




Framework design of university communication model (UCOM) to enhance continuous intentions in teaching and e-learning process

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Abstract

The technology enhancement learning (TEL) needs continuous use and high perception from learners with collaborative of technologies and multi-media applications. The problem of continuous intention in e-learning applications relies on the type of technology used that changes from one university to another. This study aims to design a framework developed from University Communication Model (UCOM) model to enhance the teaching and learning process of universities. This framework gives a high rate of significance and accurate results by examining the relationship between the factors of e-learning application and technology acceptance model (TAM). In additions, an extra factor used for continuous intention to use e-learning applications. The method used shows a survey distributed between 297 participants to validate the hypothesis proposed. The results evaluated by partial-least-structure (PLS) program, suggest and prove the significant use of (UCOM) as a continuous intention in e-learning based on 16 tested hypotheses of model item constructs.

Keywords E-learning · TAM · MOOC · Moodle · UCOM · Continuous intention

1 Introduction

Over the years Technology Enhancement Learning (TEL) services have improved the performance of the academic process of educational institutions, which are installed in both national and international educational systems (Tawafak et al. 2018a, b, c, d, e). In

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academic teaching and learning development process, online-learning has become one of the most common methods used in the educational learning process (Al-Qirim et al. 2018). However, e-learning process is faced with several issues that affect faculty and student satisfaction on learning continuity (Tawafak et al. 2018a). Thus, there is a need for institutions to evaluate their educational learning process towards improving the academic performance of their students through development the continuous intention to use the application in e-learning (Wang and Hannafin 2005).

At the moment, universities are faced with the challenge of how to add value to student learning and at the same time achieve a top-score in the world ranking community (Wilby et al. 2017). Findings from the historical development of educational institutions through different phases show that these changes are closely linked to differences in each phase, which starts with simple training in traditional face to face learning to virtual learning. Nonetheless, it is necessary for any educational system to reflect the educational needs of technology learning (Wang and Hannafin 2005). Thus, TEL is a new important area for study in high educational institutions. They are growing in popularity as a practice that includes the integration of e-learning to mediate, support active learning and authentic collaboration among students via web-based technologies. Findings from prior studies (Benson 2013; Salajan and Mount 2016) advocated for the use of technologies to support communication between teachers and learners to improve learning. The authors believed that use of technologies for teaching and learning offers flexibility to the learner, increase reading and writing of students, improves the confidence of students concerning how they communicate with their lecturers (Benson 2013; Wang and Hannafin 2005; Salajan and Mount 2016).

These variables help to investigate the differences between the individual's implementation of e-learning. Accordingly, this research discusses the following points;

- i. Explores on the influence of educational variables between students, lecturer and course material towards understanding if lecturers and students utilize tools such as YouTube, multimedia and wikis to measure the academic performance, learning enhancement, and student satisfaction.
- ii. Develop the relationship between academic performance and student satisfaction within the domain of e-learning suggested using e-learning model to examine the significant issues related to student achievements.

However, the authors (Clark 1999; Miri & Ariella 2016) did not address the variables that influence a particular domain. Besides, the studies do not consider the relationship among e-learning model as well as improvement of academic performance and student satisfaction. Furthermore, prior studies that adopted (Huang et al. 2017; Hone and El Said 2016) examined Massive Open Online Courses (MOOC) in their models in an attempt to examine the validity of the main variables with enhancing of continuous intention to use e-learning applications (Albelbisi 2019). Conversely, this research integrates the teaching and learning requirement with the technology acceptance model (TAM) variables that used to develop a model validity and continuity (Davis 1989; Islam 2016). Huang, Zhang & Liu, (2017) and Hone & El said, (2016) their findings suggest that several studies aimed to investigate the learning process involved for course content pedagogy concerning lecturers' knowledge with technology integration. Moreover, focused on the impact of students, lecturers, and technology on

communication towards improving learning procedure involved to complete a course using the MOOC model (Bookstaver et al. 2011). For instance, student's initial adoption of the e-learning can be assessed based on peers' suggestions and lecturers support, which may influence the behavior of the student to continuously use e-learning to improve their learning experiences (Lee and Choi 2013). Figure 1 shows the steps of e-learning model techniques.

This paper divided into multi-section: first was the introduction of e-learning applications and its effect on teaching and learning process. Second, shows the research questions and objectives based on the paper target. Third, shows the problem statement that faced the enhancement of UCOM framework. Fourth, the literature review with many parts of existing models and frameworks related to e-learning. Fifth, the methodology where the survey conducted and the type of pilot study. in addition, data collection and model use. Sixth, the discussion of descriptive analysis, reliability, results, and PLS assessment. Seventh, the results, and validity. Besides, the PLS assess and results. Eighth, the conclusion from each objective.

2 Research questions and objectives

Based on the previous discussion mentioned in introduction, this paper tries to arise the following research questions:

- 1) What are the independent variables that influence the teaching and learning process by merging the e-learning model with TAM characteristics?
- 2) What is the adapted model of e-learning (UCOM) to be implemented for continuous intention to use applications for teaching and learning process?
- 3) How to assess the accuracy of the adapted model UCOM being implemented for improving the E-Learning continuous intention?

Then the paper suggested the following objectives:

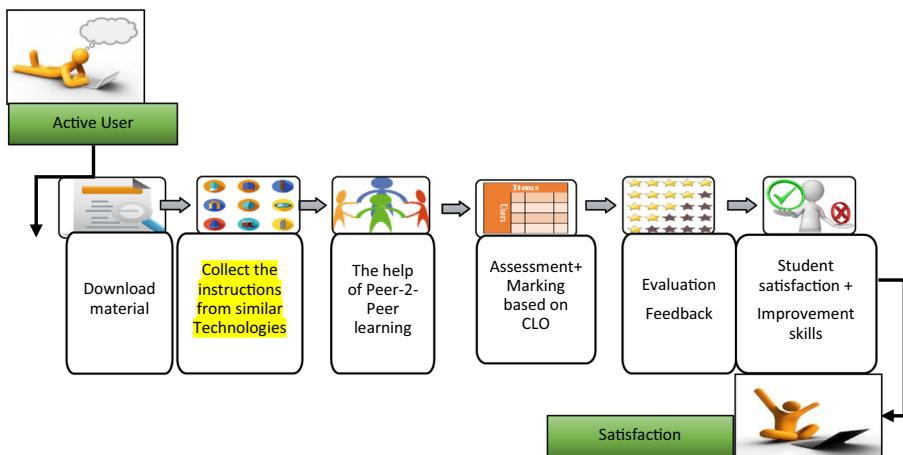


Fig. 1 Proposed E-learning model techniques steps

- 1) To identify the main factors or variables that influence the teaching and learning process using TAM factors.
- 2) To develop a university communication model (UCOM) for determining the model factor sequence that has continuous intention to use e-learning for teaching and learning process.
- 3) To validate the developed model based on survey data analyzed using PLS-SEM for determining the accuracy of the teaching and learning process.

3 Problem statement

Information Technology (IT) is significantly important in supporting the daily operation of organizations. Similarly, it is important to review the accreditation of higher educational institutions not just for assigned guiding principle providers and authorization agencies, but also for the College employees and faculty members (Abdullah et al. 2012). Thus, it is required an approach such as technology-enhanced learning (TEL) to help in the accreditation of students, lecturers, and faculties in universities. This TEL activates the technology features influence impact on student satisfaction, course content, support assessment, and academic performance enhancement Huang, Zhang & Liu, (2017) and Hone & El said, (2016). Accreditation standards is working in corporation with teaching and learning process for enhancing student learning outcomes that effect positively with technology development. The enhancement of e-learning application use connected with the influence of student grades improvement (Abdullah et al. 2012; Graffigna et al. 2014). This improvement relies to easy approve with accreditation based on the assessment development and continuous intention to use by feedback forms and satisfactions improvement (Tawafak et al. 2018c).

Researchers such as Cavanagh et al. (2014) mentioned that the capability of institutional systems such as e-learning could be employed to monitor the whole teaching and learning the quality process by linking results with technology educational learning to ensure a complementary integration between academic performance and student satisfaction. These will entail deploying new technologies for online examinations and use of IT technology applications for electronic assessment methods for managing course materials software for classes instead of face to face conversations (Kleebua and Siriparp 2016).

Furthermore, prior models are based on the perceived ease of use and perceived usefulness as main effective variables to improve the intention to use of e-learning (Salajan and Mount 2012; Barak and Levenberg 2016a, b). But, with changes in the educational domain, there are inadequate methods that can be employed to enhance the benefits of using e-Learning model to help faculties in the assessment of all individual and group student works within a particular cluster. Besides, there are fewer studies that explore how to improve and determine the important variables that significantly influence on the continue of use and acceptance of e-learning concerning satisfaction outcomes.

This study aims to address the following main problem, to develop a model by using the UCOM university communication model as a kind of technology learning adapted tool with Moodle as a common model of open access learning system. The accurate results generated used to compact the integrating theoretical framework to provide an

acceptable institutional accreditation that is related to technological improvement and use. This will enable the re-organization of the variables and classify the result through a partial-least-structure (PLS) program to decide whether accept or reject the accuracy of the developed algorithm as recommended by prior studies (Ralph et al. 2015; Janićijević 2015). Table 1 shows the main drawback of existing models and frameworks with continuous intention to use e-learning applications.

4 Literature review

There are 11 studies used in this research to explain the type of TEL used or manual coursework use to enhance the continuous use with improvements in teaching and learning process of higher education students in universities. These studies explored the research objective of developing the student learning outcomes and the advantages of getting accreditation approval of universities to enhance the teaching and learning process (Serhani et al. 2019).. Besides, there are some studies shows the benefits of using e-learning application to achieve the needed enhancement of teaching and learning in universities. Table 2 shows comparisons between existing models on their research objectives, the model used, applied active mechanism and the limitation of each study (Tawafak et al. 2019).

The collaborative work of teaching and learning process with e-learning applications is another challenge for enhancing the continuous intention to use e-learning applications. The teaching and learning process needs to identify the major features used for agreement and the approval of accreditation standards (Abdullah et al. 2012; Graffigna et al. 2014). Therefore, Table 3, shows the major factors of the accreditation process that approved by Oman Academic Authority Accreditation standards, and its impact on e-learning application outcomes and use AlYahya and Abo El-Nasr (2012). These major features include self-evaluation (Schmid et al. 2014), student learning outcomes

Table 1 Existing methods drawbacks

Authors Name / Year	Model Used	Drawbacks
AlYahya and Abo El-Nasr (2012) + Mohammadi et al. (2012)	Adapting manual coursework	Work was done in the functionality of the team manually
Liu and Chen (2012)	Manual Coursework	Stuck with students of high GP
Ioannou et al. (2015) + Bookstaver et al. (2011)	Wiki Program	Only serving student purpose in learning
O'Bannon and Britt (2011)	Wiki Program	Only serving Lectures purpose
Schmid et al. (2014)	Blended learning	Test only the effectiveness and self-evaluation
Lytras et al. (2015)	Blended learning	Not much satisfied by learners and not guarantee to improve SLO
Chen (2010)	TAM	Faculty improvement not evaluated
Islam (2016)	TAM	ignores the need for continuity use
Pilditch and Custers 2018	TAM	ignores the need for continuity use

Table 2 Comparisons between existing models

Authors/Year	Research Objective	Model Used	Mechanism Applied	limitation
AlYahya and Abo El-Nasr (2012)	Developing Learning outcomes of engineering programs at Qassim University, Saudi Arabia	Adapting manual coursework	Used two cycles of improvement slow and fact of assessment and getting feedback manually	The work is done in the functionality of the team manually
Mohammadi et al. (2012)	Develop quality assurance of universities and course capability	Adapting manual coursework	conducting an internal evaluation (self-evaluation) for management purpose	Used culture evaluation for improvement
Liu and Chen (2012)	Improve the experience for assessing program learning outcomes	Faculty Course Assessment Report (ABET) with coursework	Used seven steps to reduce the time required for improving assessment	Stuck with students of high GP, and less use of technology
Bookstaver et al. (2011)	Using chat for improving student learning	Wiki Program	Use groups of chatting for each assessment for easy understanding	Only developing student purpose
Ioannou et al. (2015)	impact of Wiki chat on student learning	Wiki Program	Use of online chat to support students in writing, developing, and formatting their reports	Only serving student purpose in learning
O'Bannon and Britt (2011)	effect of using Wiki to create, design and increase the knowledge of lecturers	Wiki Program	Use of technology with keep read, write and edit of the material	Only serving Lectures purpose
Schmid et al. (2014)	Test influence of perceived impact on e-learning	Use of Blended learning	Combine face-to-face with online learning	Test only the effectiveness and self-evaluation
Lytras et al. (2015)	Test influence of perceived usefulness and transformation with BL	Use of Blended learning	Combine face-to-face with online learning	Not much satisfied by learners and not guarantee to improve SLO
Chen (2010)	examine factors that influence e-learning adaption	Use of the TAM model	Develop students learning outcomes and enhancing academic performance.	Faculty improvement not included
Islam (2016)	moderate student learning and lecturers teaching outcomes	Use of TAM + LMS models	Used 5 constructs and teacher experience as a moderator	The model ignores the need for continuity use
Pildrich and Custers 2018	Improve organization sustainability	TAM	Three steps of belief information, action and outcomes assessment	How to develop SLO through assessment method and faculty experience

(Strang 2013), university outcomes (Aldiab et al. (2017), teacher experience (Chmiel et al. 2017), and the assessment method factor (Adwan 2016). Each one has multi features that defined to integrate the collaborative work of teaching and learning process (Ralph et al. 2015; Tawafak et al. 2018a d, e).

Table 3, shows the derived model variables of independent and dependent variables suggested to be used in the developed model. Moreover, Table 4, shows the attributes of each variable recommended with positive effects and the references connected to each variable that shows the strength of these variables in enhancing continuous intention to use e-learning for teaching and learning process.

5 Methodology

A mixed-method consisting of a cooperative case study and a simultaneous frame strategy for data analysis was used in this paper since numerical and qualitative data were collected. Thus, University Communication Model (UCOM) was developed to achieve the aims of this paper.

The methodology of this study is based on three sub-phases which includes the analysis, development, and evaluation (ADV). In the analysis phase, different articles were analyzed as a literature review. Thus, research journal and conference proceedings related to e-learning assessment methods were analysed to identify the gap and limitations, in prior MOOC and MOODLE models. Besides, the technologies used to test the validity by using the TAM model. Whereas, in the second phase the UCOM model was proposed based on the usage of TAM with the using of e-learning techniques that were deployed by adding functions for selecting of measurements to support lecturers teaching needs and students' interest. The third phase involves the validation of the data using the Smart Partial Least Square-Structural Equation Model (PLS-SEM) program to analyze and measure the role of technologies in the improvement of teaching and learning process of continuous intention to use e-learning model (Ringle et al. 2005; Henseler et al. 2014).

Based on the description of technological, governmental, and environmental characteristics, the ease of use may or may not be the most important part of the model implementation, although, it could also be one of the factors that influence the perceived usefulness. The issues of supervising and control within specific groups such as IT is required to be addressed by the auditors. Thus, the IT auditors repeatedly depend on a well-structured IT governance framework (specifically, COBIT) to improve the control of the development process.

Therefore, this study describes how the proposed e-learning framework can be deployed to promote the use of communication tools in educational methods, organization, and business requirements. The survey sent to 392 students and only 307 samples are received with answers. Then 295 only have full responding of this survey. The web-based applications such as shared online documents (Liu 2016), Wikis and discussion forums (Ioannou et al. 2015); Bookstaver et al. 2011), and use of mobile applications such as WhatsApp, Instagram, or any other social media (AlYahya and Abo El-Nasr 2012; Mohammadi et al. 2012), appear to provide easy linking and sharing that can be used by inter-organizational or in educational teams.

Table 3 Major factors of accreditation and outcomes of E-learning

Major Accreditation Factor	Features/ Attributes	Derived Model Independent/ Dependent Variables	References
Self- Evaluation	<ul style="list-style-type: none"> -Effective facilitators that support student learning -Directly or indirectly influence of TEL on university 	<ul style="list-style-type: none"> Effectiveness Student-Satisfaction Academic-Performance Support-Assessment 	Schmid et al. (2014); Abdullah et al. (2012);
Student Learning Outcome (SLO)	<ul style="list-style-type: none"> - How the students' carried out the improved standard - How the students accomplish the learning outcomes used for assessment method and curriculum design - Learn and get benefits of confident - Enhance university outcomes 	<ul style="list-style-type: none"> Academic-Performance Teacher-Subject-Knowledge Student-Satisfaction Continue Intention Interactivity Support-Assessment Effectiveness 	Lin, et al. (2017); Liu (2016); Strang (2013); Beleche et al. (2012); Aldiab et al. (2017);
University Outcomes	<ul style="list-style-type: none"> - How universities community initiate rules -Implement balance in policy issues -Targets of graduation outcomes of universities 	<ul style="list-style-type: none"> Student-Satisfaction Academic-Perform Teacher-Subject-Knowledge Support-Assessment 	Aldiab et al. (2017);
Teacher Experience	<ul style="list-style-type: none"> - Comparison of universities to investigate the quality standards - May directly or indirectly affect the performance -Targets of graduation outcomes and student achievements - Employing traditional and e-learning teaching by lecturers 	<ul style="list-style-type: none"> Interactivity Support-Assessment Teacher-Subject-Knowledge Continue Intention 	Chimiel et al. (2017);
Assessment Method	<ul style="list-style-type: none"> - Course objectives similar to a traditional formal method -To assess faculty members -To evaluate the educational process -To assess student achievements 	<ul style="list-style-type: none"> Student-Satisfaction Academic-Perform Support-Assessment Teacher-Subject-Knowledge 	Lin and Wu (2016); Wilby, Zolezzi, Daghham et al. (2013); Graffigna et al. (2014); Adwan (2016)

Table 4 Moderator independent and dependent derived variables

Variable	Attributes	References
Perceived Usefulness (PU)	<ul style="list-style-type: none"> -Learners agree on how an adapted TEL will develop their learning -Subjective belief to assess the level of job performance enhancement -Subjective work to a degree of student progress -Significant effect on satisfaction 	Al-Marouf and Al-Emran (2018); Alraimi et al. (2015); Davis (1986); Hong, et al. (2009); Joo et al. (2018)
Perceived Ease of Use (PEOU)	<ul style="list-style-type: none"> -Free of effort -Easy to acquire skills -User belief that continued intention to use will be effortless -Positive effect on perceived usefulness -Significant effect on satisfaction 	Wu, & Zhang 2014; Wu, & Chen (2017); Davis 1989; Joo et al. (2018); Al-Marouf and Al-Emran (2018)
Interactivity (IN)	<ul style="list-style-type: none"> -Enhance the learning process -Facilitate communication among the faculty, students, & peers -Help students to be more confident and trained in the use of e-learning platforms. 	Lee et al. (2017); Hone and El Said 2016; Maas et al. (2014); Huang et al. (2017); Eom et al. (2006); Marks et al. (2005); Lee and Lehto (2013).
Teacher-Subject-Knowledge (TSK)	<ul style="list-style-type: none"> -Optimizing lecturer's continuous development -Acceptance of recommendations for continued lecturer's development programs. -Degree of knowledge and expertise 	Hone and El Said (2016); Maas et al. (2014); Eom et al. (2006); Islam (2016); Cavanagh et al. (2014); Posey and Pintz (2016)
Course-Content (CC)	<ul style="list-style-type: none"> -Determining the usefulness and quality of online learning -Determined by the lecturers' knowledge 	Miri and Ariella (2016); Nawrot and Doucet (2014); Liu (2016); Hone and El Said 2016; Maas et al. (2014); Huang et al. (2017); Eom et al. (2006);
Technology Integration (IT)	<ul style="list-style-type: none"> -Use of communication tools integrity and application software as a type of interaction between students provide the mechanisms for determining the group members -Use of electronic materials such as PowerPoint slides, files, and videos 	Hone and El Said (2016); Joo et al. (2018); Lee et al. (2017); Lee and Lehto (2013); Cavanagh et al. (2014); Posey and Pintz (2016)
Behaviour-Intention (BI)	<ul style="list-style-type: none"> -Positive effect on knowledge development -Perceived usefulness affect student behavior 	Al-Marouf and Al-Emran (2018); Alraimi et al. (2015); Chmiel et al. (2017); Davis (1989); Hong, Suh, & Kim, (2009); Joo et al. (2018).
Academic Performance (AP)	<ul style="list-style-type: none"> -Direct access to online -Full course material available with all types of connections between students and faculty of the course -Improved based on higher grade scores of assignments, presentations and online exams. 	Lonka, & Ahola, (1995); Tawafak et al. (2018a, 2018b, 2018c, 2018d, 2018e); Bringula (2013); Baeten, et al. (2010); Lee and Lehto (2013).
Effectiveness (EFE)	<ul style="list-style-type: none"> - Encourages students in acquiring skills with regard to developing 	Huang et al. (2017); Hutchinson, & Wells (2013); Marks et al. (2005); Adamopoulos (2013); Greene et al.

Table 4 (continued)

Variable	Attributes	References
	ideas, attitudes, conversation, and trust - Verities of material and assessment used through the semester work	(2015); Peltier et al. (2003); Chmiel et al. (2017)
Student-Satisfaction (SS)	-Degree of feelings and feedback from positive to negative -Provide feedback reports on the assessment process that can be used to achieve the course target and design process	Huang et al. (2017); Lee, Hsieh, & Chen (2013); Lee and Lehto (2013); Joo et al. (2018); Mullen et al. (2017);
Support-Assessment (SA)	-Verities of material and assessment used through the semester work -Support for more clarifications and knowledge development	Joo et al. (2018); Davis (1989); Islam (2016).
Continue-Intention-To-Use (CI)	-Learning acceptance refers to learning satisfaction, and preference	Davis (1989); Joo et al. (2018); Lee et al. (2017); Alraimi et al. (2015).

5.1 Pilot study

A pilot test was conducted before the final version of the questionnaire was distributed to the respondents. Sekaran and Bougie (2016) have suggested that prior to collecting data; applicable statistics from the original study is to be calculated to ascertain reliability. The pilot questionnaires were sent to the participants via email. Out of all questionnaires distributed, 44 questionnaires were responded to be usable responses representing a response rate of 80%. The internal consistency of the items was measured by using Cronbach 's alpha analysis. Since the Cronbach 's alpha fell within the acceptable range (0.83 to 0.88) which it's above (0.7) the reliability of the scale was confirmed.

The participant that was selected for data collection received a preliminary declaration stating that the analysis is voluntary and that their anonymity will be guaranteed if they chose to complete the study. To ensure no difficulty was experienced in the survey, a pilot test was carried out. The feedback created from the pilot test was integrated into the survey before it was launched for the main survey. Likewise, a panel of experts consisting of English department members checked the grammar errors, while qualified and expert members of the IT department checked the understanding and meaning of the terms used in the survey.

The data was collected through surveys based on a population that comprises of participants from different universities. Then, SPSS was used to analyze the results from different universities. After which Smart PLS program was used to verify the accuracy and validity of factors (Henseler et al. 2014). The data were collected in two approaches first by selecting appropriate respondents (those that are literate, motivated, and amenable). The literacy level was not a problem since the prospective respondents were registered in graduate education. Next, the amenability is reliant on personality,

therefore, the survey was designed to be accomplished in a timeframe of approximately 10 min. The data were confined through both the hard copy distribution-based data survey with an online survey link to be filled by participants. The technique is utilized with BUC sections.

5.2 Ethical data collection

An intensive data collection process was employed during the first academic semester of 2018–19 and it comprises of 1 month to complete. Then many procedures of testing were followed collection data to sign the main study findings. In the first step of collecting data, the questionnaire was sent to some selected students to test the questions understandable level and the clear idea from each question before distributes between samples. To promote and ensure anonymity, the starting statement and survey connection were emailed to the participants from each university or college as their given names and emails were not requested by the field researcher. The survey results were forwarded directly to the researcher with no personal attributes except the name of the institution included in the survey questions (as an optional answer).

The respondents were asked to reveal their evaluation point averages, institution attended, and demographic notes in the order of gender, major, degree, age, scholar, knowledge of computer use, and how often is UCOM used. Answering these questions was voluntary to the respondents of the survey. In the second step, a letter that explains, in brief, the details of the study and a copy of designed questionnaire were sent to the management office of each selected university to facilitate obtaining data with permission to conduct this survey at their university. In the final step, after getting approval, the questionnaire link was uploaded online to respondents by email to be distributed between students and faculties asking them to fill out the questionnaire. In addition, more hard copies are distributed between common students in the university out of class timing to obtain more responses.

5.3 UCOM model design

In this sub-section, we propose new complementary factors for our model of Learning Management System (LMS) continuance that links the Technology Acceptance Model (TAM) in the theoretical background with our adopted important measurement. The factors identified from the literature based on knowledge development and the effects of assessment method acceptance are used in the educational process. The relationships between these constructs are explained by the model design in Fig. 2. Finally, it is noticed that previous studies provide knowledge that helps with continued intention to use the learning system. However, this learning is based on factors such as student satisfaction, behavior intention, support assessment and effectiveness to confirm the continued intention. However, fewer studies address details of determining learning assessment and academic performance.

This study moves in the path of drawing the characteristics of UCOM as same as MOOC technology to solve the complexity of course assessment depend on course content, teacher subject knowledge level, and interactivity. In addition, academic performance results of grade scores and student satisfaction feedback with student effectiveness and support assessment were considered. The model is different from the traditional

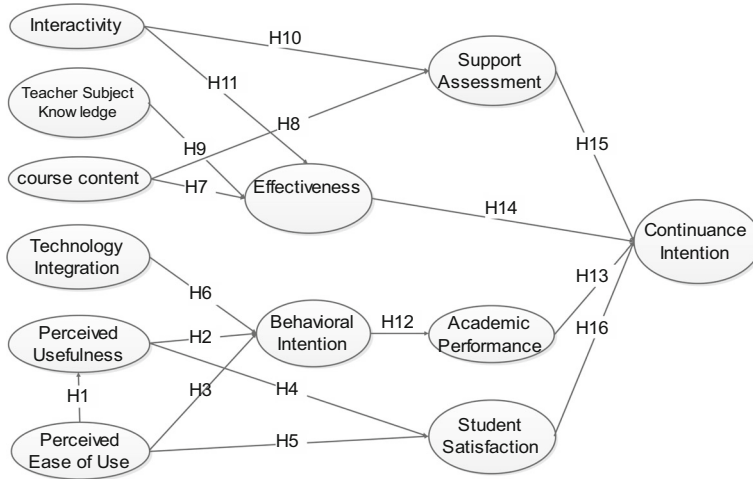


Fig. 2 UCOM model factors test (Tawafak et al. 2018d, 2018e)

teaching model that is fixed on time and real class, in which students and teachers can directly connect online or outside of course time (Lee and Lehto 2013; Huang et al. 2017).

This model derived from TAM model variables presented by Davis (1986) and the other features add from of course content, teacher subject knowledge and interactivity derived from Huang et al. (2017) and Eom et al. (2006), while effectiveness and continuance intention to use derived from Hone and El Said (2016), and student satisfaction with continuance intention derived from Joo et al. (2018). This model produces support assessment as a new variable added to increase model performance. In addition, the model variables structure built in more types of connections for better significant values using PLS-SEM program.

This model argues the following hypothesis:

H1: There is a significant positive relationship between perceived ease of use and perceived usefulness.

H2: There is a significant positive relationship between perceived usefulness and behavioral intention.

H3: There is a significant relationship between perceived ease of use and behavioral intention.

H4: There is a significant positive relationship between perceived usefulness and Student Satisfaction.

H5: There is a significant relationship between perceived ease of use and Student Satisfaction.

H6: There is a significant relationship between technology integration and behavior intention.

H7: There is a significant relationship between course content and effectiveness.

H8: There is a significant relationship between course content and support assessment.

H9: There is a significant relationship between teacher subject knowledge and effectiveness.

H10: There is a significant relationship between interactivity and support assessment.

H11: There is a significant relationship between interactivity and effectiveness.

H12: There is a significant relationship between behaviour intention and academic performance.

H13: There is a significant relationship between academic performance and continued intention to use.

H14: There is a significant relationship between effectiveness and continued intention to use.

H15: There is a significant relationship between support assessment and continued intention to use.

H16: There is a significant relationship between student satisfaction and continued intention to use.

In the context of UCOM, the model attempts to test the dependent variables of UCOM that is applied to test the relationship between student perception (perceived ease of use (PEOU)) and perceived usefulness (PU) of behavioral intention (BI) as recommended by Al-Marroof and Al-Emran (2018). These relationships influence the factors of interactivity, teacher subject knowledge (TSK) and course content (CC) on the effectiveness (Huang et al. 2017). Both relationships demonstrate an extra effect on support assessment, academic performance and student satisfaction on continued intention to use. In addition, technology integration (TI) with PEOU and PU affect behavior intention and student satisfaction which is derived from the main factors of TAM combined the additional factors from other adapted models from prior studies (Lee, Hsieh, & Chen 2013; Hone and El Said 2016; Joo et al. 2018).

The aim of the use of the technology acceptance model (TAM) presented by Davis (1986) was to explain user acceptance behavior for computer technology. Davis employed constructs related to the perception of usefulness and ease of use. In this study, the author increases the constructs to six measures, as shown in Fig. 2 and the variables used in Table 5. The TAM is adapted to measure the level of support assessment and evaluate the academic performance improvement using the UCOM model. Therefore, TAM is used as the background for the effectiveness of the adapted technologies' enhancement of learning that uses many factors to influence their decision (Al-Marroof and Al-Emran 2018).

5.4 Data analysis techniques

Finally, the study employed structured equation modeling using PLS software that is based on a set of data collection used to evaluate all the questions with different variables. However, before embarking on the data analysis, missing data, outlier, normality and multicollinearity issues were addressed, to cleaned the data before further data analysis was employed. The data analysis procedure starts in the classes where UCOM was used during the course, and it shows the importance of UCOM in-class learning and in improving self-motivation in relation to the level of satisfaction and agreement of assessment support and discussion announced through class meeting and UCOM chat course.

Table 5 Variables items and citation

Item	Citation	Type
perceived usefulness (PU)	(Davis 1989; Wu & Chen, 2017; Al-Marroof and Al-Emran 2018; Joo et al. 2018	Independent variable
perceived ease of use (PEOU)	Al-Marroof and Al-Emran 2018;	Independent variable
course content (CC)	Peltier et al. 2003; Hone and El Said 2016	Independent variable
interactivity (Int)	Peltier et al. 2003; Hone and El Said 2016	Independent variable
teacher subject knowledge (TSK)	Christensen 2017	Independent variable
Technology Integration (TI)	Peltier et al. 2003, Hone and El Said 2016	Independent variable
support assessment (SA)	Ifinedo et al. 2018	Dependent variable
Academic Performance (AP)	Ifinedo et al. 2018	Dependent variable
behavior intention (BI)	Watson et al. 2017; Al-Marroof and Al-Emran 2018; Hwang et al. 2018	Dependent variable
Effectiveness (EFF)	Peltier et al. 2003	Dependent variable
Student Satisfaction (SS)	Al-Marroof and Al-Emran 2018; Ifinedo et al. 2018; Joo et al. 2018	Dependent variable
Continue Intention to use (CI)	Taylor & Todd 1995; Joo et al. 2018	Dependent variable

Additionally, students utilized the e-learning model as a supplementary tool for the education process to improve student learning outcomes and increase the confidence of students. Furthermore, students were informed that some of the uploaded material in the model will be included in the final exam to evaluate the involvement of students with this model. Then, the integrative mixture between materials was employed between different universities that depend on the specific course that matched between two program studies. Even when students present their assignments, the connection between different groups to discuss and moderate the answers also involves faculties to moderate the assessment process. Ultimately, 392 questionnaires were distributed, and only 307 replies were collected, with 12 records having missing answers.

The analyzed result helped to assess the interest of students to add more updated communication tools that encourage teamwork among students. This, in turn, can motivate lagging students to learn and add learning skills when they know the weakness of their evaluation by the faculty and moderator through the sequence of assessments. This process can help in controlling can monitoring students' outputs in finalizing the impact related to AP and SLO in a short amount of time and efficient values. This is supposed to reduce the wasted time and update the applications, which are easy to access, use, and develop by the users of this technique.

6 Discussion

6.1 Descriptive analysis

Descriptive analysis of the data is carried out to analyze the demographics of the respondents and the frequency, mean, and standard deviations of the variables. The descriptive analysis was performed to examine the influence of independent variables on the dependent values in the proposed model as seen in Fig. 2.

6.2 Skill reliability analysis

The measures employed in this study were supported by earlier research and were modified for this current study. Similarly, the instrument employed in this study has been applied in a similar context based on an analogous population. Also, the scales used to conduct the reliability analysis is computed based on the Cronbach's alpha value from the questionnaire items in assessing the reliability of the constructs which reflect the consistency of the respondent's replies in terms of the items Cronbach's alpha measure which is above the required benchmark suggesting high-reliability measurements.

6.3 Information results and impact

Kitchenham and Pflieger (2002) stated that it is required to carry out pre-testing of a survey instrument to ensure that the consistency and strength of the instrument are valid. Thus, the data was collected based on the 5-point Likert scale, as suggested by Kitchenham and Pflieger (2002) to reduce the time of answering the survey questions. The employed scale showed how to balance validity and reliability. This scale is similar to the approach utilized by where the author utilized online survey such as (Google application for design and evaluation surveys). This ensures that respondents can be navigated to the survey via a specified hyperlink (Fricker and Matthias 2002).

6.4 Using PLS to assess the measurement and structural models

A two-step approach was adopted to assess the research model based on the assessment of the measurement model and assessment of the structural model. The guidelines used to assess both measurement and structural models of this study are deliberated in the next subsections. The measurement model determines the link between the independent variables, and dependent variable and assesses the variables indicators values based on the confirmatory factor analysis (CFA) technique. Next, the measurement model's validity can be evaluated by testing the convergent validity and discriminant validity.

The convergent validity assesses to what extent the constructs measures are different from the other constructs in the model. The value of the convergent validity measure is based on a merged or percentage of variance. Several techniques are employed to measure the relative quantum of convergent validity among item measures. Accordingly, Hair et al. (2013) suggested the use of factor loadings, composite reliability, and Average Variance Extracted (AVE) in measuring the convergent validity, where Factor loadings ≥ 0.5 , and preferably ≥ 0.70 , show high convergent validity. Whereas, composite reliability estimates

≥ 0.70 show enough convergence or internal consistency. The AVE exhibits the indicators total variance accounted for by the latent construct and the value for the AVEs should be ≥ 0.5 . Thus, when the values are higher than the minimum recommended score for factor loading, composite reliability, and AVE it signifies that the instrument items are valid and reliable.

7 Results

7.1 Discriminant validity

A discriminant validity measure is another test carried out the measure the extent to which a construct is truly different from other constructs. A high discriminating validity shows that a concept is specific and highlights some effects overlooked by other measures. To assess discriminating validity, latent constructs correlations matrices were applied where the square roots of the AVEs along the diagonals are indicated. Correlational statistics between constructs are shown in the lower-left off-diagonal elements in the matrix. Thus, discriminant validity is realized when the diagonal elements (square roots of AVEs) exceed the off-diagonal elements (correlations between constructs) in the same row and column as suggested by Fornell and Larcker (1981).

7.2 Assessment of structural model

The structural model's characteristic is measured by studying R^2 determination coefficients, regression estimates, and statistical significance. The R^2 value assesses the amount of prognostic power and shows the extent of divergence, justified by its antecedent variables in the model. The model's R^2 values should be high enough to reach a minimum level of explanatory power. Accordingly, considered R^2 values of 0.67 as significant, 0.33 as reasonable, and 0.19 as, poor. Another measure carried out in the assessment of the structural model is

Table 6 Inner VIF values

	AP	AA	Int	KND	PEOU	SP	SS	SU	TSK	TS
AP		1.867					1.641			
AA							1.624			
Int				3.192						
KND	1.500	1.867								
PEOU						1.500		2.731		
SP								2.731		
SS										
SU				2.839						
TSK				2.095						
TS				2.615			1.330			

the path coefficient value which measures how strong the link between the independent variable and dependent variable. To assess if the path coefficients are significant the value should be higher than 0.100 within the model and be substantive at the 0.05 level of significance at least. Table 6. Shows the VIF values that number range between (above of 1.3 and less than 3.9). Table 6, shows the inner cross between factors are matching with the limitations and all positive reflection between column crossing and factors itself. In addition, Table 7, shows the results of the value for each relationship created between

Table 7 Indirect effect: Mean, SD, T Value and P Value

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/ STDEV)	P Values
Perceived Ease of use -> Behavior intention -> Academic Performance	0.075	0.078	0.034	2.18	0.03
Perceived Ease of use -> Perceived-usefulness -> Behavior-intention -> Academic Performance	0.034	0.034	0.013	2.635	0.009
Technology-Integration -> Behavior-intention -> Academic Performance	0.018	0.022	0.021	0.866	0.387
Perceived Ease of use -> Perceived-usefulness -> Behavior-intention	0.094	0.095	0.034	2.742	0.006
Perceived Ease of use -> Behavior-intention -> Academic Performance -> Continue-Intention to Use	0.011	0.012	0.007	1.567	0.118
Perceived Ease of use -> Perceived-usefulness -> Behavior-intention -> Academic Performance -> Continue Intention to Use	0.005	0.005	0.003	1.96	0.051
Technology Integration -> Behavior-intention -> Academic Performance -> Continue Intention to Use	0.003	0.003	0.004	0.715	0.475
Course Content -> Effectiveness -> Continue -Intention to Use	0.123	0.125	0.038	3.278	0.001
Interactivity -> Effectiveness -> Continue Intention to Use	-0.119	-0.118	0.032	3.706	0
Teacher Subject Knowledge -> Effectiveness -> Continue Intention to Use	0.035	0.037	0.029	1.208	0.227
Perceived Ease of use -> Student Satisfaction -> Continue Intention to Use	0.029	0.031	0.019	1.558	0.020
Perceived Ease of use -> Perceived-usefulness -> Student Satisfaction -> Continue Intention to Use	0.033	0.034	0.011	2.974	0.003
Course Content -> Support Assessment -> Continue Intention to Use	0.036	0.036	0.024	1.495	0.136
Interactivity -> Support Assessment -> Continue Intention to Use	-0.052	-0.05	0.028	1.865	0.063
Perceived Ease of use -> Perceived-usefulness -> Student Satisfaction	0.174	0.177	0.034	5.06	0

Table 8 Common method bias test

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.819	20.043	20.043	8.819	20.043	20.043
2	2.984	6.781	26.824	2.984	6.781	26.824
3	2.455	5.581	32.404	2.455	5.581	32.404
4	2.185	4.966	37.370	2.185	4.966	37.370
5	1.881	4.276	41.646	1.881	4.276	41.646
6	1.697	3.856	45.502	1.697	3.856	45.502
7	1.570	3.567	49.069	1.570	3.567	49.069
8	1.456	3.309	52.378	1.456	3.309	52.378
9	1.418	3.222	55.600	1.418	3.222	55.600
10	1.364	3.101	58.701	1.364	3.101	58.701
11	1.202	2.733	61.434	1.202	2.733	61.434
12	1.145	2.603	64.036	1.145	2.603	64.036
13	1.118	2.541	66.577	1.118	2.541	66.577
14	1.018	2.313	68.890	1.018	2.313	68.890
15	.984	2.235	71.125			
16	.904	2.053	73.179			
17	.790	1.796	74.975			
18	.755	1.717	76.691			
19	.731	1.662	78.353			
20	.681	1.549	79.902			
21	.661	1.501	81.403			
22	.640	1.455	82.859			
23	.584	1.327	84.185			
24	.564	1.281	85.466			
25	.541	1.230	86.696			
26	.485	1.103	87.799			
27	.464	1.054	88.853			
28	.444	1.010	89.862			
29	.441	1.002	90.865			
30	.415	.944	91.808			
31	.381	.866	92.675			
32	.357	.812	93.486			
33	.336	.764	94.250			
34	.329	.748	94.998			
35	.320	.728	95.726			
36	.288	.654	96.380			
37	.274	.624	97.004			
38	.258	.587	97.591			
39	.235	.534	98.125			
40	.212	.482	98.606			

Table 8 (continued)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
41	.173	.392	98.999			
42	.156	.354	99.353			
43	.153	.348	99.701			
44	.131	.299	100.000			

Extraction Method: Principal Component Analysis.

factors and hypothesis. These values explained in original sample use, sample Mean (M), sample Standard Deviation (STDEV), T-test Statistics (STDEV) and *P* values.

Table 7, shows, *P* values were weak in the following relationships, Technology-Integration -> Behavior-intention -> Academic Performance give *P* value (0.387). Perceived Ease of use -> Behavior-intention -> Academic Performance -> Continue-Intention to Use have *P* value (0.118). Technology Integration -> Behavior-intention -> Academic Performance -> Continue Intention to Use, *p* value (0.475). Teacher Subject Knowledge -> Effectiveness -> Continue Intention to Use, *p* value is (0.227). Course Content -> Support Assessment -> Continue Intention to Use, *p* value = (0.136). Therefore, the model shows low performance with these paths.

Table 8, shows in the first part the initial Eigen values with percent of variance and cumulative for each component, while the second part shows the Extractionsums of squared loadings with percent of variance and cumulative percent for all components.

Table 9 Validity and powerful of current model vs. Existing models with alpha, CR, AVE

Construct	Current	Prev.	Current	Prev.	Current	Prev.
	Alpha	Alpha	CR	CR	(AVE)	(AVE)
Interactivity	0.772	0.689	0.727	0.684	0.571	0.479
Support Assessment	0.733	0.730	0.803	0.792	0.673	0.610
Teacher Subject Knowledge	0.845	0.882	1.000	0.967	1.000	0.978
Academic Performance	1.000	0.893	1.000	0.833	1.000	0.837
Behavior Intention	0.814	0.822	0.813	0.679	0.689	0.701
Effectiveness	0.754	0.864	0.807	0.820	0.680	0.830
Perceived Ease of Use	0.709	0.683	0.826	0.832	0.704	0.540
Student Satisfaction	0.813	0.825	0.826	0.820	0.704	0.715
Perceived Usefulness	0.943	0.931	0.904	0.759	0.703	0.693
Technology Integration	0.946	0.928	0.925	0.840	0.804	0.971
Course Content	0.884	0.730	1.000	0.972	1.000	0.950
Continue Intention to Use	0.883	0.871	0.875	0.651	0.700	0.620

Table 10 Summarized research objectives, research questions, and hypotheses

Objectives	Questions	Hypotheses	Decision
I. To identify the main factors or variables that influence the teaching and learning process using TAM factors.	I. What are the independent variables that influence the teaching and learning process by merging the e-learning model with TAM characteristics?	H1: There is a significant positive relationship between perceived ease of use and perceived usefulness.	Supported
		H2: There is a significant positive relationship between perceived usefulness and behavioral intention.	Supported
		H3: There is a significant relationship between perceived ease of use and behavioral intention.	Supported
ii. To develop a university communication model (UCOM) for determining the model factor sequence that has continuous intention to use e-learning for teaching and learning process.	ii. What is the adapted model of e-learning (UCOM) to be implemented for continuous intention to use applications for teaching and learning process?	H4: There is a significant positive relationship between perceived usefulness and Student Satisfaction.	Supported
		H5: There is a significant relationship between perceived ease of use and Student Satisfaction.	Supported
		H6: There is a significant relationship between technology integration and behavior intention.	Not Supported
		H7: There is a significant relationship between course content and effectiveness.	Supported
		H8: There is a significant relationship between course content and support assessment.	Supported
		H9: There is a significant relationship between teacher subject knowledge and effectiveness.	Not Supported
		H10: There is a significant relationship between interactivity and support assessment.	Supported
		H11: There is a significant relationship between interactivity and effectiveness	Not Supported
		H12: There is a significant relationship between behaviour intention and academic performance.	Supported

Table 10 (continued)

Objectives	Questions	Hypotheses	Decision
iii. To validate the developed model based on survey data analyzed using PLS-SEM for determining the accuracy of the teaching and learning process.	iii. How to assess the accuracy of the adapted model UCOM being implemented for improving the E-Learning continuous intention?	H13: There is a significant relationship between academic performance and continued intention to use.	Supported
		H14: There is a significant relationship between effectiveness and continued intention to use.	Supported
		H15: There is a significant relationship between support assessment and continued intention to use.	Supported
		H16: There is a significant relationship between student satisfaction and continued intention to use.	Supported

Table 9, explains the comparisons between the current values achieved from this study and the best results achieved from the previous works. The compare used to check the positive results in testing Alpha, CR, and AVE.

Table 10 depicts the summarized description of the research objectives, research questions and related hypotheses based on the final effect and decision.

8 Conclusion

The three objectives are accomplished successfully in this thesis. For objective 1, there are many papers used to analyst the selected variables that have a high effect on the continuity intention of E-Learning. Then a lot of finalized papers was used to derive the clear need to enhance the teaching and e-learning framework of the currently available models and applications seen in section 3, literature review.

In objective 2, this dissertation derived a proposed adapted model that considers the TAM model as a basic and standard model. Many independent variables added to the original model to increase the validity of model continue intention to use and to enhance the assessment method of the relations between variables proposed in section 4, sub-section 4.3, with Fig. 2.

The third objective accomplished by a survey distributed between four select-ed universities in Oman with 200 and 95 responses participates in filling all 13-partition related to the proposed model seen in Appendix Table 11 the survey previously checked and revised by an expert faculty and most of the questions used in adapted form from previously cited papers. The results analyst by PLS_SEM program and the reliability, validity, and normality evaluated in section 6 with effective values in mean and standard deviation. The cross leading between variables and the Alpha, CR, and AVE, also confirmed the validity of the model values from the other works.

Appendix

Table 11 Variables with detailed items and references

Variable	Code	Measures	References
Perceived Usefulness	PU1	Learning systems enhance my effectiveness	Ifinedo et al. 2018, Wu & Chen 2017
	PU2	Learning systems improves my academic learning performance	Ifinedo et al. 2018, Wu & Chen 2017
	PU3	Learning systems easily translates the learning material into specific Knowledge.	Al-Marroof and Al-Emran 2018, Ifinedo et al. 2018
	PU4	Using Learning systems would enable me to accomplish tasks more effectively	Davis 1989, Joo et al. 2018
Course Content	CC1	Learning systems effectively challenged me to think	Peltier et al. 2003, Hone and El Said 2016
	CC2	Course assignments were interesting and stimulating	
	CC3	This course was up-to-date with developments in the field	
	CC4	Student evaluation techniques such as projects, assignments, and exams were related to the learning objectives of this course	
	CC5	Course included applied learning and problem solving	
Perceived Ease of Use	PEOU1	Learning systems is easy to use	Al-Marroof and Al-Emran 2018, Ifinedo et al. 2018
	PEOU2	It's easy to get materials from Learning systems	
	PEOU3	Learning systems is clear and understandable	
	PEOU4	Learning systems allows me to submit my assignments	
Interactivity	IN1	I felt free to express and explain my own views throughout Learning systems	Peltier et al. 2003, Hone and El Said 2016
	IN2	I had sufficient opportunity to interact with other students using Learning systems	
	IN3	The instructor provided timely feedback on assignments, exams or projects	
	IN4	Learning systems facilitates the collaboration among the students	
Teacher Subject Knowledge	TSK1	Learning systems is trusted by faculty to enhance learning	Christensen 2017
	TSK2	Learning systems can be used to improve 21st-century skills.	
	TSK3	Learning systems allows the student to enjoy privacy with the instructor	
	TSK4	Learning systems guides curriculum updating courses	
	TSK5	Learning systems increases the effectiveness of moderation	
Technology Integration	IT1	The interactive content of Learning systems effectively communicated from the same course	Peltier et al. 2003, Hone and El Said 2016
	IT2	The interactive content of Learning systems included information not covered in printed material of the same course	
	IT3	The interactive content of this course contributed to learning	
Support Assessment	SA1	Learning systems guarantees trusted in assessment Timely and quality feedback	Moloo 2017, Ifinedo et al. 2018
	SA2	Projects/assignments were clearly explained using Learning systems	Ifinedo et al. 2018
	SA3	Learning systems guarantees support my learning motivation	Ifinedo et al. 2018
	SA4	Learning systems makes technology convenience to any time	Moloo 2017

Table 11 (continued)

Variable	Code	Measures	References
Academic Performance	AP1	I anticipate good grades in courses where Learning systems is used heavily	
	AP2	I anticipate better grades in classes where Learning systems is used heavily compared to where they are not used	Ifinedo et al. 2018
	AP3	Learning systems efficiently allows faculty-student interaction	Moloo 2017
Behavioral Intention	BI1	I found myself considering the new information I have learned with Learning systems when taking action related to the topic.	Watson et al. 2017
	BI2	It is worth to recommend the Learning systems for other students.	Hwang et al. 2018, Al-Marroof and Al-Emran 2018
	BI3	I'm interested to use the Learning systems more frequently in the future	Hwang et al. 2018, Al-Marroof and Al-Emran 2018
Continuous Intention to use	CI1	I intend to use Learning systems in the future continuously	Taylor, Todd 1995, Joo et al. 2018
	CI2	I intend to utilize Learning systems for various purposes such as self-development as well as earning credit hours.	
	CI3	If Learning systems becomes diverse in the future, I intend to use it frequently even after graduation.	
Student Satisfaction	SS1	Learning systems is user-friendly	Al-Marroof and Al-Emran 2018
	SS2	I am really happy with Learning systems after using it	Ifinedo et al. 2018
	SS3	Learning systems is a very delighting experience.	Joo et al. 2018, Spreng, et al. 1996
Effectiveness	EF1	I would recommend Learning systems to friends/colleagues	Peltier et al. 2003
	EF2	I have learned a lot in this Learning systems	
	EF3	I have enjoyed learning systems	

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