An Empirical Study of Learning Object Acceptance in Multimedia Learning Environment

Siong-Hoe Lau, Multimedia University, Melaka, Malaysia, lau.siong.hoe@mmu.edu.my
Peter C. Woods, Multimedia University, Cyberjaya, Malaysia, p.woods@mmu.edu.my

Abstract

The purpose of this study was to develop Learning Object Acceptance Model (LOAM) to examine the underlying factors and causal relationships that determine learners' behavioral intention to use multimedia learning objects in higher education. This study called for the 342 respondents to progress through two phases of learning objects participation: Introduction and Direct-use experience. Structural Equation Modeling (SEM) was used to evaluate data from the resultant surveys with the AMOS 4.0. The results showed that the study model produced measurement and structural models with adequate model fits. Learners' perceived of usefulness and ease of use fully mediated the relationship between learning object characteristics and behavioral intention. However, individual characteristics were found to have no statistically significance on behavioral intention in this context.

1. Introduction

In recent years there has been an increased in the role of e-learning, and in the effectiveness and efficiency of various instructional design strategies for multimedia learning environment. One of the most important breakthrough in this regard has come from the reusable object-based learning approach, referred to as "learning objects" [1]. Now, learning objects are gradually becoming popular instructional resources for teaching and learning [2]. More and more instructional content developed specifically to be deployed as learning objects in multiple learning contexts due to its potential for reusability, interoperability, discoverability, and manageability [3].

Like any information systems [4, 5], the success of multimedia learning object technology also depends on user satisfaction and acceptance. A high level of user satisfaction reflects the users' willingness to accept and continue using the technology [6]. The measurement of the user perception [7] and understand the factors that promote the effective use of systems [8] become increasingly important to enhance our understanding and prediction of the acceptance and utilization of educational technologies. Thus, learners' behavioral intentions and acceptance of learning objects need to be explored. The purpose of this study was to develop a Learning Object Acceptance Model (LOAM) to examine and identify the underlying factors and hypothesized causal relationship that determined learners' behavioral intentions to adopt learning objects.

2. Theoretical Background

The growths of the Internet and World Wide Web (WWW) have significantly changed the nature of teaching and learning at all levels of education [9]. Learning objects are self-contained, modular pieces of course material appropriately annotated with metadata. They may be used as a single learning unit or combined to form larger educational interactions to allow teaching and learning to be cantered on the needs and interests of the learners. Now, this concept has gained such broad acceptance and has filtered into the fields of education [2, 10] due to its potential for reusability, interoperability, discoverability, and manageability [3]. Many learning object repositories, such as Multimedia Educational Resource for Learning and Online Teaching (http://www.merlot.org/), Connexions (http://cnx.org/), Campus Alberta Repository of Educational Objects (http://careo.netera.ca**/),** Educational Object Economy (http://www.eoe.org) and Wisconsin Online Resource Centre (http://www.wisc-online.com) have been developed to cater for a variety of knowledge domains. Commercial companies like Cisco Systems Inc. and National Education Training Group Inc. have also introduced the concept of learning object in their Web-based training strategies to cater for a variety of knowledge domains [11, 12]. Surry and Ely [13] pointed that there is no guarantee for the adoption of an instructional sound and technically superior instructional resource itself because it is a complex process that is influenced by many factors such as individual attributes, system characteristics, organizational and social interactions. Thus, understanding why learners use instructional technology and why they do not seems very important to the educators and instructional designers.

There have been numerous empirical studies relating to the adoption and diffusion of IT innovations in the field of Management Information Systems (MIS). Thus it would be beneficial to study information technology acceptance in educational contexts by building upon the foundations in both the education and MIS areas. Several intention-based theories and models have been applied to a variety of information technologies in different contexts and populations in understanding user adoption and usage of IT innovations [14-16]. For example, the Theory of Reasoned Action (TRA) [17], the Technology Acceptance Model (TAM) [18], the Theory of Planned Behavior (TPB) [19], Innovation Diffusion Theory [20], and the IS Success Model [21]. Among them, the TAM [18] is one of the most influential

and frequently tested models, and widely applied to explain general information technology adoption in the MIS literature [22, 23].

In this study, an extended version of TAM was developed to examine how external variables and users' beliefs and perceptions will influence the usage of learning objects as supplementary learning resources in addition to traditional face-to-face class in enhancing the student's learning. The findings of this study, hopefully, will assist educators and instructional designers in understanding the underlying factors leading to an effective and efficient use of learning objects and also in identifying causal relationships in predicting learners' acceptance of learning objects.

3. Research Model and Hypotheses

The study model is formulated with the constructs and variables gleaned from the literature of education and MIS research to determine underlying factors and causal relationships in predicting learners' acceptance of learning objects. Figure 1 portrays the preliminary LOAM for this study which integrates not only the core determinants of TAM, but also two external variables was studied. This research model involves testing four sets of hypotheses as follows:

H_1 – Perceived usefulness of learning object is positively influenced by the learning object characteristics of technical quality (H_{1a}), content quality (H_{1b}), and pedagogical quality (H_{1c}), the individual characteristics of self-efficacy (H_{1d}) and Internet experience (H_{1e}) and perceived ease of use (H_{1f}).

H_2 – Perceived ease of use of learning object is positively influenced by the learning object characteristics of technical quality (H_{2a}), content quality (H_{2b}), and pedagogical quality (H_{2c}), and the individual characteristics of self-efficacy (H_{2d}) and Internet experience (H_{2e}).

H_3 – Behavioral intention to use learning object is positively affected by perceived usefulness (H_{3a}) and perceived ease of use (H_{3b}).

H_4 – Actual use of the learning object is positively influenced by behavioral intention to use.

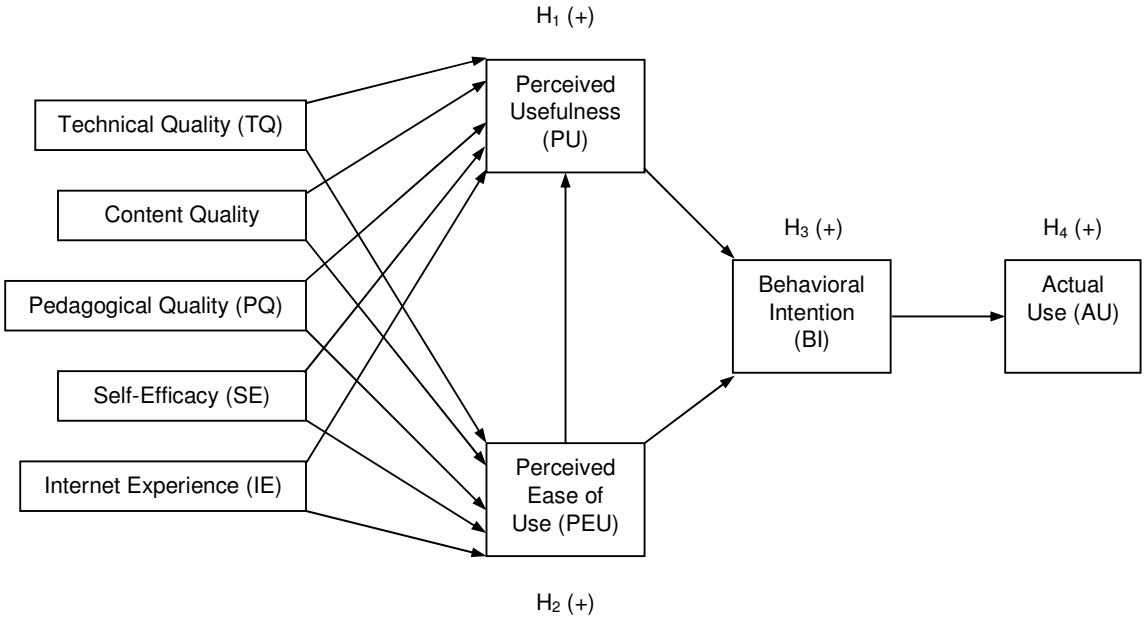


Fig 1. Learning Object Acceptance Model (LOAM)

4. Research Design and Procedures

This study utilized web-based surveys to collect data for quantitative testing of the research model. A review of the IS literature was used to identify existing measures for constructs and variables, which had been used in previous MIS research. Items were rewritten as necessary to fit the context of this study. The target population for this study consisted of undergraduate students from Multimedia University. These students have the basic ability in using the computer and the Internet and have relevant experience in online learning. They as a whole represented those who would be interested in using learning objects and could evaluate learning objects based on their current online learning experience. Learning objects for one subject matter (Digital Systems) were retrieved from various general repositories and assembled like any traditional course hierarchy into chapters, lessons and topics. Relevant learning objects were incorporated into the lecture notes with the aim of

helping students to understand the more abstract and complex concepts of Digital Systems.

The research method used in this study emphasized the pre-usage intention of users and their intention to continue using the learning objects. This empirical study called for the respondents to progress through two phases of participation with learning objects: Introduction and Direct-use experience. Using the longitudinal study approach, subjects were asked questions at each phase. These approaches were designed to ascertain every respondent progress through all two phases of using learning objects as they evaluated and ultimately decided on their actual behavioral intentions to adopt the learning objects. Responses collected from two phases of surveys were matched to create a single record for each respondent. Structural Equation Modeling (SEM) was used to evaluate data from the resultant surveys with computer program AMOS version 4.0 that uses the two-step approach to model construction and testing [24].

5. Data Analysis and Results

The Measurement and Structural Models

The analysis of the measurement model was to refine the preliminary LOAM by eliminating measured variables or latent constructs that did not fit in well with the initial Confirmatory Factor Analysis (CFA). Results from the final measurement model showed a good fit. All the fit criteria were within the acceptance level as shown in Table 1. The χ^2/df (1.030) measure was less than 3.0, RMSEA (0.010) was less than 0.05 indicating a close fit, GFI (0.919), NFI (0.963), and CFI (0.999) were all above the 0.90 acceptable levels, and AGFI (0.900) was also above its 0.80 threshold value.

Building upon the best fitting measurement model, a path analysis for the structure equation model (SEM) with latent variables was performed to evaluate the hypothesized causal relationships that predict learners' behavioral intention to use and actual use of learning objects. As presented in Table 2, the SEM model indicated a good fit to the data with χ^2/df = 1.957, RMSEA = 0.055, GFI = 0.854, AGFI = 0.830, NFI = 0.926, and CFI = 0.962.

Table 1: Measurement model

Model	χ^2	*df*	χ^2/df < 3.0[a]	*RMSEA* < .08[a]	*GFI* > .90[a]	*AGFI* > .80[a]	*NFI* > .90[a]	*CFI* > .90[a]
CFA Model	472.958	459	1.030	0.010	0.919	0.900	0.963	0.999

Note. N = 312. [a] Recommended values.

Table 2 : Structural model

Model	χ^2	*df*	χ^2/df < 3.0[a]	*RMSEA* < .08[a]	*GFI* > .90[a]	*AGFI* > .80[a]	*NFI* > .90[a]	*CFI* > .90[a]
SEM Model	496.731	478	1.039	0.011	0.914	0.899	0.961	0.998

Note. N = 312. [a] Recommended values.

Hypotheses Testing

The proposed LOAM hypothesized fourteen relationships. Most of the parameter estimates exhibit correct signs as shown in Figure 2. Starting from the perceived usefulness of learning objects, pedagogical quality (β = 0.374, P < 0.001) had significant positive effects on it. As expected, perceived ease of use had significant positive effects on perceived usefulness (β = 0.347, P < 0.001). These determinants explained about 64% of the variance of perceived usefulness of learning objects. Therefore, hypotheses H_{1c}, and H_{1f} were supported. The total effects of self-efficacy, Internet experience technical quality and content quality were insignificant. As to perceived ease of use, the major determinant of perceives ease of use was technical quality (β = 0.381, P < 0.001), followed by content quality (β = 0.355, P < 0.001) and pedagogical quality (β = 0.151, P < 0.01). The total effect of self-efficacy and Internet experience were insignificant. Therefore, hypothesized H_{2a}, $H_{2b,}$ and H_{2c} were supported. These determinants accounted for approximately 65% of the variance of perceived ease of use. With regard to behavioral intention to use learning objects, about 58% of the variance in behavioral intention could be explained by perceived ease of use (β = 0.228, P < 0.01) and perceived usefulness (β = 0.564, P < 0.001). Therefore, hypotheses $H_{3a,}$ and H_{3b} were supported. Finally, behavioral intention to use had a significant positive effect on actual use (β = 0.544, P < 0.001). Therefore, hypotheses H_4 was supported. The model accounted for approximately 30% of the variance of actual use of learning objects.

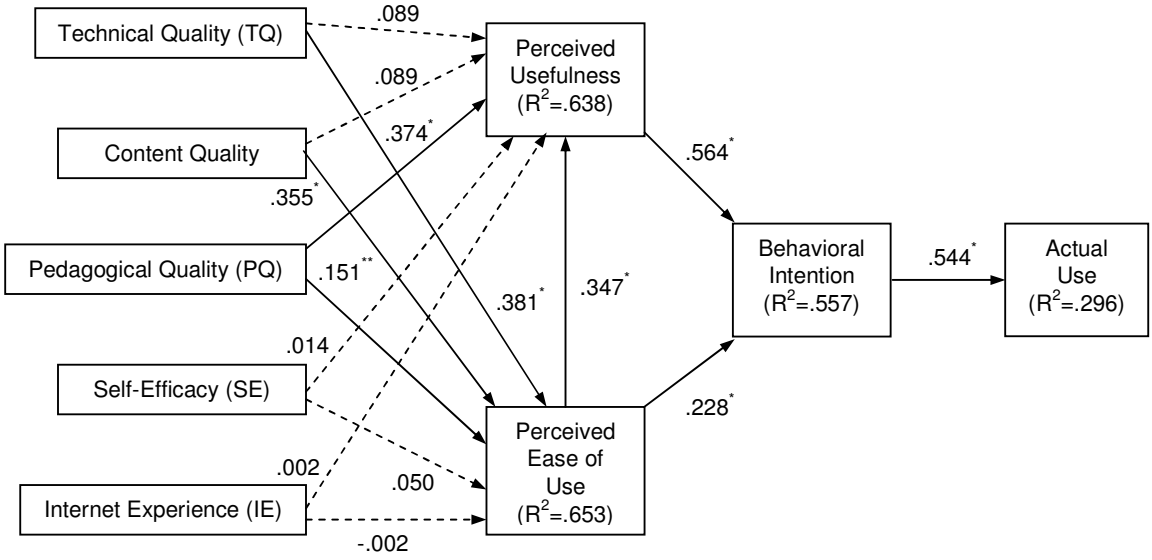
6. Discussions

The purpose of this study was to examine the acceptance of learning objects as supplementary learning resources for traditional face-to-face class as perceived by university students. A test of the proposed model indicated that the learning objects characteristics had significant effect on the use

belief constructs which, was consistent with the influence of more general system characteristics reported in studies of other information technologies [25, 26]. On the other hand, individual characteristics were found to have no significant effect on users' belief constructs and intention to use.

The results also suggest that the users' perceptions of usefulness and ease of use of learning objects had significant influences on their behavioral intention to use and actual use of learning objects. User perceptions of usefulness had even stronger influences on intention to use than user perceptions of the learning objects' ease of use. Additionally, users who indicated that they intend to use the learning objects also performed well in the prediction of their actual use of learning objects.

The importance of the learning objects characteristics and users' beliefs in influencing the behavioral intention and actual use of learning objects have several implications for researchers and practitioners. First, it highlights the importance of attending to learning objects characteristics, especially in usefulness and ease of use when learning objects are designed and developed. Thus, educators and instructional designers of learning objects should carefully consider the needs and values of learning object users, and ensure that the suggested learning objects characteristics in this study are present prior to implementation. For example, learners who perceived that the learning objects had better turnaround time and flexible which allowed for a better feeling of control over course content would indicated that the learning objects were easier to use. Moreover, learners who indicated that the learning objects fitted in with their learning contexts with comprehensive, up-to-date, easy to comprehend contents together with appropriate pedagogy features to support their learning goals helped them to become committed towards the learning. Such compatibility between learning objects and user needs has been found to enhance IT adoption in other contexts [27, 28].



Path significant: *p < .001; **p < .01

Fig 2. LOAM – Path Analysis

7. Conclusion

This study contributes to the understanding of user acceptance of learning objects by identify the underlying factors and causal relationships that predicted learners' behavioral intention and subsequent actual use of learning objects. The proposed study model, LOAM demonstrated that the learning objects characteristics were important determinants of users' belief constructs. Specific characteristics of the learners; self-efficacy and Internet experience had no influence upon users' belief constructs. This indicated that learning object characteristics were important external stimuli for learners as they formed the perception and intention to use learning objects. Users' beliefs of usefulness and ease of use mediated the relationship between learning objects characteristics and behavioral intentions to use learning objects. More studies in the future are needed to verify and refine the findings of this study to expand the knowledge base on important

determinants of learning objects use that will assist educators to understand the factors leading to an effective and efficient adoption of learning objects.

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