LAE-LMS: Applying Pedagogical Aspect of Learning Activity in E-Learning System

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Abstract: Learning occurs when learners are actively involved in various learning activities. Current e-learning systems focus more on content development rather than on learning activities itself. Embedding pedagogical aspect in learning activities into e-learning system is value added as it represents the natural way of learning process. This pedagogical aspect of learning activities embedded in e-learning system play a vital role to help learners achieve learning outcomes. This study propose features of learning activity in an e-learning system called Learning Activities E-Learning Management System (LAE-LMS) realized from analysis results of a few current systems. The LEA-LMS was developed by applying a part of the Level A IMS LD (Instructional Management Systems Global Learning Consortium Learning Design) Conceptual Model. This system allows teacher to plan, manage and monitor learning activities, while students carry out the activities. LAE-LMS consists of five modules: registration module, synopsis module, authoring module, monitoring module and learner module. The features of learning activity are evaluated by performing an acceptance testing to the LAE-LMS. Acceptance testing of LAE-LMS showed that teachers and learners have high positive perception on security, suitability, accurateness and satisfaction of the features of the system.

Key words: E-learning system, learning activities, pedagogical, learning design, LMS, IMS

INTRODUCTION

During the past few years, the use of e-learning has expanded enormously (Westera *et al.*, 2005; Mangalwede and Rao, 2009). At the beginning, many educational organizations desired to control access to the learning content such as who is using the content, the level of usage of content and the outcome of the usage (Fallon and Brown, 2000). Security also becomes a fundamental requirement in e-learning system once e-learning increases in popularity (Weippl, 2005). A Learning Management System (LMS) is an application that provides the administrative and data tracking functions necessary to do such tasks (Fallon and Brown, 2000; Ismail, 2002). LMS enable teachers to author their courses from newly created and existing e-learning material (Snae and Brueckner, 2007). However, the current authoring tools that support LMS do not have features that allow for design of activities based on pedagogical approaches such as constructivist and collaborative learning (Hummel *et al.*, 2005). Current research in e-learning is too content-centric (Dalziel, 2005). Lecturers use LMS to put content online without applying any sound pedagogical principles (Vrasidas, 2004). The current content-centered e-learning causes many e-

learning course developers to resort to technical tricks to make contents interesting and appealing to learners without considering how learner learns (Lim, 2005). The emphasis on learning objects development cause e-learning to be static, fossilized, have dead content, have low learner motivation and engagement and have impersonal and isolated environments (Hummel and Koper, 2005).

Adding a learning activity in e-learning is an added value to e-learning. According to Britain (2004), learning activities can be sequenced or structured carefully and deliberately in a learning flow to promote more effective learning. E-learning should provide facilities for designing learning activities for sharing and reuse in the future (Britain, 2004; Hummel and Koper, 2005; Lefrere, 2009). Besides, Dalziel (2005) has come out with an archetype of a Learning Design (LD), which provides a sequence of activities to be formally described and hence captured, stored, shared, reused and adapted.

The way to carry out learning activities in these e-learning systems can be enhanced and future study on designing and development of learning activities systems are needed in order to help students achieve the learning objectives by doing the learning activities. IMS LD can be applied in designing and development of an e-learning

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system since this is a specification used to describe a method, which enable students to attain learning objectives by performing certain learning activities in a certain order in the context of a certain learning environment (IMS, 2005; Ruiz *et al.*, 2008).

This study starts by defining learning activity and the potential of traditional learning activities embed to an e-learning system.

Learning activity: Learning activities are coordinated actions that exercise basic intellectual skills, thought processes and analysis techniques (Horton, 2000). Reading, answering questions, writing, solving paper-and-pencil problems, listening to lectures, taking notes, working in small groups, completing projects, studying for tests and participating in educational games are examples of traditional learning activities in schools (Cunningham and Billingsley, 2003). These learning activities are designed by a teacher to lead a particular learning outcome, while the activities are the actions that a learner is required to perform. Learning activities can be categorized into two types: solo learning activity and collaborative learning activity (Ip and Canale, 2003). Solo learning activity is activity performed by a single learner such as listening to a story or solving puzzle. Example of computer-based solo learning activities are answering multiple choice questions and using rule based simulation game. Collaborative learning activities involve >1 learner who needs to collaborate with others to perform particular role and engage with various learning activities, which aims to achieve particular learning outcome. Therefore, learning activities can be designed to teach, train and test knowledge, skills and confidence. The definition of activity shows that learning activity is an action that must be carried out by students to attain learning objectives (Ip and Canale, 2003; Mok, 2008).

Pedagogical aspect of learning activity: From the pedagogical aspect, teachers need to select a teaching and learning strategy which is a plan to perform learning activity in a learning environment. Strategy means method and technique used to deliver a learning content in an effective way (Mok, 2008). Teachers need to plan a suitable approach and strategy to carry out teaching and learning for a certain subject. The strategy planned includes the use of method and technique to deliver contents of a subject. Learning activity is carried out through the method and technique used. These learning activities can be carried out either by an individual student which is a learning activity or a group of students
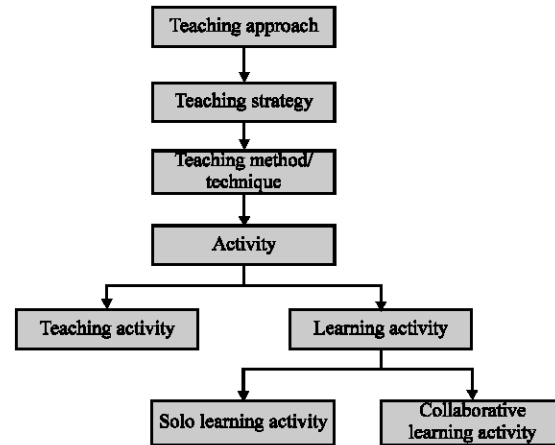

Fig. 1: The definition of learning activity as used in LAE-LMS

which is defined as collaborative learning activity. Figure 1 shows the meaning of learning activity used in LAE-LMS.

LAE-LMS is an e-learning system that allows teachers to plan, manage and monitor learning activities based on pedagogical approach. The types of learning activity tools embedded in LAE-LMS are based on the study and analysis of teaching methods and techniques, which are discussion method, project method, solving problem method, grouping teaching method and simulation technique.

Teaching activity and learning activity interact in a teaching and learning process; learning activity is an action done by the learners to achieve the learning outcomes (Ip and Canale, 2003; Mok, 2008). In a process of teaching and learning a certain course, teachers have to plan suitable approach and strategy. The strategy planned involves the usage of method or technique to deliver learning contents. Learning activity is carried out via the method or technique that has been used.

Before starting teaching session, teachers have to prepare the teaching resource, determine learning objectives, plan summary for teaching and acquire teaching aids. For lesson plan, teachers have to prepare topics and the activities to be implemented by learners.

A part of Level A Conceptual Model IMS LD also need to be applied to an e-learning system that can allow teachers plan or design the learning activities which needs activity's description. This means that each of the learning activity tool must describe who should be given the task and what should be done. After the teachers finished planning teaching and learning activity, they should monitor the status of learning activity performance

by students so that the learning objectives can be achieved. Therefore in conclusion, plan, monitor and manage the learning activity is a must in pedagogical aspect of a learning activity system.

Limitation of current e-learning system: Many institutions of higher learning education in Malaysia, such as University Malaysia Sabah (UMS), University Putra Malaysia (UPM), University Technology Mara Malaysia (UiTM) and Malaysia University of Science (USM) use e-learning system in a mixed-mode environment known as blended e-learning whereby a combination of e-learning and face to face learning are used together (Jowati, 2004). Most of the learning activities in the current e-learning systems use collaborative tools, such as email, chat and forum which are limited in representing various types of learning activities. As an example, forum is a tool embedded in e-SPRINT, LMS of UPM which allows two way communications between lecturers and students (Sidek *et al.*, 2003). E-mails, online forum and online bulletin board, which are embedded in the university's course management system (VOISS) of University Tun Abdul Razak (UNITAR) are conducted between lecturers and students for interaction purposes. Shamsul *et al.* (2007) found in their academic computing survey involving 62 public and private colleges in Malaysia that ICT was more commonly used as a source of information to support learning and play a role in traditional classroom tool. Besides, other learning institutions such as primary and secondary schools are also using courseware in the form of CD-ROM learning package to carry out learning activities (Mok, 2008).

However, the use of CD-ROM, collaborative tools such as e-mail, chat and forum has limitation to carry out learning activities in an e-learning system. Three identified limitations are: do not allow use of learning strategy or learning methods, which are strongly emphasized in pedagogical aspect; lack of appropriate design and development tools to plan and deliver learning activities easily; lack of visualization tools for teachers to visually design learning activities either solo or collaborative activities for their classes; poor reusability and customizability of LMS (Wang, 2003) do not allow teachers to reuse and select certain learning design in planning and designing learning activities for students.

Features of learning activity in e-learning: To overcome limitations of existing learning technology specifications and standards, the Open University of the Netherlands initially developed a specification named Educational Modeling Language (EML) (Es and Koper, 2006). Based on EML, the Instructional Management Systems Learning Design Specification (IMS LD) was developed and released by the IMS Global Learning Consortium (Es and Koper, 2006). IMS LD is a specification to represent and encode learning structures and methods for learners and teachers (Dalziel, 2005). It is also, a specification used to provide a containment framework that can describe any design of a teaching and learning process in a formal way (Berlanga and Garcia, 2005; Lim, 2005). IMS LD is focused on the design of pedagogical methods that enable teachers to manage learning activities within a learning flow. This learning flow consists of plays, acts, activities, activity structures and environments (Burgos *et al.*, 2007). According to Philip and Dalziel (2004), a combination of well designed activities and selected resources will contribute to the achievement of rich and engaging learning environment.

A part of concepts from conceptual model of level A IMS LD were used in the development of LAE-LMS. In LAE-LMS, activity tools are provided in authoring module to make a learning design. Activity can be assembled into structure-activity in a sequence. Learning activities in a learning design can be performed by >1 learner (roles). Activity, which is performed by the student can be assembled to an activity-structure in a sequence. Activity structure in a sequence means the different activities that must be accomplished in the designed sequence (IMS, 2005). This concept was used in authoring module of LAE-LMS, which enable teachers to design activities in sequence. Student need to carry out each activity one by one based on the designed sequence.

Activity can be carried out by one or many students (IMS, 2005). This concept was applied to authoring module of LAE-LMS too. Some activity tools in authoring module can be carried out by a group of students. For example, grouping tool enable students to be divided into small groups to carry out the learning activity of small groups, such as group assignment, discussion, group project and searching.

If compared to e-learning systems which emphasize learning contents and have few collaboration tools to perform learning activities, LAE-LMS is more advantageous. LAE-LMS enable teachers to plan a LD, which is based on the parts of conceptual model of level A IMS LD and manage students learning activities in a well controlled and systematic system Analysis of various e-learning systems that have been conducted shows the feature differences among e-learning systems (Table 1).

In this study, we have designed a model for the process of performing learning activities. The design model for the process of performing learning activities is shown in Fig. 2. Each module designed in LAE-LMS play

Table 1: The difference in features of e-learning systems

| System/criteria	LAE-LMS	SSIS	VOISS	MMLS	MyLMS	LAMS
Pedagogical approach	√	√	√	√	√	×
IMS e-learning specification	Use a part of level A LMS	×	×	×	×	Level A IMS LD V1.0
Tool for planning course synopsis	√	√	×	×	×	×
Tool for monitoring status of learning activity performance by the learners	√	√	√	√	×	√
Tool for designing learning activities in a sequence	√	×	×	×	×	√
Tool for determination starting date and completing date for learning activity	√	√	×	×	×	×
Reuse activity tool	√	×	×	×	×	√
Types of activity tool	Set induction Grouping Searching Discussion Assignment Project Comment	Discussion via e-mail, massage system and bulletin board (Educational Technology Division, 2004).	Discussion through forum. Presentation (use PowerPoint slide) via web conference tool.	Discussion via online forum according to course for asynchronous interaction Discussion via chat and e-mail.	Discussion via forum board, e-mail, bulltin board and chat room. Face to face tutorial session via face to face interaction.	Chat Chat and scribe Chat and scribe + journal Forum Grouping Journal Multi choices Notice board Ask and question Ask and question + journal Source sharing File delivery Survey Voting Voting + journal

Guidance, ×: No, √: Yes
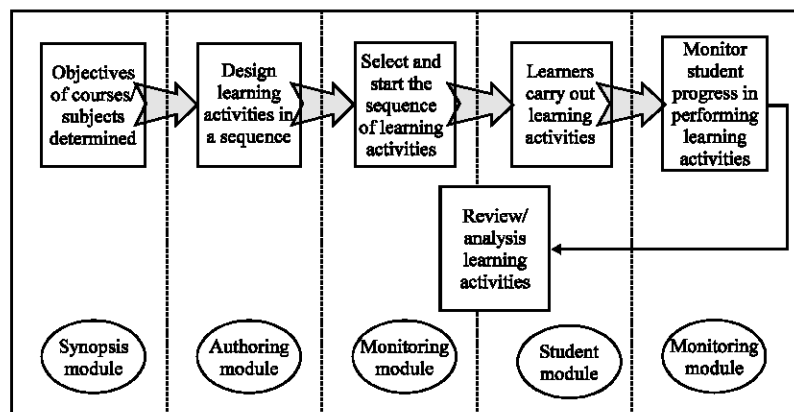
Fig.2: LAE-LMS Model for performing learning activities in E-Learning

a vital role in the process of managing and performing learning activities. At the beginning, the objectives of a subject/course are determined in synopsis module.

Then, the learning activities are designed in a sequence in authoring module. After that the sequence of learning activities can be reviewed in monitoring module and selected to start the session of learning activities. Students can carry out the learning activities in learner module after the session has been started. At the same time, teachers can monitor the students' progress in performing learning activities in monitoring module. These learning activities will be reviewed for the learning objectives achievement.

The learning activity tools embedded in LAE-LMS have been studied and analyzed from the pedagogical aspect. Learners can learn better when they are engaged in active learning, participate in learning activities, collaborate with peers in solving problem and their research monitored and evaluated in the authentic assessment by teachers. This is the advantages of LAE-LMS, which provide a tool to allow teachers to plan a LD based on certain teaching approach or method, reuse LD that has been designed, monitor the status of performing learning activities by the students and evaluate their given task. Learners can participate in learning activities, which are designed by the teacher.
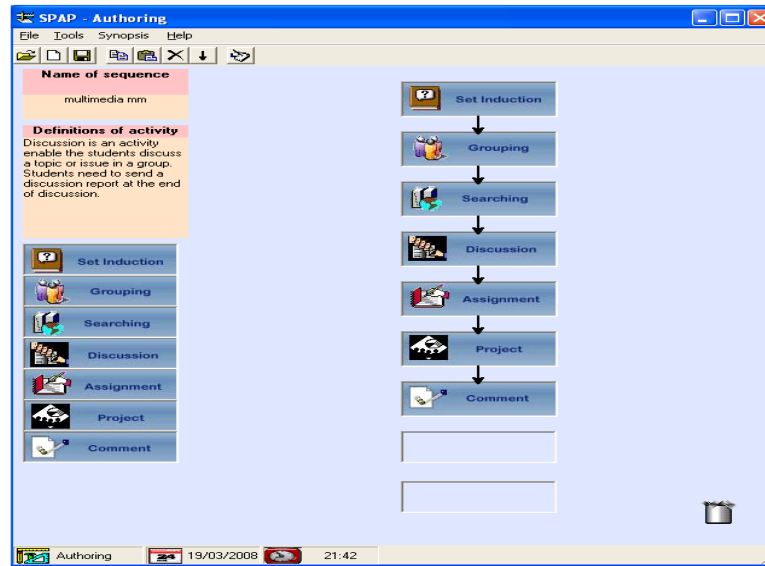
Fig. 3: Authoring module of LAE-LMS

Before the teacher or student use LAE-LMS, they must get the authorization from administrator. Each of them will be assigned an ID and password to log in LAE-LMS after registration by the administrator. This access control is necessary to prevent unauthorized use of learning activities and contents.

Implementation of LAE-LMS prototype: The Learning Activities Management System (LAE-LMS) is a system for designing, managing and delivering learning activities. LAE-LMS consists of 5 modules: registration module, synopsis module, authoring module, monitoring module and learner module. Registration module can be accessed by administrator (a role, which is played by a teacher) to do all kinds of registration for users, organizations, courses and user to courses.

LAE-LMS provides teachers with an intuitive visual authoring interface for creating sequences of learning activities. The authoring process focuses on development of student-centered activities supported by appropriate learning resources, rather than the more common e-learning model, which often focuses on the delivery of content, which may or may not be supported by suitable activities with opportunities for interaction.

Authoring module is a module special for teachers to design learning activities in a sequence and to save the design. Figure 3 shows the drag and drop authoring interface of LAE-LMS. This module provides teachers with a visual representation of their learning design. Activities are displayed in a flow chart. Activity tools to be customized are dragged from the left side of the frame into middle frame and links between activities are created

by clicking transition button in the top menu bar. Once, the sequence is saved, associated with a list of learners and turned on to run, the system will display each of the activities for learners in the order shown in the flow chart. This sequence of learning activities is for learners to follow according to the design set by the teacher. Besides, the sequence and properties of the activities can be edited if the teacher needs to create changes for the design of sequence. The ease of editing activity sequences would suggest that reuse of these learning design is high in the future. There are seven activity tools developed in authoring module of LAE-LMS: set induction, grouping, discussion, searching, assignment, project and comment.

The learner module interface can be seen in Fig. 4. Learner module is the module accessed by learners to do learning activities designed by teachers. Learners are given a clear visual path of their progress via the progress bar on the left side of the frame, which is perpetually visible. The progress bar will show what activities have been completed and which activities are still to be finished. Large groups of learners can be managed and coordinated simultaneously through the monitoring interface of LAE-LMS. Teacher can monitor the learners' progress of performing learning activities through this monitoring module at any time. The contents or answers submitted by learners can also be reviewed through this module. Figure 5 shows the interface for individual progress of performing learning activities Besides, the authoring, learner and monitoring module, LAE-LMS also provides teachers with a tool for planning the synopsis of courses in the synopsis module. In this module, teachers
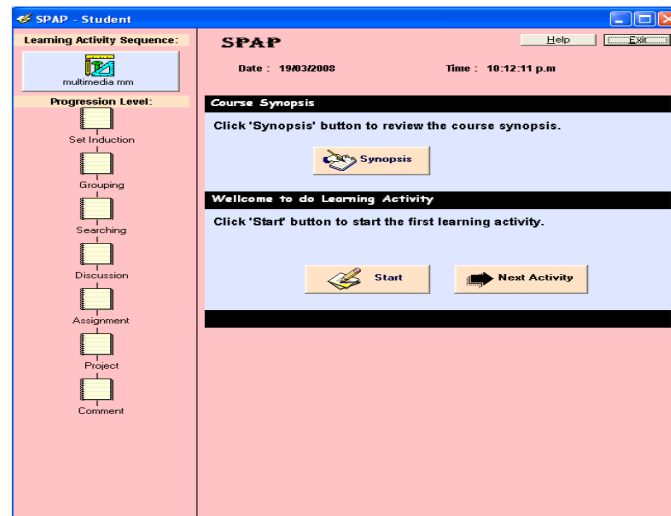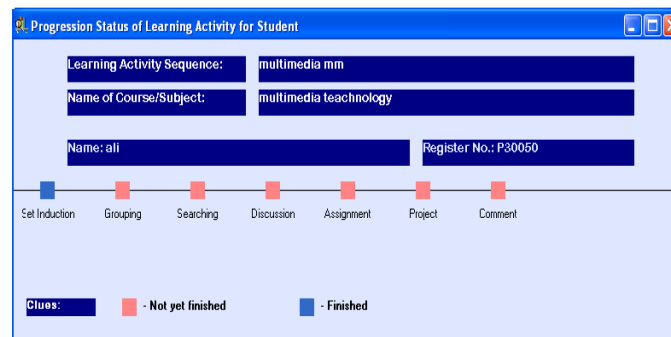
Fig. 4: Learner module of LAE-LMS

Fig. 5: Interface of individual progress of performing learning activities
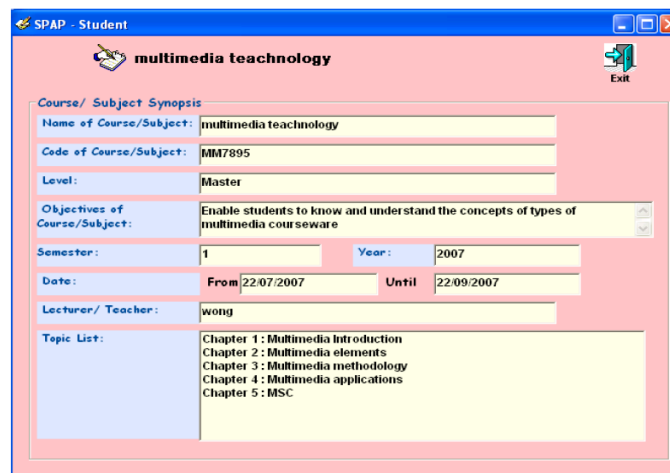

Fig. 6: Interface for reviewing synopsis in learner moudle

can determine the objectives, duration of course, topics of course, methods of teaching and learning outcomes for different course topics. Learners can review this course synopsis in learner module. Figure 6 shows the interface for reviewing synopsis in learner module. The contents of synopsis can also be edited in the synopsis module

MATERIALS AND METHODS

The LAE-LMS were evaluated by conducting acceptance testing for all the features and overall functionality of the system (Futrell *et al.*, 2002; Pressman, 2005). Four acceptance testing criteria were used to evaluate LAE-LMS: security, suitability, accuracy and satisfaction. The acceptance testing involved teachers and learners. These criteria of acceptance testing need to be determined in designing an e-learning system to ensure the system can function as per users' requirements (Wang, 2003; Mavromoustakos *et al.*, 2005). These four criteria are the sub-features for the functional features to ensure the software quality (Futrell *et al.*, 2002). Security, suitability and accuracy are the sub-features for software functional features in Model International Organization of Standardization (ISO) 9126-1991 (ISO, 1991; Futrell *et al.*, 2002; Chua and Dyson, 2004; Mavromoustakos *et al.*, 2005). The study by Chua and Dyson (2004) also showed that Model ISO 9126 can be used for e-learning system's evaluation.

System's security focused on the effort to prevent data or programming access without permission, either intentionally or unintentionally. This aspect is vital for LAE-LMS testing to ensure that all the saved data cannot be accessed without permission (Laudon and Laudon, 2002). Security in LAE-LMS is relevant because trust in an electronic system is a perquisite for user acceptance (Weippl, 2005). Students may obtain access only to those objects for which they have received authorization. Otherwise, they may copy or modify content without permission and distribute them to unauthorized party. Suitability focused on appearance and suitability of one set function which followed a certain task (Chua and Dyson, 2004). This means that suitability is a feature to determine whether, the system can perform the given tasks or not. Accuracy focused on the errorless or acceptable outcome (ISO, 1991). This means that the system's outcome is displayed correctly or not based on the user's request (Chua and Dyson, 2004). Satisfaction is an affective reaction followed by the different level to select and use a product in a certain period (Giese and Cote, 2002; Wang, 2003). User's satisfaction to LAE-LMS interface and overall system were tested using this criteria.

In acceptance testing, 20 respondents (10 teachers and 10 learners), who had experience using the traditional e-learning system from the Faculty of Health Science, UiTM were selected randomly. LAE-LMS prototype was installed on the computers in the computer lab, which has local area network. Each component in the modules of LAE-LMS was tested. Teachers did the testing for registration, synopsis, authoring and monitoring modules while, learner respondents tested the learner module. After using the system, respondents were required to fill up the questionnaire form given to them at the beginning of the session.

Data from the questionnaire were analyzed using Statistical Package for Social Science (SPSS) for Windows version 10.0.1, employing descriptive statistics. Mean score for each criteria tested is used for comparison of the 3 interpretation of system testing, which are:

T_{A1} : System module is not secure to use
T_{A2} : Security of the system module is moderate
T_{A3} : System module is secure to use
T_{B1} : Functions of modules are not suitable with the task
T_{B2} : Functions of modules are moderately suitable with the task
T_{B3} : Functions of modules are suitable with the task
T_{C1} : Display of module information is not accurate
T_{C2} : Display of module information is moderately accurate
T_{C3} : Display of module information is accurate
T_{D1} : Modules are not satisfactory to users
T_{D2} : Modules are moderately satisfactory to users
T_{D3} : Modules are satisfactory to users

Interpretation is dependent on the Likert Scale score and total of level interpretation, with this formula:

$$\text{Range mean score} = \frac{\text{Maximum score} - \text{Minimum score}}{\text{Total of interpretation level}}$$
$$= \frac{5-1}{3}$$
$$= 1.33$$

Based on the above interpretations and the formula, level of user's agreement was determined as:

- Interpretation one (T_{A1}, T_{B1}, T_{C1}, T_{D1}) accepted if mean score is in the range of 1.00-2.33
- Interpretation two (T_{A2}, T_{B2}, T_{C2}, T_{D2}) accepted if mean score is in the range of 2.34-3.66
- Interpretation three (T_{A3}, T_{B3}, T_{C3}, T_{D3}) accepted if mean score is in the range of 3.67-5.00

RESULTS AND DISCUSSION

Every module was tested by the target user. Table 2 showed the results of descriptive statistic analysis for registration, synopsis, authoring and monitoring module, which were evaluated by the teachers. The results are in the range of 3.67-5.00, so the third interpretation (T_{A3}, T_{B3}, T_{C3}, T_{D3}) are accepted. This means that registration, synopsis, authoring and monitoring module is secure to use, functions of these four modules are suitable with the task, display of these modules information are accurate and registration, synopsis, authoring and monitoring module are satisfactory to teachers.

Table 3 showed, the results of descriptive statistic analysis for learner module, which was evaluated by the learners and the results are in the range of 3.67-5.00. This learner module is secure to use, functions of this module is suitable with the task, display of this module information is accurate and the learner module is satisfactory to learners.

Table 4 shows the average mean score for each criteria for all modules, which are in the range of 3.67-5.00. Therefore, all the interpretation three (T_{A3}, T_{B3}, T_{C3}, T_{D3}) are accepted. This means that system module is secure to use, functions of modules are suitable with the task, display of module information is accurate and modules are satisfactory to users. The acceptance testing of LAE-LMS showed that teachers and learners have positive perception about the system's security, suitability, accuracy and satisfaction for all the modules. Learners can perform learning activities effectively through LAE-LMS if the provision of computers is sufficient and with LAN networking. Nevertheless, LAE-LMS can be improved and upgraded to an internet web-based system so that learners can perform their learning activities anytime and anywhere.

CONCLUSION

Learning activities, which are embedded in e-learning system need to be stressed in order to help the learners achieve learning objectives. Learning activity play an important role to attain learning outcomes when students carry out the learning activity in the teaching and learning process. We proposed a design model of LAE-LMS, which shows the interrelation of performing learning activities process with the modules of LAE-LMS. A further investigations and studies in designing an e-learning activity system applying the whole Conceptual Model of IMS LD, especially Level B and Level C is recommended. This is because Level B adds powerful features to build more complex e-learning lesson plans and Level C aggregates a specific and useful trigger element (Burgos *et al.*, 2007).

In sum, embedding pedagogy concept of learning activity in e-learning system has enhanced the current LMS. The design of representing the learning activity also satisfied the teachers and learners.

ACKNOWLEDGEMENTS

Table 2: Descriptive statistic analysis for registration, synopsis, authoring and monitoring module

Criteria	Mean score (module)			
	Registration	Synopsis	Authoring	Monitoring
Security	3.900	3.900	4.100	4.100
Suitability	4.300	4.360	4.271	4.400
Accurateness	4.200	4.200	4.225	4.260
Satisfaction	4.275	4.250	4.400	4.283

Table 3: Descriptive statistic analysis for learner module

Criteria	Mean score
Security	3.800
Suitability	4.067
Accurateness	3.975
Satisfaction	4.225

Table 4: Average mean score for overall LAE-LMS testing

Criteria	Average mean score
Security	3.960
Suitability	4.280
Accurateness	4.172
Satisfaction	4.287
Max: 5.000	

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