explored the e-learning development trends in the institutes of technology and polytechnics (ITP) sector in New Zealand and found that there is strong interest from institutions in promoting e-learning technologies. It was found that all ITPs have invested in a learning management system (LMS) to promote e-learning within their institutions. It was however revealed that despite the effort by institutions to introduce e-learning technologies, there is low uptake from staff.

In terms of organisational settings, the analysis suggested that characteristics of the institution have little impact on the final outcomes of the results.

The study found that over half of New Zealand tertiary teaching staff had considerable teaching experience (over 10 years) and higher academic qualifications such as masters and doctorate degrees. The study also found that the majority of staff had high computer literacy levels however their e-learning knowledge was comparatively low in comparison to their computer literacy levels. The research found that the degree of e-learning knowledge was varied according to age group. Staff over 50 years old had a lower knowledge than staff less than 50 years old. The e-learning knowledge, however, was greater among the experienced staff (over 10 years) and staff with masters and doctorate degrees than those who had lesser experience and qualifications.

In terms of technology adoption, the study found that over half (60%) of the tertiary courses are supported with some form of e-technology tools, such as email, e-discussion lists or video conferencing. The LMS adoption rate, however, is low with only 38% of all papers delivered with the aid of LMS systems.

The study identified key factors that would influence or inhibit the adoption of LMS by teaching staff. While the research was carried out within a comparatively small group of staff of New Zealand tertiary institutions, 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 analysis outcomes suggest that the findings of the study are relatively universal and are not influenced by staff age, gender or the institute type.

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 need 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 a significant majority of the features 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 delivery would strongly impact on the decision of academic staff to embrace this technology. This result signified the need for adequate training and support during the system implementation stage. It indicates that the failure to provide training will result in high level of user apprehension in accepting this technology.

The study identified that individual perception towards e-learning is a significant factor for system acceptance. The study leads to the conclusion that influence of colleagues is a key factor, but not all pervasive. Slightly over half of the survey sample agreed that the influence of their colleagues would impact upon the adoption whereas around a quarter of the survey sample felt that the opinion of their colleagues would not influence adoption.

There is no single universal belief that staff would adopt the LMS technology even if they believed it would improve their face to face delivery. The opinion of over half the survey sample was that they would adopt LMS technology if they believed that it would improve the face to face delivery. It is notable that a further third of the survey sample disagreed and around a quarter strongly disagreed.

The staff in the survey sample also strongly believed that LMS relevancy towards their face to face delivery was a key factor to influence their uptake of LMS technology. At the same time it could be noted that a positive faculty culture towards e-learning is one of the key influencing elements for staff uptake.

At the system level the LMS attributes that were significantly (over 80% rating) important were; appropriate flexibility, functionality and tools to design and deliver online courses. At the external system level, the sufficient capacities and the reliability of ICT infrastructure are key determinants for system uptake. The study however found that the flexible administration services such as online enrolment, distance library services, flexible student support services, security and reliability of online assessment do not have any major impact in staff uptake of LMS.

In terms of organisation factors, the faculty facilitation of staff skill development in e-content design and delivery and staff release time for online engagement are key contributory factors for staff uptake in e-learning. In addition to the e-learning specific skills, sufficient training in information and communication technologies and facilitating efficient helpdesk services to complement the e-delivery would greatly boost staff interest in e-learning uptake.

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 institutions 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 distance learning needs.

On the whole, the study identified that while individual factors have a significant impact on user adoption, a number of aspects within organisational and the system were ranked as the highest determinants for LMS uptake. The five essential factors that have been identified in their order of significance are: (1) release time for staff (2) ease of use of LMS (3) usefulness of the LMS (4) training and support to develop online content and (5) reliability and performance of information and communication technologies.

From this result it could be concluded that release time for staff to engage in e-learning development is the highest determinant of intention and usage of a LMS. Secondly, the LMS that is offered for adoption should be easy to learn and use. LMS with higher levels of complexity will reduce the uptake of the chosen system. Staff belief on how the system can enhance or attain gains in their job performance is another key determinant for system uptake. The greater the perception of benefit resulting from LMS adoption, the greater the acceptance and use of the system. The strength of the facilitation by the institution to train and enhance staff skills in content design and development is a key influence in increasing LMS uptake. The reliability and performance of ICT infrastructure was the fifth of the essential factors with the highest significance. The conclusion is that the perception of or actual history of failures of the ICT platforms will greatly impede staff uptake in LMS.

Overall, the analysis of the survey results concludes that with the exception of a few items, the majority of elements that have been identified in the proposed e-learning framework have a significant influence over user acceptance in e-learning systems. Of the 26 factors tested, the majority, 13 (50%) factors received a very high degree (agreed by over 75%) of acceptance from staff, another 10 (38%) factors gained high (51%-75%) acknowledgement. The three (12%) factors with the lowest influence within the external system characteristics were: availability of online enrollment system, distance library services and online assessment. These were regarded as the least (rated 25%-50%) important in influencing LMS uptake for staff. However, it may be that these factors might have a strong influence on the adoption of e-learning by students.

The results conclude that the five factors which are essential for e-learning adoption fall within the system and organisational factor groupings within the proposed e-learning framework. It is noted that these factors closely represent the factors that have been selected from the recognized technology acceptance models TAM and UTAUT. The two factors, ease of use and the usefulness factors in the system, represent the perceived ease of use and the perceived usefulness of the system in TAM. The release time, training and support and the availability of ICT infrastructure have similar representation to the facilitation conditions of the UTAUT model. The conclusion is that the incorporation of elements from recognized models have given added credibility and validity for the proposed e-learning framework (Figure 1) in the study thus increasing dependability for its application.

Overall, with this outcome it can be concluded that the empirically tested proposed e-learning framework is a valid representation for user acceptance in LMSs in the tertiary teaching institutions.

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