

# The Use of Blended Learning in Development of Multimedia Courseware: Loci in Two Dimension.

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**Abstract:** *Multimedia courseware has been widely used after the introduction of smart school project. This paper describes the development of the interactive courseware with embedment of Pedagogical Agents, Games Based Learning and Blended Learning elements. The focus of the courseware is Loci in Two Dimensions since most of the students have difficulties in understanding this topic. The combination of these three elements can provide an exciting, meaningful learning and at the same time assist them in learning the topic. A heuristic evaluation was conducted to evaluate the courseware's interface and usability. 7 teachers from a school in Perak was involved in the evaluation. The structured questionnaire has been used to evaluate the content, interactivity, screen design and student preferences towards use of the Loci in Two Dimensions courseware. The results have shown positive feedback from evaluators.*

## 1. Introduction

Computer based learning has become popular in Malaysia after the introduction of Smart School project. The usages of courseware are meant to support the learning and teaching process to enhance student performance [1]. An effective and highly usable courseware is believed to increase the student understanding on that particular topic or subject especially for slow learners or less capable students [2].

Mathematics is a challenging subject as it involves understanding the theories and visualizing pictures for applying the formulae [3]. [4] claimed that the conventional learning instrument for learning mathematics such as text book, revision book, and courseware are not very effective in ensuring a mastery of the subject.

Among the problems that students are facing in learning mathematic are [3]:

- Visualization problem - Most of students face difficulties in understanding the concept of mathematic and apply it in everyday life.
- Motivation problem - The difficulty in understanding mathematic concepts may cause the students to become less motivated in learning that topic.
- Learning instrument - Most of the conventional learning instrument just text and exercise. Students do not able to respond and interact to it.
- The existed courseware – The existed courseware that was provided by the Ministry of Education is for the teachers references. Students also need their own courseware which they can learn using the courseware at their own time and pace.

Loci in Two dimension is one of the topics in the secondary school Mathematic curriculum syllabus for form two. In this topic, the students are required to understand the concept and application of the locus. Besides that they will also have to construct the locus. Most of the students see the topic as a complicated and confusing topic because they find it hard to relate the locus concept to the real life [4].

Therefore, it is necessary to find a solution to assist student in understanding the mathematic easily [4]. According to [5], the embedment of interactive Pedagogical Agents (PA) in the computer mediated learning environment will foster meaningful learning and higher learning transfer. The element of entertaining and fun that provide by the game-based learning (GBL) will simultaneously develop mastery skill in the given tasks [6]. While the implementation of learning using the concept of blended learning (BL) will make it easy for students to study and be able to change their attitude towards learning mathematics. The Blended learning is a combination of e-learning and traditional types of learning [4]. By incorporating these three elements on the multimedia courseware, it would enhance student motivation as well as improve the student performance in learning mathematics. The objectives of this paper are set as below:

- To discuss several theoretical explanation which support the embedment of Pedagogical Agent, Game-Based Learning and Blended Learning into multimedia learning environment.
- To design the courseware module that applied the PA, GBL and BL elements.
- To report the heuristic evaluation result of the courseware.

This paper is organized into several sections. Section two presents the related work. Section three puts forward the methodology carried out in developing the courseware. Section four presents the courseware module and discussed the results of heuristic evaluation. Lastly, the conclusion and discussion on further research are explained in section five.

## **2. Literature Review**

In this section, concepts and element related to improve the effectiveness of the courseware are discussed.

### **2.1 Pedagogical Agents (PA)**

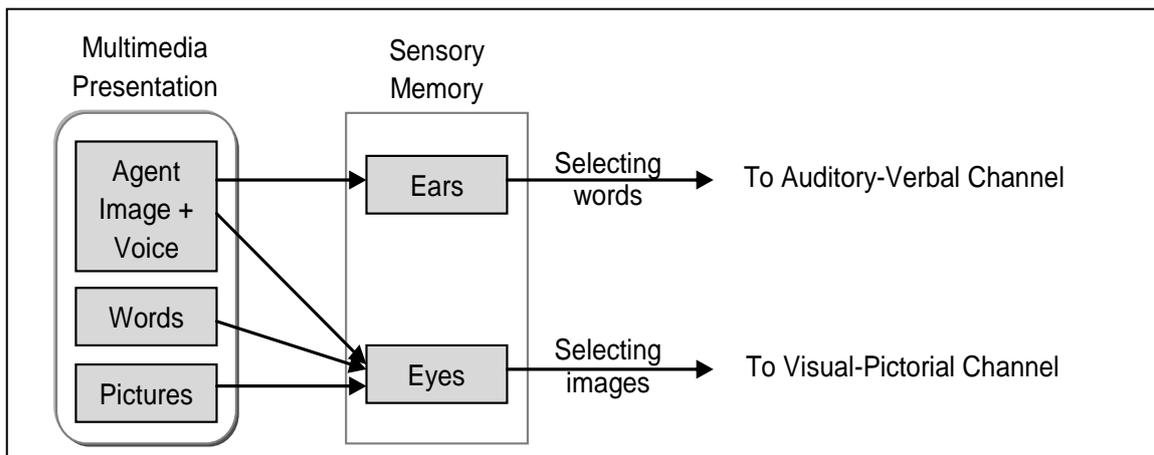
Pedagogical agents are autonomous agents that support human learning in interactive learning environments. The pedagogical agents (PA) communicate in verbal (e.g. words, speeches) and nonverbal (e.g. gesture, gaze) forms in the multimedia learning environments to promote learners' cognitive engagement as well as motivation towards the instructional materials. Thus, it is ideally suited to serve as virtual instructors, tutors, mentors or peers to aid in the learners' knowledge construction and skill acquisition. The pedagogical agents in multimedia instructional can enhance the potential of human-computer communication and increase the ability of multimedia learning environment to engage and motivate learners for effective knowledge construction [5].

[7] highlighted that PA recognizes the learner's affective and motivational needs to help students achieve their learning goals . It can perform three main functions which are as tutor, an expert and as motivator. As a tutor, the PA will guide the student through practice lesson using a series of hints, suggestion and demonstration. While as an expert, PA will offer the professional help within the program. Lastly as motivator, the appearance of PA will create the engagement environment that enhances the learning and motivation rate.

[8] investigate the difference of learning outcome between the student who use the personal agent and who received the identical verbal and visual materials in a computer – based text environment. The study involved 44 colleges where twenty four students serve in the no PA group the other twenty serve in the PA group. They receive identical factual information consisting of same verbal and visual material. In the end they were tested based on the information they get. The

student in the PA group produced significantly more correct solution on transfer problems than student in the no PA group. The result proved that the students are more motivated interested and achieve better understanding when the lesson is imparted by pedagogic agent rather than on screen non –personalized text

[9] illustrated the redundancy effect when human agent’s image, words and pictures enter visual channel simultaneously (as in Figure 2.1). The auditory-verbal channel and visual-pictorial channel can be utilized simultaneously by the appearance of Pedagogical Agent. The integration of Pedagogical Agent’s image with text and graphic material may overload the visual-pictorial channel. This situation enable student to learn better.



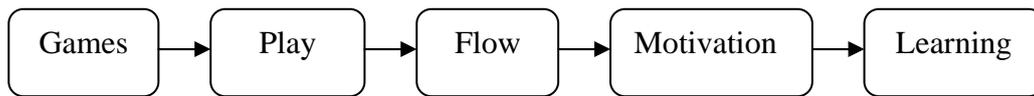
**Figure 2.1** Redundancy Effect

## 2.2 Game-Based Learning (GBL)

GBL is software applications that apply games that have defined learning outcomes [10]. Computer game-based learning can transform the way students learn, and motivate .It will engage a new generation of learners in a way that traditional education does not. The computer games are intrinsically motivational, which it can be exploited to make learning more motivating and learning will happen spontaneously [11].

Game-based Learning courseware offered interest, curiosity, fun, enjoyment, energetic and concentration for continual learning. It becomes a better procedure in the presentation of learning contents and educational information. Thus, it enhances students’ achievement and motivation in learning difficult concepts. The skills they learned from playing the challenging games such as problem-solving and decision making could develop their confident and improve their thinking skills for higher learning in future [12].

[6] illustrated the potential of well-designed educational games (as in Figure 2.2). Games promote play, then it will produce a state of flow, next it will increases motivation and supports the learning process. The learning outcomes with well-designed game mechanics can result in learning experiences which are essentially motivating. The challenge for educational designer is to design environments where the dynamics of learning are fully incorporated with dynamics of game-play.



**Figure 2.2** Potential of well-designed educational games

### 2.3 Blended Learning (BL)

Blended Learning combines the engaging benefits of traditional instructor with the advantages brought by a variety of technologies to create an optimum benefit during the learning process. BL comprise multiple teaching and learning activities which include face-to-face (f2f) meetings, e-learning, e-portals, e-mailing, case studies, problem-based learning (PBL), independent work and self-paced learning [13].

There are several benefits of BL reported by [14] were (i) provide student-centered learning (ii) help promote critical thinking; (iii) have advantage for applying online assessment system and computer tutorials.

## 3. Methodology

The heuristic evaluation was carried out in this project to evaluate the interface of the courseware. The objective of the evaluation is to identify the usability in the user interface design. The set of heuristic guideline was adapted from the heuristic evaluation for learning programming using interactive multimedia courseware [15]. 7 respondents participated in the evaluation. According to [4] the average of 5 evaluators for heuristic evaluation can detect 75% of the usability problems. The respondents involved in this study are teachers from a school in Perak. They filled in the form after they have gone through the loci in two dimension courseware. The five-point Likert scale with 1-strongly disagree to 5-strongly agree are used. Respondent will be asked to indicate their agreement or disagreement by choosing the five point Likert scale.

## 4. Results and Discussion

### 4.1 Courseware Module.

The loci in Two Dimensions courseware system contain four main units of instruction: (1) Lesson Module; (2) Do it Module; (3) Tutorial Module; and (4) Quiz. Figure 2 shows a Courseware Module for the Loci in Two Dimension courseware. The lessons are delivered in a step-by-step format that allows student to repeat review the lesson until they have mastered the subject matter.

#### 4.1.1 The Lesson Module

The lesson module provides definition, explanation and example of the loci in two dimension concept. The module utilizes the pedagogical agents in the learning environment. [9] stated that the image of the Pedagogical Agent can motivate the learner to learn better. The social

interactions from the pedagogical Agent promote the active cognitive processing in learning process. This may promote student interest towards instruction which is turn foster learning.

#### 4.1.2 Do It Module

The do it module demonstrate the animation of constructing the locus. In this Module the student need to do by their own. This module applies the blended learning principle where the teacher will demonstrate the step to construct the loci with the assistance of multimedia courseware. This approach will help the student to clearly visualize constructing the loci.

#### 4.1.3 The Tutorial Module

The tutorial module have two levels ; level 1 and level 2. The level 1 is more on the guided exercise where the learner will be given hint and explanation on every question. The Level 2 of the tutorial module is game based learning where the learner may join the series of treasure exploration. The learner will have to master to each aspect of the topic throughout the journey inside the game

#### 4.1.4 The Quiz Module

The quiz module give the student the opportunity to test their knowledge through multiple choices question based on the material covered in the previous lesson. 10 questions were developed. [16] state that assessing student knowledge and linking it to the stated objectives of the course is an important part of the courseware.

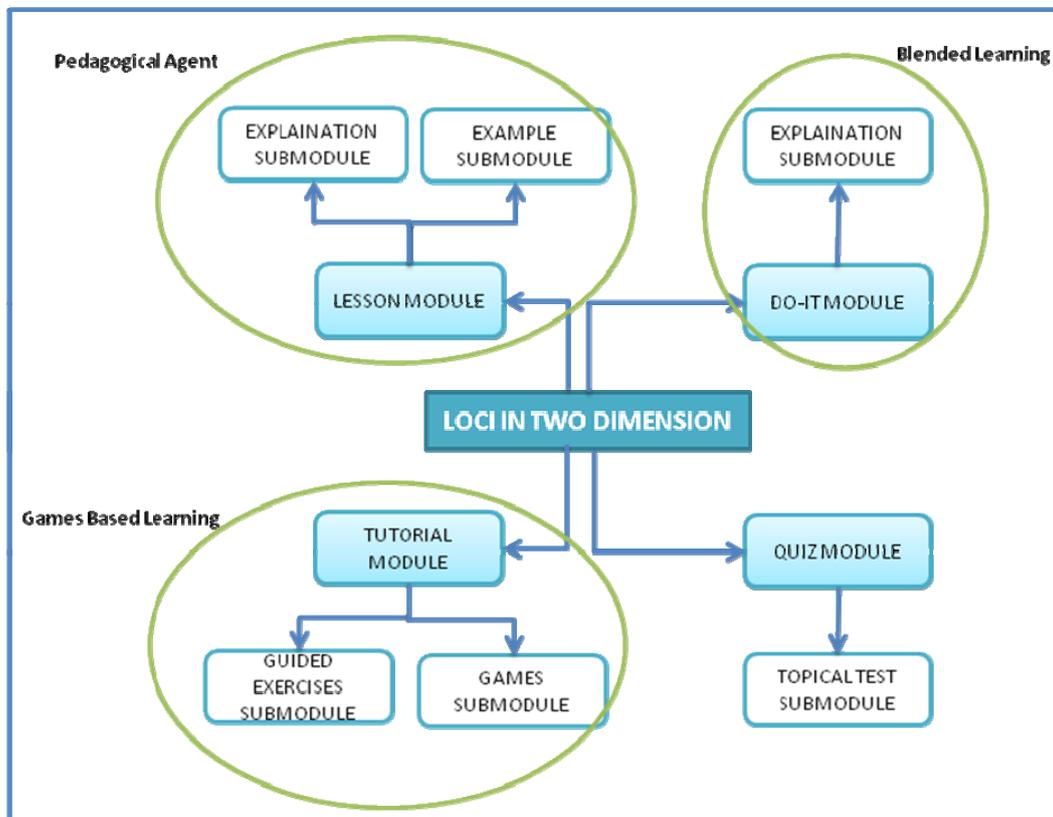


Figure 4.1 Loci in Two Dimension Module


**LOCI IN 2 DIMENSION**



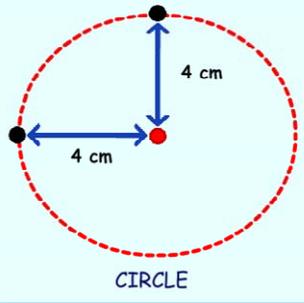


**HOME** **LESSON**






The locus of points which are constant distance from a fixed point



CIRCLE

Mark a fixed point

Mark another point that are distance 4 cm from the fixed point

Then mark the second point with the same distance from the fixed point

Continue finding such point until get a pattern




Figure 4.1.1 Screenshot of Lesson Module

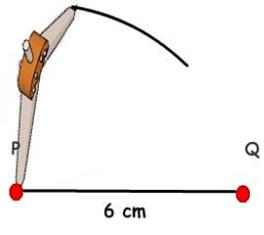

**LOCI IN 2 DIMENSION**





**HOME** **DO IT**



Steps:

1. Draw a line segment PQ of 6 cm
2. Open the compasses to a radius more than half of the length PQ
3. With the point P as the centre, draw an arc below and above the line




Figure 4.1.2 Screenshot of Do it Module

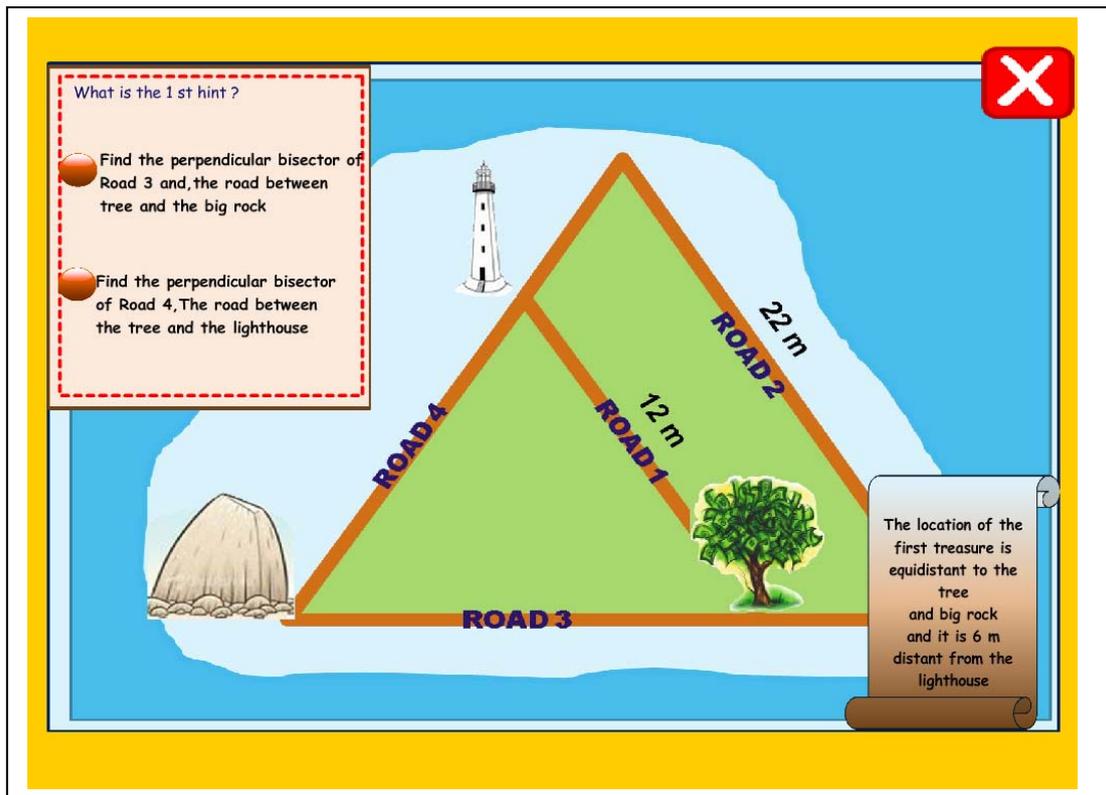


Figure 4.1.3 Screenshot of Tutorial Module

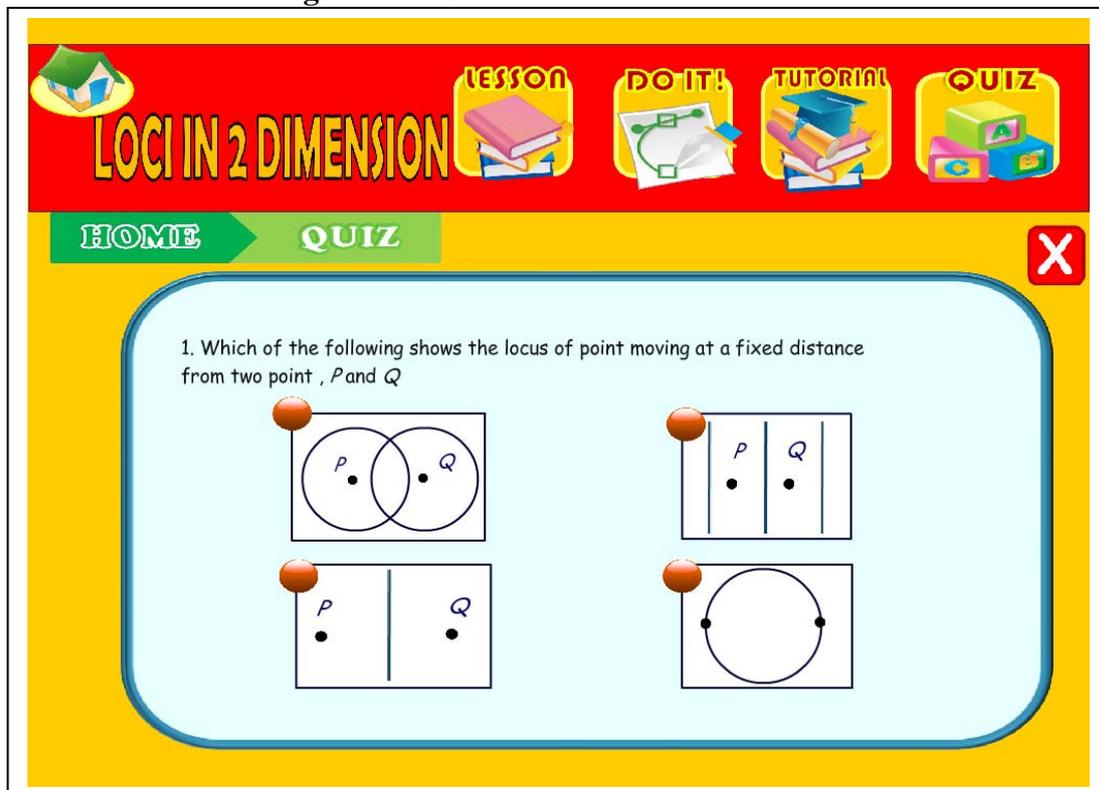
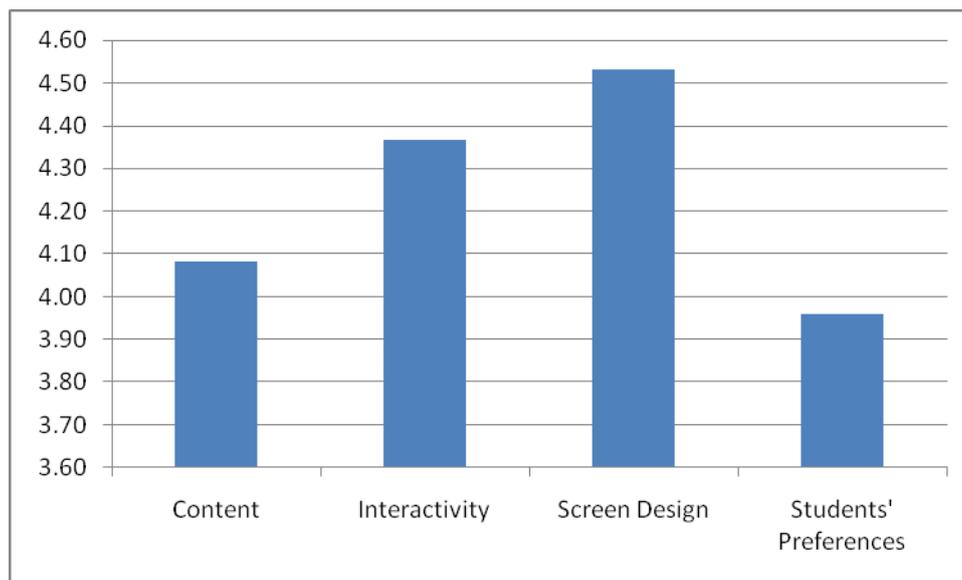


Figure 4.1.4 Screenshot of Quiz Module

## 4.2 Heuristic evaluation

The study used a structured questionnaire developed based on content, interactivity, screen design and student preferences towards use of the Loci in Two Dimensions courseware. The results are presented in Figure 4.2. The average mean score was 4.47. Therefore it could be concluded that most of the evaluators are satisfied and pleased with the courseware. From the survey, the evaluators have highlighted several usability problems: To include more examples to enhance students understanding, the instructions of the game should be clear, the games graphic should be improve and include the sound for the game to attract users. All the feedback obtained from the evaluation will be used for the courseware enhancement.



**Figure 4.2** Usability result.

## 5. Conclusion and Future Work

The paper has discussed on the courseware module for Loci in Two Dimension courseware. The courseware is embedded with the pedagogical Agent, game – based learning and blended learning principle. Positive feedback has been obtained from the heuristic evaluation. For future work, the improvement of the courseware will base on the evaluator comments. The improvement will be including additional sound, animation, graphic and video. Once the courseware improvement has completed, the summative evaluation will be conducted to evaluate the effectiveness of courseware for student's self learning purpose.

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