บทความวิชาการ

Implementing E-learning Specifications in Teaching-learning Process

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In recent years, a variety of tools and learning environments have been created and installed in schools, universities and companies to support learning. There is a growing awareness of the need for effective dialogue among learners, teachers, educational researchers and developers of specifications and systems, to ensure that e-learning systems are usable by learners and teachers in flexible and appropriate ways. A significant number of e-learning specifications are considered to improve the interoperability between systems and to remove islands of e-learning. The challenge is how e-learning designers can effectively embed teaching-learning practices into the specifications.

E-learning specifications are adapted from multiple sources to provide a comprehensive suite of e-learning capabilities that enable interoperability, accessibility and reusability of web-based learning content [1]. There are several existing specifications such as IMS Content Packaging (CP), IMS Question and Test Interoperability (QTI), and IMS Learning Design (LD). Their details are presented below.

1. E-learning Specifications

1.1 IMS Content Packaging

In the context of e-learning, content refers to items such as blocks of text, pictures, diagrams, animations, tests and answers, learner information, resource information, collaborative tools, etc. [2]. These contents, which are part of the e-learning materials in the teaching-learning process, need to be packaged. The reasons for packaging are to form a coherent e-learning course, to be stored in digital repositories in order to be made accessible to many learners, dispersed areas and to address the reusability of the course materials [3]. Hence, IMS CP Specifications were designed containing necessary meta-data information to find the relevant content for the learner, to move contents from one location to another, and to interoperate in different learning management systems by use of XML [4].

1.2 IMS Question and Test Interoperability

The IMS QTI specification, defined by the IMS Global Learning Consortium, is part of the same family of

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specifications as IMS Learning Design. IMS QTI specification is established to describe a data model for representing question and test data, as well as their corresponding result reports. In addition, this specification has been designed to support both interoperability and innovation [5]. It describes the basic structure that is necessary to represent questions (AssessmentItem) and test of evaluations (AssessmentTest). Moreover, this specification enables the exchange of these items; test and results data between authoring tools, item banks, test constructional tools, as well as learning systems and assessment delivery systems. QTI version 2.0 processing is illustrated in Figure 1.

When a learner accesses a Virtual Learning Environment or Learning Management System (VLE/LMS) to view and respond to a QTI question, the system initially sends a QTI XML file to a QTI processing service where a Question renderer renders the question, the rendered question is sent back to the VLE/LMS for display to the learner. The learner's answer is sent to a QTI Response renderer which marks the answer and provides feedback. The rendered feedback is sent back to the VLE/LMS for display to the learner.

1.3 IMS Learning Design

IMS LD starts from the position that learning is different from content consumption and that learning comes from being active. It recognises that learning happens when learners cooperate to solve problems in social and work situations [7]. IMS LD is based on the following principles: in a learning process each person has a role (learner or teacher) and seeks to obtain results by carrying out learning activities and/or support within an environment. The major concept of the IMS LD is the method which allows the coordination of activities of each role in the associated environment to achieve learning objectives according to prerequisites. The learning process is modelled on a theatrical play from a structural point of view [1].

2. Integrating IMS LD and IMS QTI

There are many tools for implementing e-learning specifications including RELOAD (Reuseable eLearning Object Authoring and Delivery) editor, RELOAD learning design editor and CopperCore, discussed below.

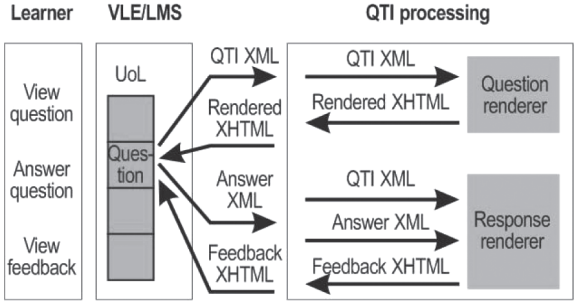

Figure 1 QTI version 2.0 processing [6]

The RELOAD editor [8] is a content package and metadata editor. It can package electronic content such as web pages, images, etc., and describe them ready for storage in content repositories such as JORUM. At present, the RELOAD editor supports V1.1.3 of the IMS Content Packaging specification and V1.2.2 of IMS Metadata specification. The RELOAD learning design editor [9] based on the IMS Learning Design specification, supports the creation of re-useable "Pedagogical Templates", allowing the user to define a set of learning objectives, activities, and learning environments.

The CopperCore [10] is an IMS Learning Design engine, which supports all three levels of IMS Learning Design. It provides the core functionality of interactions between the various roles, resources and activities. However, other developers can implement an interface on top of it.

These tools were used to implement a Thai tea unit of learning in order to explore how to implement learning design in a general way. This covers the teaching-learning process such as interactions between teachers and students, collaborative learning, adaptive learning and personalisation, teacher monitoring and conformance to IMS QTI. The screenshot of this implementation is illustrated in Figure 2. This screenshot is the part of the assessment activity consisting of three questions with true/false choices.

In this unit of learning (UoL), a student can follow a tea course. The lesson plan composes of six lesson activities, a three-question activity, a feedback activity, and the additional information learning object based on student's scores. This scenario supports for two students. Both students can access to this course simultaneously. This is based on the assumption that the appropriate learning flow is set to sequence rather than selection. Both students have to completely finish all learning activities from the introduction lesson activity to the

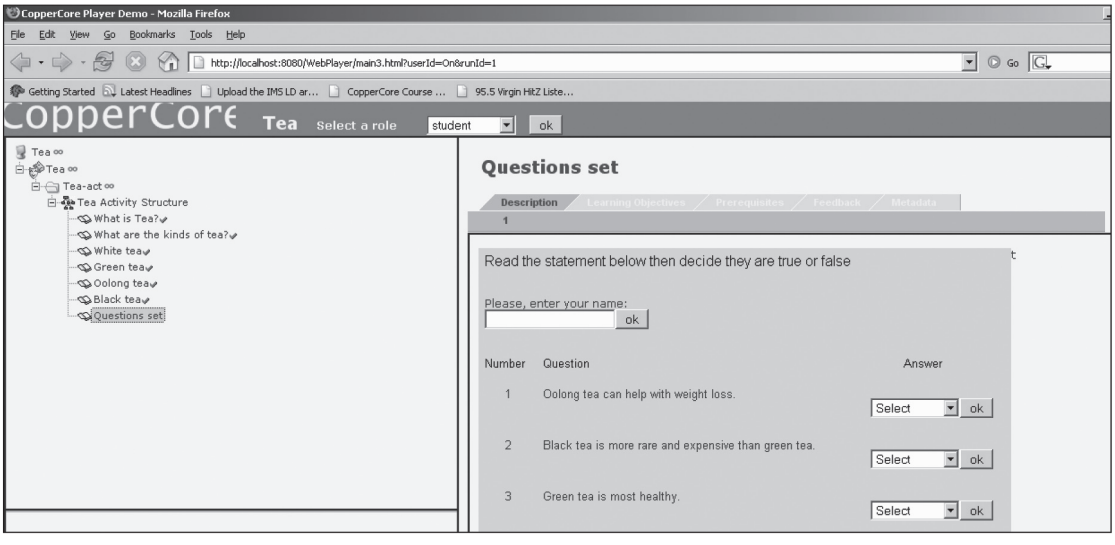

Figure 2 the assessment activity

feedback activity before starting the forum activity. In the same time, the teacher can monitor the performance of individual learners by considering the student's score. The structure of this implementation is presented in Figure 3. A play consists of two acts; Act Tea-Lesson composes of two role-parts, Act Forum composes of one role-part. Each student in learner role can get into all activities within the Lesson-Assessment activity structure in sequence. In addition, each student can access the more information learning object in the environment.

3. Discussion

The editor tool should be suitable for instructional programmers or teachers with knowledge of IMS LD and programming because they must have some experience of logic programming such as condition, identifier, property and value element. This editor also generates identifier's name from system such as LD-DBA35-78-25. Then, it is difficult for the instructional designers to recognise if they would like to edit XML code in a UoL.

The pedagogical approaches in this case based on nine events of instruction [11], Laurillard's conversational framework [12]and a model of learning transaction [13] are adaptive learning, collaborative learning, personalization and interactive pattern of assessment described as follows:

3.1 Adaptive learning

The adaptive learning aims to personalise the instruction by providing each individual learner a set of learning activities and resources which fit the individual

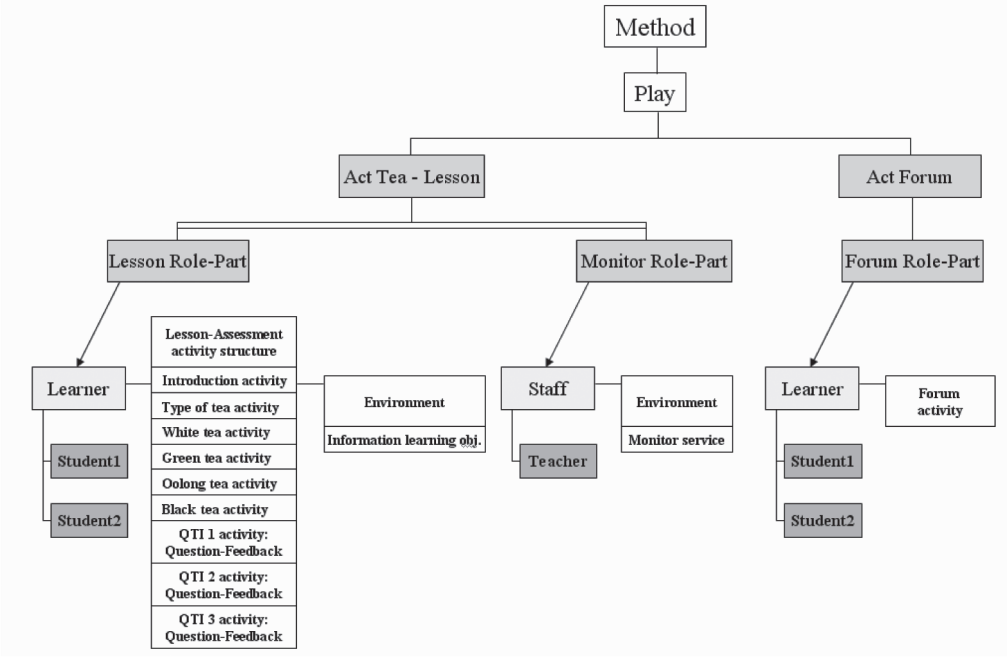

Figure 3 the structure of implementation in the tea UoL

learner's properties such as the personal learning objectives, prior knowledge, situational circumstances and the results of an assessment. In this implementation, the advice gives extra information about student's weakness point and it will be adapted with the results of assessment of each student by using property elements to set and view the information of each person's properties, as well as using condition elements to manage and change property values of an extra information message of each student.

3.2 Collaborative learning

The collaborative learning aims that students at various competency levels can work together in groups. The collaborative learning increases the interest among participants, facilitates the cognitive representation and far transfer of knowledge, and stimulates critical thinking. Hence, the implementation facilitates the grouping of students and the support for discussions within the groups by including specific collaborative tools such as the forum and monitoring of student's progress. Additionally it offers facilities for teachers to monitor the progression of individual students and supports the group in an efficient way. Using the monitor service, all types of properties can be viewed, for example, properties of the learner, properties of the others in the same group or properties of other individuals or groups. The teacher can monitor the scores and the extra information of each student.

3.3 Personalisation

Personalisation of learning is founded by using mechanism of the role-part element. The role-part element describes the activities to be performed by a role in an act which could be used to group students. In this way, every role-part covers a set of learning activities for the specific characteristics of the learning such as learning style and knowledge. For example, the lessons and forum activities are assigned for the learner roles. On the other hand, the monitor service is assigned for the teacher roles.

3.4 Interactive pattern of assessment

The interactive pattern in an e-learning system context means a form, template or model which can be used to generate a commonly effective interactivity. When the students actively process the course information and materials, they should be given a prompt and specific feedback of the teaching-learning process. To achieve this approach, the IMS QTI property is operated relating to the feedback. The feedback in the IMS QTI composes of two types; the modal feedback and the integrated feedback. The modal feedback is shown to the learners after the learner's response and before any subsequent attempt or review of the answer. In contrast, the integrated feedback is only shown during subsequent attempts or at the last question concerned with the total scores of all questions. So, the IMS QTI naturally provides the function of interactive pattern in the assessment. However, some redundancy of simple sequencing is discovered within IMS LD and IMS QTI.

The condition text and runtime tracking are founded from the implementation. With LD it is possible to model surveys and questionnaires when needed. However, for interoperable tests and powerful feedback the IMS QTI specification should be used preferably. This case demonstrates that how to model some questions and provide feedback on completion of answering all questions, and runtime tracking about student's scores.

Arithmetical calculations are implemented with the stored property values and provide contextual feedback based on these calculations. For instance, there are three questions with two answers and

two possible values for each answer; 0 and 1. After the student answers all the questions, a total score is calculated and stored in property values for each student.

The difficulty of the affordance is founded relating to learning design coding. Because of the essential of checking a condition of the complete feedback activity for two students, this implementation is operated with more affordance of learning design coding to examine the sequence of the forum activity. However, the alternative way to solve this problem is using the mechanism of act. A play consists of sequential acts so a role in an act has to be completely finished by all persons in this role. As a result, the problem of the affordance of learning design can be solved.

4. Conclusion

This study provides an introduction to e-learning specifications: IMS CP, IMS QTI, and IMS LD. The purpose of this work is to explore and conduct experiments in how to implement learning design with teaching-learning process. IMS LD and IMS QTI specification are very flexible to implement in practice with many forms of pedagogy. The IMS QTI specification can be considered as an integrative layer in implementing IMS LD Unit of Learning. In addition, they also support adaptation. However, this implementation showed some shortcomings, such as ineffective interactivity, difficulty of learning design coding, inflexibility, and poor reusability for the group study implementation. Instructional designers should consider this issue when integrating IMS QTI items within an IMS LD Unit of Learning. Hence, the next step of implementation is to explore the capability of the mechanism and functionality with those specifications to discover an appropriate way of implementation with adaptation.

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