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Title of the Paper: The Development of Learning Object Design System (LODS) for Instructional Designers

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ABSTRACT OF THE PAPER

This project intended to build a platform for Instructional Designers (IDs) to analyse the content and document their inputs on the content analysis. The purpose of the system is to aid IDs in the process of content design and produce an efficient design plan for learning objects using technology, in this case Learning Object Design System (LODS). LODS is a system where the instructional designer record the findings from content analysis (learning outcome, scope of content, cognitive level of content, content structure, summary) as well as learning design attributes for the particular learning object (instructional approach, content presentation method, learning activities, assessment method). The system was initiated due to the absence of standardised procedures in the beginning phase of the learning object design which is content

design. This is a case study involving interviews with experts and literature reviews to derive the attributes for the content analysis process. A set of guidelines was developed which highlighted the steps in analysing the content. These guidelines were then transformed into a Learning Object Design System (LODS). LODS enable the IDs to record, save, retrieve and print their input on the content analysis findings. The LODS is expected to aid the IDs in the decision making process as it provides step-by-step template with options. The documentation will become as easy as filling in forms as they would be automatically formatted into one standard version. LODS is expected to speed up the content production and simplify the IDs' current work process. For further research, it is recommended to make the LODS as collaborative platform between IDs and SMEs to enhance the quality of learning objects.

Introduction

The first phase of multimedia learning object development involves the instructional designer (ID) analysing the instructional goals and needs in an attempt to understand the instructional problem, followed by selecting, sequencing, synthesising and summarising the content for instructional purposes and identifying the scope and content of the subject (Keppell, 2000). These areas represent the 'problem space' of the IDs. In addition, most designers do not share a common understanding of what constitutes a learning object (LO), which leads to further problems in determining the structure, function, and the content of the Multimedia Learning Object MILO (Gibby et al., 2002; Mohan & Daniel, 2004; Lim, 2007). Current standards do not yet provide specific guidance on how to plan for or create multimedia learning objects (MILO), although some principles and guidelines available from existing literature can aid in the content design process (Beaudrie, 2001; Centre for Learning Technologies, 2000 in Reese, 2009). This study addresses the gaps and challenges perceived by the ID from a particular institution during their content design process of a multimedia learning object (MILO). From the findings, the researcher studied and designed Learning Object Design System (LODS) pertinent to the characteristics and goals of an LO, which will assist the ID in producing the necessary content, instructional strategies, and assessments to build the MILO. It is hoped that this research will be able to serves as a source of information to them on how to aggregate the content and decide on the instructional approach more systematically.

Research Objective

The objectives of this study are given below:

1. To develop Learning Object Design System (LODS) for instructional designers to record the content analysis findings as well as design ideas for multimedia learning objects (MILO); and
2. To assess the effectiveness of LODS to instructional designers in guiding them in process of analysing the content for learning objects.

Literature review

Expert reviews on learning object design structure

This section of literature review was used as data for the design of the LODS for multimedia learning object. The data is about the instructional components of LO which the LO author (instructional designer) need to be planned when analysing the content.

According to Chyung (2007) one of the first things to do in learning object development is to conduct a content design plan (also called as content analysis). Optimally, designers should analyse the instructional content before determining which media ought to be used to deliver the content. From a content level analysis, instructional designers are able to state specific lesson objectives, instructional strategies, and assessment methods for use in the instructional steps required in the course.

During the analysis of content before storyboarding, the specific components of the LO must be addressed. The manner in which learners will be presented with the instruction is determined (the delivery media and learning activities), and the sequencing and aggregation of content (Chyung, Treñas, 2009). These tasks must be completed by the instructional designer before proceed into storyboarding.

Merril (1983) in his component display theory has highlighted four types of content including concepts, facts, procedures, and principles. After an additional item, processes, has been added to the types of content, the five items are often referred to as CFP3 (Clark 1999), which Cisco uses in its RLO strategy (2003). Cisco (2003) applied David Merrill's and Bloom's taxonomy while Chyung (2007) proposed content taxonomy based on David Merrill's and Gagne's three types of verbal information (Table 1).

Table 1
Content Taxonomy Models for E-learning Development

3 categories of e-learning content	Type: Concept, Fact, Principle, Procedure, Process
Declarative knowledge (knowing what),	Concepts and facts
Procedural knowledge (knowing how)	Procedures and processes
Situated knowledge (knowing when and how).	Principles

It has been quite frequently argued that instructional design principles should guide the design of MILOs (Wiley, 2000). From an instructional design perspective, Gagne, Briggs, and Wager identified four basic elements that should be taken into account for lesson planning. These are:

1. "A statement of the objective of the lesson
2. A list of instructional events to be employed;
3. A list of the media, materials, and activities by which each event is to be accomplished;
4. Notes on the teacher roles and activities"

(Gagne, Briggs, & Wager, 1992, p. 237).

These elements of lesson planning as defined by Gagne, Briggs, and Wager (1992) are very close to the way Cisco (2003) approaches the concept of a MILO, that is, as a container of the learning objective, activities, and content. A similar approach to MILO design has been also adopted by Macromedia (Gallenson, Heins, & Heins, 2002). Finally, Plodzien, Stemposz, and Stasiecka (2006), based on a "model of effective learning," identified four broad categories of a MILO's structure: introduction, main content, summary, and evaluation. These categories were further used as measures for evaluating the quality of MILO (Gallenson, Heins, & Heins, 2002). The researchers concluded that the presence of such instructional components within a learning object had a positive impact on the way users evaluated its quality (Plodzien, Stemposz, and Stasiecka, 2006). Baruque and Melo (2003) proposed the following attributes to be specified for each MILO: learning outcomes, content to be covered, evaluation method, example, practice, media and instructional approach. This last item can be chosen among the following cases: presentation, demonstration, collaborative learning, learning by discovery, problem solving, instructional games, simulation, tutorial and drill-and-practice.

Ally (2004) proposed three main components which a LO should consists of. First component is a pre-learning strategy such as a learning outcome, advance organizer and overview. The second component is a presentation strategy which includes the content, materials and activities to achieve the outcome for the LO. The content includes facts, concepts, principles and procedures in the form of text, audio, graphics, pictures, videos, simulation or animation. The third component is a post-learning strategy in the form of a summary and post-assessment to check the achievement of the learning outcome.

Thompson and Yonekura (2005) have produced a structural model with the goal of producing instructionally sound MILO. Their MILOs model consists of useful and reusable digital components that: 1) state a learning objective, 2) present content, 3) provide opportunity for practice and 4) assess achievement of the objective. According to their model, all four elements must be present for a component to be considered a MILO. They have provided instructional guidelines for each of the component in the model that any author of MILOs must take into consideration. The summary of the guidelines presented in the below table:

Table 2
Guidelines for Each Component in the Instructional Model of LO Proposed by Thompson and Yonekura (2005)

Element in LO	Description
Learning objective	Each MILO can address only one learning objective. The learning objective must address the task (what the learner will perform), conditions (under which conditions should the learner complete the objective?) and criteria (To what degree should the learner achieve this objective?).
Content	Text, video, audio, images or interactive media that convey the

	facts, concepts, processes, procedures and/or principles of the subject matter should be included. The content has to be chunked and organised into key ideas according to the high-to-low level importance.
Practice	A MILO should provide opportunities for learners to review facts, key concepts and principles through exercises, instructional games, simulations, problem solving and guided reflections.
Assessment	The assessment part in LO is to ensure whether the learner has achieved the stated learning objective. MILO authors have the choice of using traditional assessment methods such as quizzes (i.e., multiple choice, true-or-false, etc.) or non traditional methods such as games and simulations.

From the literature reviews discussed, it can be concluded that, a MILO hould have 5 main attributes which are 1.) introduction, 2.) content – chunking and content display methods have to be specified 3.) learning activities / practices 4.) summary and 5.) assessment / evaluation. The extracted elements from the literature reviews were used as the data for the LODS.

Methodology

This research was segmented into two phases: One involves the gathering of the data and information to produce the guidelines, and the other involves evaluating the guidelines' effectiveness. In this study, the participants are five instructional designers from an open and distance learning institution located in Kuala Lumpur, who are involved in the development of multimedia learning objects (MILO).

Data collection

The data collection methods used to gather information for guidelines design and evaluation of the guidelines are described in following sections.

Gathering of the data and information to produce the LODS

The data for LODS were collected via:

a. Job analysis via a focus group interview of the IDs:
   Krueger and Casey (2000) describe focus group interviews as 'organized group discussions which are focused around a single theme'. He stressed that focus group interviews allow people with certain characteristics to provide qualitative

data to help understand the topic of interest. The reflections of the respondents, who are IDs involved in MILO development, were recorded in this interview. The objective of this interview was to establish the gap occurring in the performance of the IDs in content analysis.

b. Interview of subject matter experts (SME):
Interviews with experts, who are involved in learning objects or any web-based content development, were conducted. According to Begner and Menz (2002) in Flick (2009), the expert interview can be used for preparing the instrument in a study of other targeted groups. In this study, the findings from the expert interview were used as the guidelines (instruments) for the IDs (targeted group). The first interview was conducted with a project director of the MILO development project. The second interview was conducted with the leader of the e-content development team.

c. Review of the existing literature and best practices:
Apart from that, the insights and information from the literature were used as context knowledge (Flick, 2009) of content development of the MILO. The findings from expert interviews were then triangulated (mapped) with the information extracted from the literature review to validate the information gathered from the experts.

Evaluation of the LODS

Each ID was given the task of analyzing a sub-topic from a print module developed by the institution and recording the analysis findings in the content analysis document during the first session. During the second session, each ID was asked to present their content analysis findings and explain their own experience of analyzing the content. In order to determine whether LODS was useful for them or not, a focus group interview session was conducted with the IDs. This interview focused on:

a. Their experience in conducting content analysis by using the guidelines and documenting their analysis findings.
b. Feedback on how to improvise the guidelines.

Data analysis

Thematic analysis was used to derive themes emerging from the interviews and literature reviews. Thematic coding was chosen because this study involved researching a particular issue or perspective of a process (Creswell, 1998) (what are steps involved in content analysis, how particular guidelines assist IDs in conducting content analysis). Coding was flexible to allow for the emergence of any unexpected potential categories (Conover, 2008).

Findings

The interview of the IDs during job analysis revealed that each ID analyses the content according to his or her own understanding and convenience. There is no standardization of the procedures involved in conducting content analysis. Also, there is no documentation of the IDs' decisions on content structure, presentation, and assessment made during the content analysis.

Interviews of two SMEs were conducted, as explained in methodology after the results from the interview of the IDs as well as the performance gap analysis findings were presented. Based on the findings, the SMEs suggested certain steps for conducting content analysis. The existing literature on LO structure was analyzed to extract the instructional components to be considered during the content analysis. A checklist containing all the key points regarding LODS was drawn.

1. Identify the learning objective (Cisco, 2003; Ally, 2004; Baruque & Melo, 2004; Thompson & Yonekura, 2005; Plodzien et. al, 2006).
2. Present the advance organizer (Ally, 2004).
3. Present the overview or introduction (Ally, 2004; Baruque & Melo, 2004; Plodzien et al., 2006).
4. Merrill's content performance index and Bloom's taxonomy to determine the cognitive level of the content (Cisco, 2003; Chyung, 2007).
5. Present content that includes facts, concepts, process, procedures, and principles (Cisco, 2003; Ally, 2004; Baruque & Melo, 2004; Thompson & Yonekura, 2005; Plodzien et al., 2006).
6. Choose an appropriate instructional approach from following cases: presentation, demonstration, collaborative learning, learning by discovery, problem solving, instructional games, tutorials, and drills and practices (Baruque & Melo, 2004).
7. Include practice or activities such as drills and practices, games, and problem solving (Cisco, 2003; Ally, 2004; Baruque & Melo, 2004; Thompson & Yonekura, 2005; Plodzien et al., 2006).

Later, the extracted components were mapped with the interview findings. All the information gathered through the expert interviews was also highlighted by the literature. The steps that have been mentioned in both the literature and by the SMEs were used as the content for the LODS. Based on the mapping, a content flow chart was designed to illustrate the content flow of the guidelines. The content flow chart was later approved by both SMEs Figure 1 shows the flow chart of the LODS. After the approval, LODS was developed. The LODS is an online database system in which the instructional designers record their findings from the content analysis (nature of content, learning outcome, cognitive level of learning outcome, summary) and document their design plan for the MILO, which includes the introduction, content presentation method, learning task, and assessment (Figure 2a-2f).

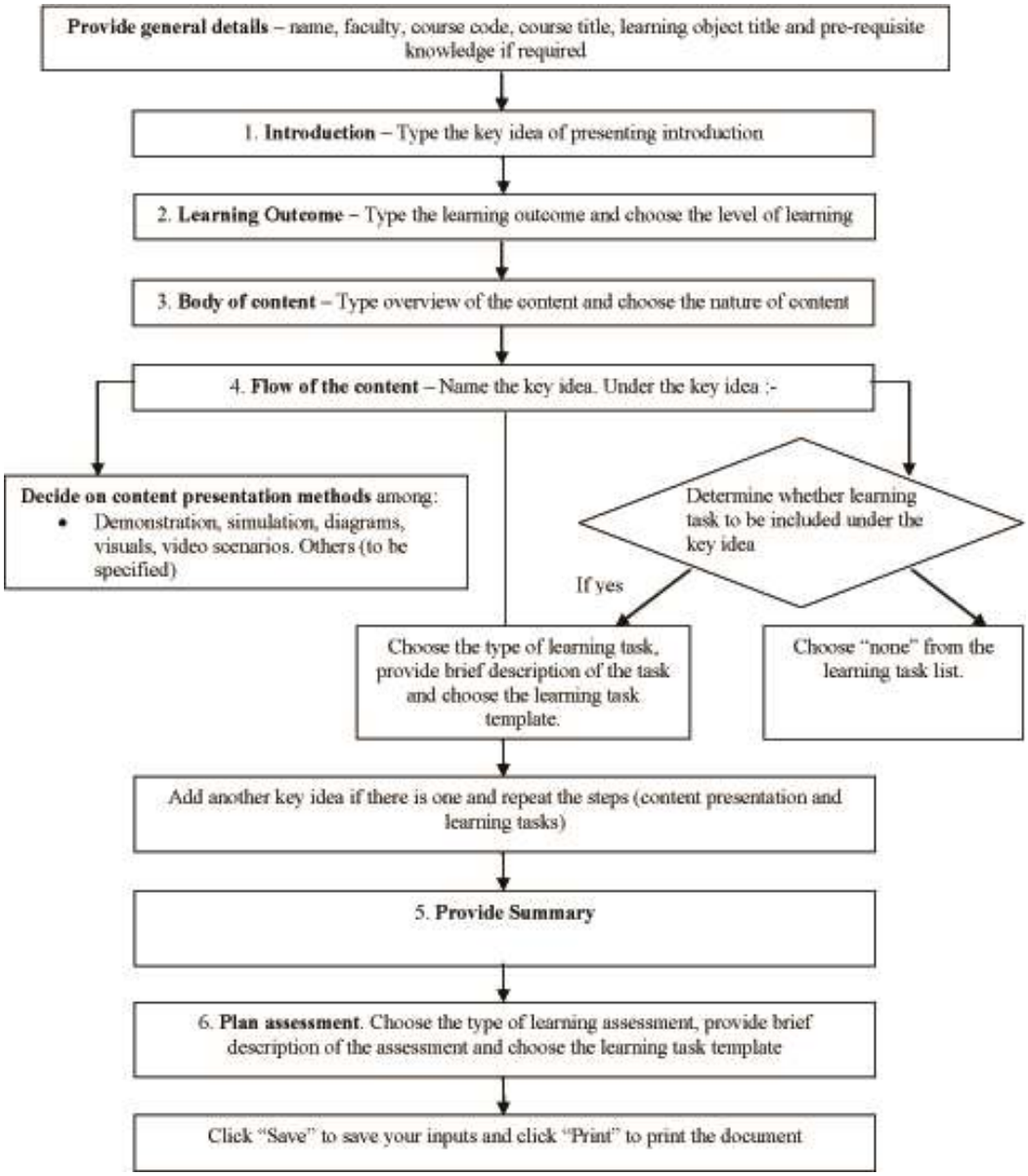
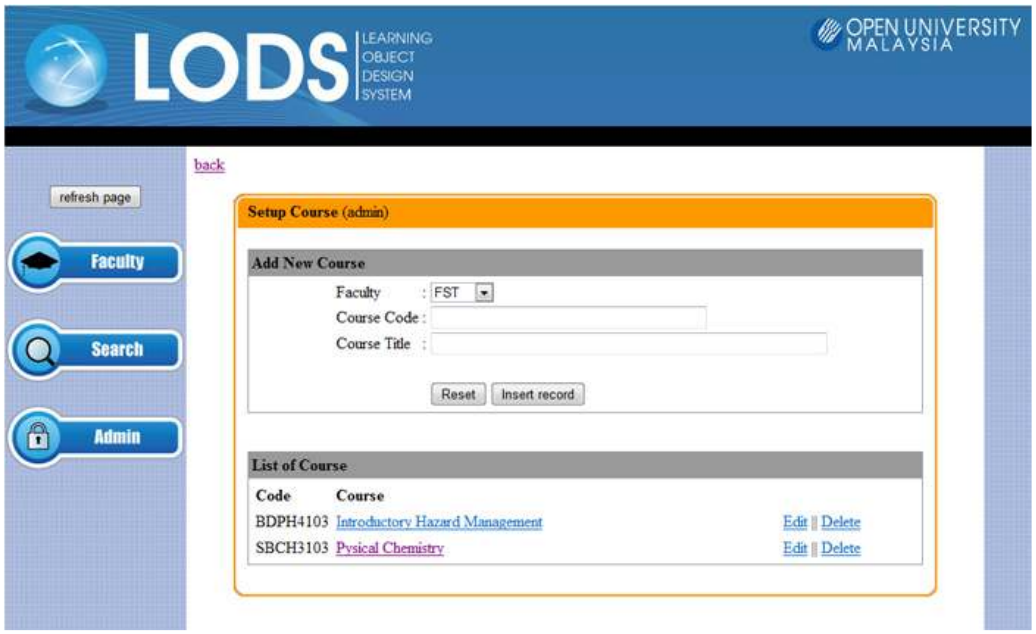


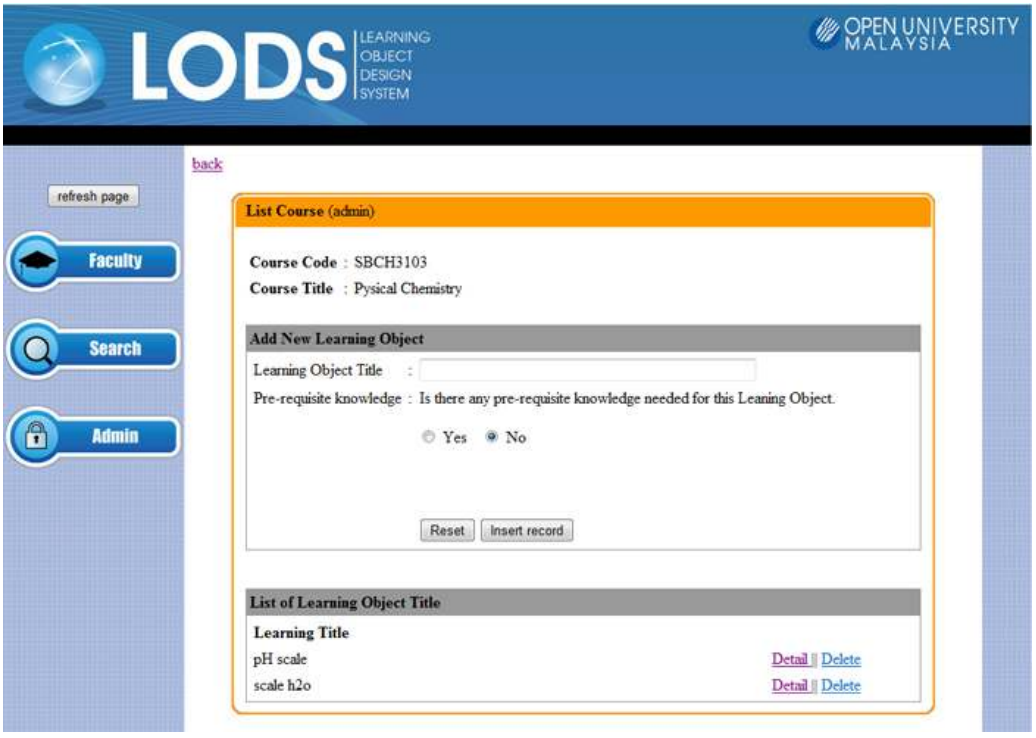
Figure 1. Flow chart of Learning Object Design System (LODS)

Figure 2a shows the main page of the system where the user has to log in before proceed into creating new content analysis document. After log in, the user will choose the faculty and the course which the new analysis document will be parked under.

Figure 2a Login page

Next the user will insert the course code, title, learning object title and pre-requisite knowledge for record.





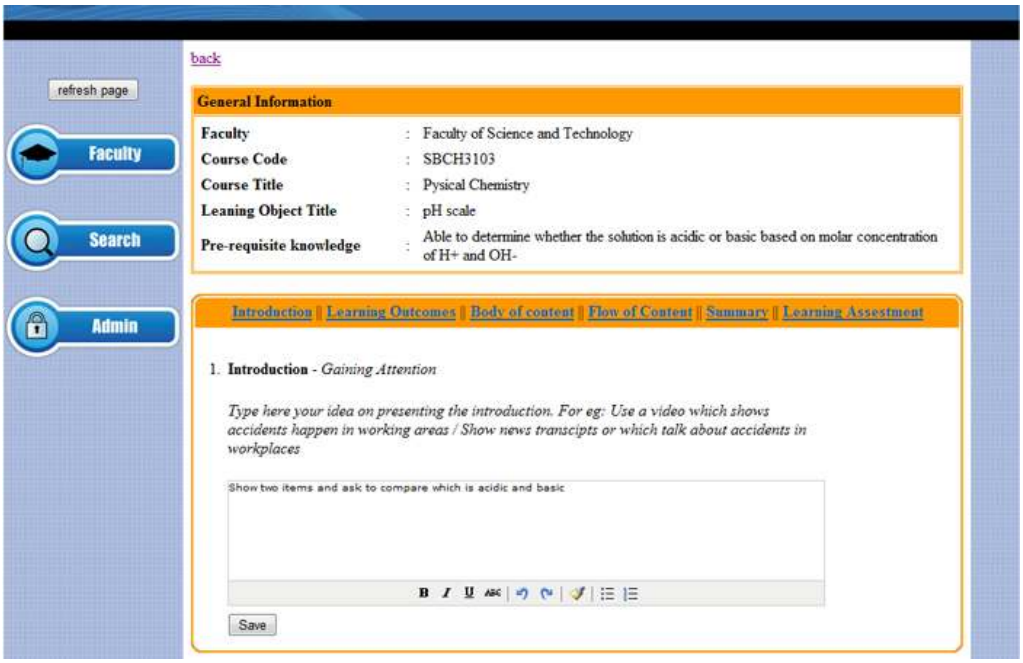


Figure 2b Create introduction

In this page the user will decide on the method of introducing the content. This is first step to capture attention of learner. Presenting videos, news transcripts, images can be regarded as one of attention grabbing methods.

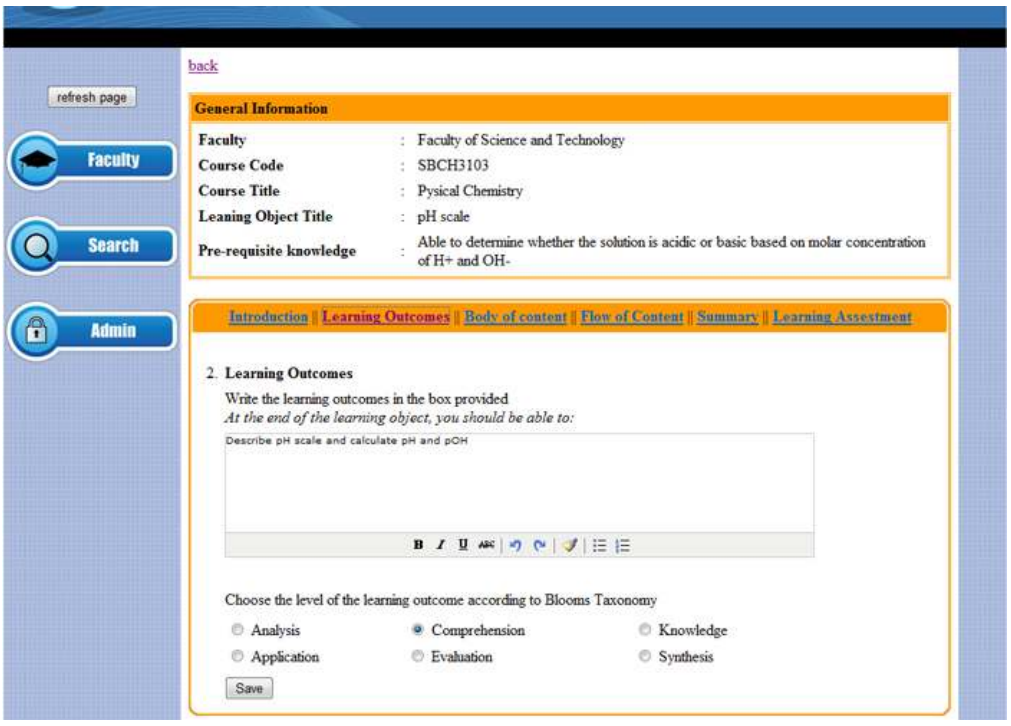


Figure 2c Learning outcome

Here the user need to address the learning outcome and the level of learning outcome according to the Bloom's Taxonomy.

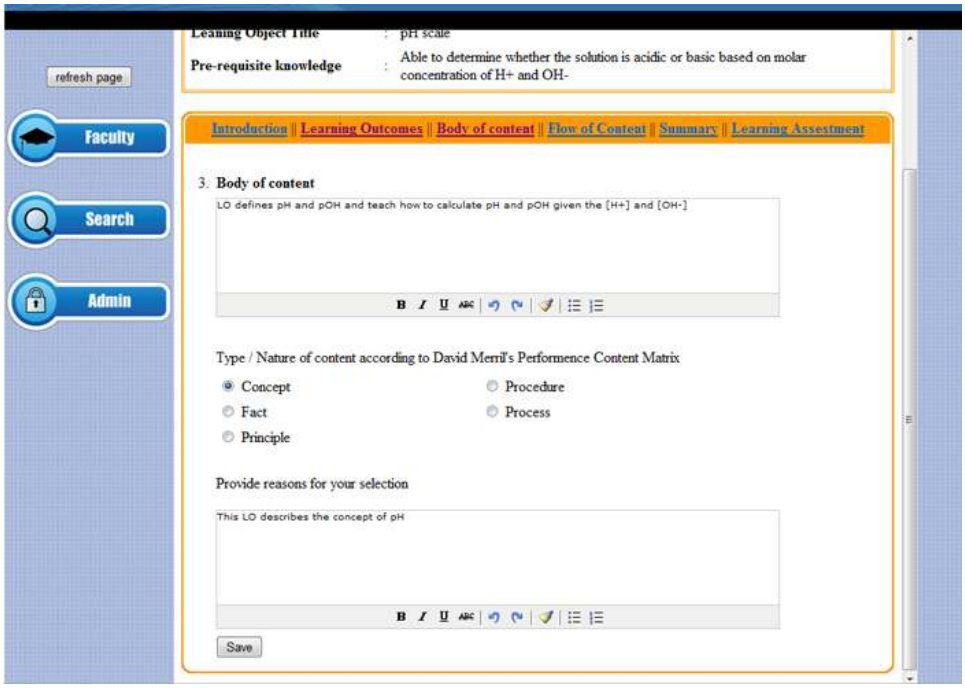


Figure 2d Select the nature of content

Here the user need to identify the nature of content according David Merril's content taxonomy in order to determine the display the content and learning task.

Figure 2e Plan the flow of content, presentation method and learning task

In this step the user will chunk the ideas into few key ideas. Under each key idea the user need to choose the presentation method from the choices given. After identifying the presentation method the user need to design learning task to provide the opportunity for learners to assess themselves. There are options for learning task and the templates.

Example LO title : DNA structure.
Key idea : Present building blocks of DNA
Content presentation : Animation , text.
Learning task :Label the building blocks of DNA
Learning task templates : Drag and drop

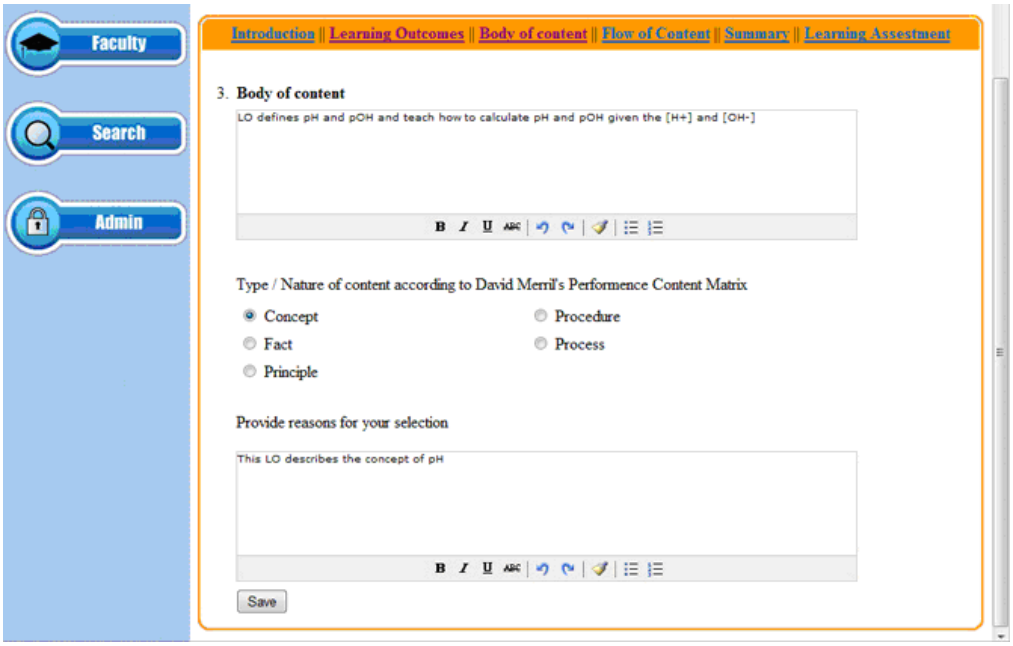


Figure 2f Plan assessment

Here the user chooses post assessment of learning object from the various assessment methods given.

Example:
Description: Recall the role of each level of manager. Given the description of task, choose the level of manager.
Assessment: Quiz
Assessment template: Multiple choice question

This system has also enables public sharing of the content design inputs. The user can upload his/her input on content design inputs and also can retrieve other records. Since this is an online system, external SMEs especially tutors can be also appointed to analyse content and record the findings and submit online. The findings from the analysis recorded in the system can be retrieved at any time by using search method to edit.

Evaluation of LODS

A focus group interview session was conducted with the participants in order to assess the effectiveness of the guidelines and the content analysis document. In the interview, the IDs overall indicated that the Learning Object Design System (LODS) has helped them to save the time and effort spent in deciding the instructional approaches (content presentation method, learning activities, and assessment). They also indicated that the task has became more organized and structured. One of the ID said "We have to generate as many as options on our own when it comes to deciding the instructional methods. But the beauty of this system is it already draws out all the options for us. We just have to choose. For example, the content presentation methods are all displayed. We just have to choose the best for the content".

All the participants agreed LODS has created a platform to document the ideas and decisions made during content analysis. One of the participants mentioned that the recorded findings in LODS would help the IDs save time in creating a storyboard. She said, 'We have already decided on the learning outcome, content structure, and brief ideas of the learning tasks during the content analysis. So, during storyboarding, we can focus more on finding external resources, designing the learning activities with feedback, and media programming.' According to another ID, 'by having the predetermined ideas of the MILO design, designing the storyboard would become easy. We just have to refer to the things that we recorded in the system.'

Conclusion

This study has highlighted the importance of planning the content design process before storyboarding. The guidelines developed had indeed helped the IDs from the particular institution. LODS was an initial step to guide the IDs before they proceeded to the detailed design of the LO (storyboarding). This system has smoothen the planning process of LO content design as it aid the decision-making processes entail selecting the type of content, presentation mode, learning activity and assessment by providing options.

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