



DESIGN AND DEVELOPMENT OF A MULTIMEDIA COURSEWARE USING PERSONALIZED LEARNING ENVIRONMENT APPROACH FOR NUTRITION TOPIC

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ABSTRACT

The study of Nutrition is one of the most important in Science subject but often difficult subjects to teach at the secondary school education level. This paper discusses the design and development of a Personalized Learning Environment for Nutrition (PLENut) by using personalized learning approach to enhance the learning of Nutrition among Form 2 secondary school students. With the technology of multimedia widely used in the classroom, the requirements of multimedia courseware are increasingly high. A courseware is systematically developed using ADDIE model to assist students who had difficulties in mastering and acquiring the concept of the topic. The findings of this study show that the courseware is well designed in terms of using personalized learning elements which goes through a series of systematic testing stages. In turn, it is highly anticipated that the creation of the PLENut, would be an alternative approach so that all students could capture, in a richer and more meaningful manner, the concepts of Nutrition. This process carefully links the organization's needs, instructional strategy and the desired learning outcomes for an effective program. The ADDIE systematic of instructional design focuses on the expectations of the organization, and what learners are to know or do when the instruction is completed.

Keywords: ADDIE model, courseware, multimedia learning, PLE.

INTRODUCTION

Over the last two decades the use of E-learning technology increased to such an extent that the role of the traditional academic has been forced to change (Nurul *et al.*, 2015). According to Redecker *et al.*, (2011), new forms of teaching and learning are emerging new formats of educational resources have appeared and being used by teachers and students example digital resources, open educational resources and educational platforms. During the last twenty years computer based learning has emerged as the innovative delivery method for education (Moos and Azevedo, 2009). In some instances internet based education has taken the place of traditional classroom learning (Zhang *et al.*, 2004; Huddleston and Pike, 2008). E-learning standard covers all the aspects of online education, virtual education, learning platforms, web-based training, and flexible teach that architect the learning management and educational applications (Sivakumar *et al.*, 2015). The intention of using the technology is not to replace the traditional ways of teaching and learning, but rather to provide an additional aided learning tool for some areas that require more attention, and those which have been identified as needing alternative methods, apart from the normal way of teaching (Syazwan *et al.*, 2011).

Science education reform emphasised the need for computer technology to be integrated into learning, teaching, and assessment (Fazzlijan and Mona, 2013). This is also mentioned by Sharifah Nadiyah *et al.*, (2014) stated that technology is seen as an important enabler for improving student learning outcomes. In the past decade, the advent of Information and Communication Technology (ICT) made it pivotal to have an effective

instructional design for better education in science (Dow, 2006). The student's perspective has been covered by various researchers (Wang and Wang, 2009; Hardaker and Singh, 2011; Macharia and Pelsler, 2012).

Since Malaysia is committed to developing and providing world-class educational systems, there was a need, in various fields, for an effective instructional medium which incorporates an appropriate learning environment. However, in the last few years, the advent of ICT eased the burden on the necessary resources for the teaching and learning processes. The use of computers, as a ubiquitous teaching device, has become prevalent in the Malaysian education context. As such the use of computers, in combination with effective teaching strategies, has a tremendous potential in the teaching and learning processes (Fazzlijan and Mona, 2013).

This paper explains the design and development of a courseware called Personalized Learning Environment for Nutrition (PLENut). The aim of this approach is to enhance the learning of Nutrition topic. It was reported that Nutrition was a facts topic which difficult to understand and affected students' learning outcomes. Due to new possibilities, perspectives, insights and challenges, the concept of PLEs seems to be an interesting but not a very well developed or elaborated concept for introducing an innovative approach within technology-enhanced learning and especially within the field of higher education (Che Ku Nuraini *et al.*, 2014).

A qualitative method, using unstructured interviews and observations were carried out to gather useful information to elicit the students' problem in succeeding in Nutrition and the need for any new instructional strategies. The researcher also identified



Science teachers, with various secondary schools at Malacca state in order to participate in these interviews.

The finding of this preliminary investigation revealed that the current students faced problems in the learning of Nutrition topic. The results revealed that there was a lack of good quality resources of learning materials for them to refer. According to Fazzlijan and Mona (2013), limited time for revision and exploring each topic are deemed to be problems which needed to be solved in order to enhance their performance and understanding of Nutrition.

Complex processes and the use of technical terms made it difficult to learn some topics such as Nutrition (Petro, 2008; Rice, 2013).

MULTIMEDIA STUDIES IN EDUCATION

Multimedia courseware is one of the solutions in dealing with students' differences in learning styles and knowledge background since it integrates media elements that can engage human information retrieval methods which are visual, auditory, reading and kinaesthetic (Syazwan *et al.*, 2011); (Syahrul and Jonathan, 2006). Multimedia has proven for its efficacy as computer assisted tools in learning. An effective multimedia courseware required understanding design and learning theories during pre-development process. Multimedia is the combination and integration between text, graphics, sound, animation and video. This creativity concept has started been given attention and become a necessity in a software (Mohd *et al.*, 2013). The word multimedia itself helped accept the current changes, which is now also commonly known as a multimedia interactive multimedia to show how interactivity is considered as one element that is emphasized in any multimedia application (Tasir *et al.*, 2005). Multimedia technology can be seen easily through individual that owns a set of computers equipped with CD-ROM drive, audio card and speakers (Mohd *et al.*, 2013).

WHAT IS PERSONALIZED LEARNING ENVIRONMENT (PLE)

Personalized learning systems support learners to set own learning goals of the students and manage their learning process, also managing both content and process, communicate with in process of learning, and by achieving learning goals (Antonio Garrido 2014). Hwang *et al.*, (2010) further developed an adaptive learning system to guide individuals to learn in a real-world environment by generating the personalized learning paths based on the learning status of each student and the relationships between the authentic learning targets. It can be seen that the provision of personalization or adaptation modules, including personalized learning materials, navigation paths or user interfaces, has been recognized as an important issue for developing effective learning systems (Chiou *et al.*, 2010; van Seters *et al.*, 2012). At the same time, and from a first perspective, Barroso *et al.* (2012) include authors such as Fiedler and Pata (2009), Amine (2009), Henri *et al.*, (2009) as the ones who consider PLEs a self-defined collection of resources, services, tools and devices which can help teachers and students shape their personal

learning and knowledge networks. A PLE also puts students in charge of their own learning processes, challenging them to reflect on the tools and resources that help them learn best. By design, a PLE is created from self-direction and therefore the responsibility for organization and thereby for learning with the learner (Che Ku Nuraini *et al.*, 2014).

In Malaysia, the Ministry of Education envisaged that by the year 2020, learning and learning content will be personalized. In addition, future classrooms are described as to have the following components (MSC 2005, 46-57):

- a. **Teachers:** The task is to train non-technical teachers to create, publish personalized content and post e-learning material online; teachers to become virtual mentors to learners; and teachers in 3 dimensional images are projected to students' homes with online interaction both synchronously and asynchronously.
- b. **Learners:** Each student will have one or several virtual mentors who can be accessed anytime; learners learn in communities that involve parents, teachers, university lecturers, professionals, industry members.
- c. **Tools:** the use of technologies of tomorrow-sophisticated ICT-enabled teaching and learning environment such as virtual learning and tele-immersion technology; the use of virtual reality will be common by 2020.
- d. **Pedagogy:** community-based and constructivist learning using experiential and project-based instructional approaches. Besides that, teachers should create materials that are personalized to learners for the purpose of engaging learners in learning.

HOW PLE HELPS TO DEVELOP THE COURSEWARE

Social media are being increasingly used as tools for developing formal and informal learning spaces or experiences that start out as an individual learning platform or PLE, enabling individual knowledge management and construction, and evolve into a social learning platform or system where knowledge is socially mediated (Dabbagh and Reo, 2011a; Johnson *et al.*, 2011; McGloughlin and Lee, 2010; Minocha and Kerawalla, 2011).

Examples of social media include experience- and resource-sharing tools such as Delicious, WordPress, and Twitter that enable online/social bookmarking, blogging, and microblogging that enables the creation of collaborative workspaces; media sharing tools such as Flickr and YouTube that enable social tagging; social networking sites (SNS) such as Facebook and LinkedIn that enable social networking; and web-based (cloud-computing) office tools such as Google Apps that enable document and calendar sharing and editing among other things (Dabbagh and Reo, 2011b; Kitsantas and Dabbagh, 2010). This offers the opportunity to develop learning environments whilst simultaneously accessing and shaping



the production and business process through such interfaces.

Specifically, PLEs require the development and application of self-regulated learning skills because PLEs are built bottom-up starting with personal goals, information management, and individual knowledge construction, and progressing to socially mediated knowledge and networked learning (Dabbagh and Reo, 2011a; Turker and Zingel, 2008).

PLEs provide learners with their own spaces under their own control to develop and share their ideas. Moreover, PLEs can provide a more holistic learning environments, bringing together sources and contexts for learning hitherto separate. Students learn how to take responsibility or their own learning.

ADDIE MODEL

The ADDIE model is a popular instructional design model that has a step-by-step process that helps create effective instruction. Almost all instructional design models contain core elements of the ADDIE (Dempsey and Reiser, 2012). The ADDIE model as shown in Figure-1 has become a popular term used to describe a systematic approach to instructional design (Dempsey and Reiser, 2012). The ADDIE Instruction Design Process consists of five basic steps which is 1) Analysis; 2) Design; 3) Development; 4) Implementation and 5) Evaluation. Each step has an outcome that feeds into the next step in the sequence.



Figure-1. ADDIE model (Dempsey & Reiser, 2012).

Analysis

During analysis phase, the researcher has to identify the learning problem, the goals and objectives, the audience's needs, existing knowledge and any other relevant characteristics. Analysis also considers the learning environment, any constraints, the delivery options and the timeline for the project. Besides that, researcher has to identify all the variables that need to be considered when designing the course, such as learner characteristics, learners' prior knowledge and resources available.

Design

During the design phase, a systematic process of specifying learning objectives. It also identifies how materials will be created and designed for instance, it may include describing what content areas are to be covered

and a storyboard outlining what will be covered in text, audio and video and in what order and deciding on the selection and use of technology. Detailed storyboards and prototypes are often made and the look and feel, graphic design, user-interface and content are determined here. In addition, this situation provides the possibilities to create assessment that is more complex and complete (Helmy *et al.*, 2012).

Development

During the development phase, the actual creation of the content and learning materials based on the Design phase. The creation of content, including whether to develop in-house or outsource, recording videos or audio, loading of content into a prototype.

Implementation

During implementation, the plan is put into action and a procedure for training the student and teacher is developed. This is the actual delivery of the course, including any prior training or briefing of teacher and student assessment. Materials are delivered or distributed to the student group. After delivery, the effectiveness of the training material is evaluated.

Evaluation

Before the evaluation can be made, respondents are required to use multimedia applications. This section relates to the process of application development involving the use of multimedia elements and interactivity elements found in the application. The assessment, are made based on the use of text, graphics, color, audio, video, and animation. The results of the assessment will help to improve the application. In completing the questionnaire, respondents are required to choose either strongly agree with the questions provided, or agree, or not agree, or disagree, or strongly disagree. Here are the questions proposed:

- a) Appropriate font type
- b) Appropriate font size
- c) Appropriate graphics
- d) Appropriate button
- e) Appropriate colour
- f) Appropriate audio
- g) Navigation is easy
- h) Navigation is clear and concise
- i) Number of buttons and links understandable
- j) Links are consistent
- k) Links are easy to access

RESULTS

Courseware development

The courseware design is based on ADDIE Model (Dempsey and Reiser, 2012). Learning modules are shown on the main page when student access the courseware in Figure-2. There are seven learning modules which is 1) Introduction, 2) Notes, 3) Learning Styles, 4) Exploration, 5) PLE Elements, 6) Forum and 7) Glossary.

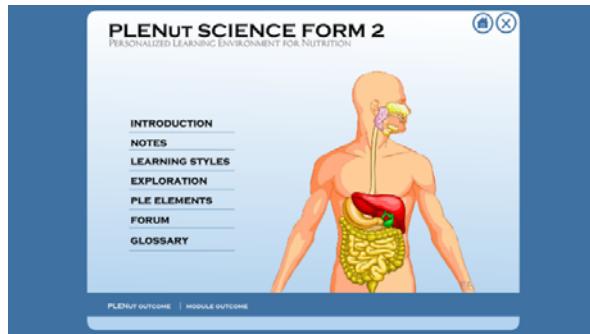


Figure-2. Main page.

Figure-3 shows the Learning Styles module. There are three types of learning styles which is 1) Visual, 2) Auditory and 3) Kinesthetic. The modules will be chosen by student based learning styles preferences. Students learn in many different ways. Some students are visual learners, while others are auditory or kinaesthetic learners. Visual learners learn visually by means of charts, graphs, and pictures. Auditory learners learn by listening to lectures and reading. Kinaesthetic learners learn by doing (Abbas P., 2012). Everyone has their own learning style along with their cultural influences; the students who are taught using their own learning style taking into consideration cultural aspects of individuals will perform better academically (Sywelem *et al.*, 2012).

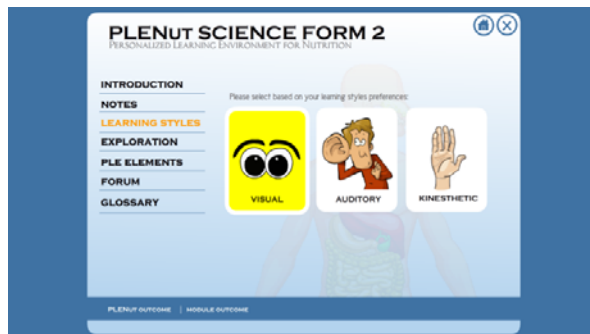


Figure-3. Learning styles.

Figure-4 shows the PLE Elements in the courseware. There are seven PLE elements. The elements are classified based on previous researcher. There are few tools for each element. The elements are 1) Content, 2) Communication, 3) Communication, 4) Community, 5) Colloboration, 6) Colletion and 7) Creation.

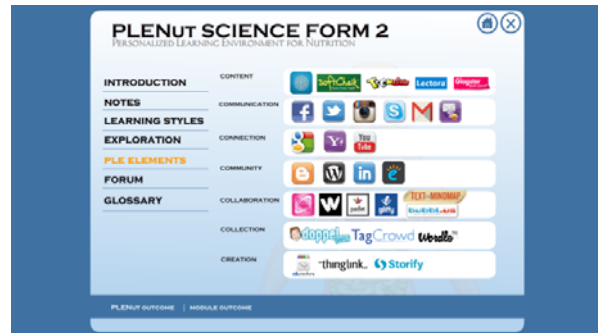


Figure-4. PLE elements.

User acceptance test

User acceptance test is conducted to identify what a system will do and how it will benefit to the end user before it is implemented in real environment. Table-1 is tabulated with each Likert point response, bearing 1 for strongly disagree and 6 for strongly agree. User acceptance test consist 25 items to measure Content, Module, Multimedia Element, Navigation and Usefulness. Based on results, majority of the students agree that the content is related to Nutrition topic. For Module in PLENut, it can be said that majority respondents agree except for Module Notes only 1 respondent (3.3 %) disagree. Multimedia element that applied in the prototype includes the appropriateness of font type, font size, graphics, button, colour and audio. Majority of the respondents agree with the multimedia elements that except for audio only 3 respondents (10 %) disagree. The quality of the audio or sound needs to be improved. There are 10 respondents (33.3 %) disagree with links are easy to access. So, the links in the prototype need to revise for easy access for real testing.

**Table-1.** User acceptance test.

Item	Frequency					
	1 Strongly Disagree	2 Somewhat Disagree	3 Disagree	4 Agree	5 Somewhat Agree	6 Strongly Agree
Content						
The content is clear				3 (10 %)	19 (63.3%)	8 (26.7 %)
The content is easy to understand				6 (20 %)	19 (63.3 %)	5 (16.7%)
The content is related to Nutrition topic					15 (50 %)	15 (50 %)
The content in PLENut is interesting			1 (3.3 %)	4 (13.3 %)	15 (50 %)	10 (33.3 %)
Module						
Introduction				8 (26.7 %)	13 (43.3 %)	9 (30 %)
Notes			1 (3.3 %)	2 (6.7 %)	16 (53.3 %)	11 (36.7 %)
Learning Styles				3 (10 %)	14 (46.7 %)	13 (43.3 %)
Exploration				7 (23.3 %)	10 (33.3 %)	13 (43.3 %)
PLE Elements				4 (13.3 %)	14 (46.7 %)	12 (40 %)
Forum				5 (16.7 %)	14 (46.7 %)	11 (36.7 %)
Glossary				7 (23.3 %)	8 (26.7 %)	15 (50 %)
Multimedia Element						
Appropriate font type				4 (13.3 %)	11 (36.7 %)	15 (50 %)
Appropriate font size				2 (6.7 %)	12 (40 %)	16 (53.3 %)
Appropriate graphics				3 (10 %)	7 (23.3 %)	20 (66.7 %)
Appropriate button				4 (13.3 %)	10 (33.3 %)	16 (53.3 %)
Appropriate colour				3 (10 %)	8 (26.7 %)	19 (63.3 %)
Appropriate audio			3 (10 %)	7 (23.3 %)	12 (40 %)	8 (26.7 %)
Navigation						
Navigation is easy				11 (36.7 %)	10 (33.3 %)	9 (30 %)
Navigation is clear and concise				11 (36.7 %)	10 (33.3 %)	9 (30 %)
Number of buttons / links reasonable				8 (26.7 %)	18 (60 %)	4 (13.3 %)
Links are consistent				9 (30 %)	11 (36.7 %)	10 (33.3 %)
Links are easy to access			10 (33. %)	9 (30 %)	10 (33.3 %)	1 (3.3 %)
Usefulness						
PLENut is useful for Visual students (Picture)				3 (10 %)	6 (20 %)	21 (70 %)
PLENut is useful for Auditory students (Sound)			1 (3.3 %)	10 (33.3 %)	4 (13.3 %)	15 (50 %)
PLENut is useful for Kinaesthetic students (Touch)				6 (20 %)	6 (20 %)	18 (60 %)

CONCLUSIONS

The PLENut applied the main components of personalized learning in that (1) it specified clearly what was to be learnt and how it would be evaluated; (2) it allowed students to learn at their own pace in the instruction; and (3) testing the final learning criteria has been achieved. Hence, this study will produce a persuasive multimedia application that will contribute to the current efforts of the Malaysia Ministry of Education (MOE) and especially teachers and students themselves. Academics have mentioned the effects of technology, and further research on how to manage expectations in an E-learning

environment would be of interest (Nurul *et al.*, 2015). The decision of adopting applications, the development of matching learning activities, integrating technologies in instruction are all roles and activities that directly contribute to the successful implementation on PLE (Che Ku Nuraini *et al.*, 2014).

In the future work for the other researcher, this template could be adapted easily to other difficult science topics and, therefore it will save the development time in the future. In addition this study was useful, in terms of how the effective use of technology in education could help to overcome learning difficulties. Along with the



current technology and on-line sources of information, students should be exposed to active learning and flexible learning strategies. What more important is that, the teaching and learning session must be meaningful to both teachers and students. At the same time, PLE will provide students real life connection, forum for sharing of ideas, promotes creativity among students, critical thinking, deep learning and understanding (Che Ku Nuraini *et al.*, 2014).

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