3rd International Malaysian Educational Technology Convention

BLENDED EDUCATION:

Towards A Personalised Learning Environment

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Designing a Virtual Laboratory for Chemistry Using Animated Pedagogical Agent (APA)

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Abstract

This paper presents about designing the animated pedagogical agent in virtual laboratory for chemistry subject, alcohol. To further develop and exploit this potential, there are, however, several issues that need to be resolved. In this paper we discuss on theoretical framework modelling that is divided into five parts which is analysis, design, development, implementation and evaluation. For the second objective, researcher will view on the visual form of virtual laboratory and key aspects of look of animated pedagogical agent to make human-computer interaction more enjoyable and productive. In designing the development of virtual laboratory, researcher has used approach in learning theory such as cognitive and constructivism. Concept through learning-by-doing and simulation will be added in the virtual laboratory where through the concept used student can obtain understanding via experience.

Introduction

Chemistry learning method practiced in schooling system in Malaysia more patterned passive and behaves one-way. It is contrary to education policy who wants an effective methodology of education through active discovery process. In realizing this need, a new lesson method based on technology orientation should give attention naturally in helping teacher produce learning pattern that is required nowadays.

Current learning theory suggests that student's learning is increased when more interactive and multimedia richness of the educational resources are use for active learning. High interactive and rich multimedia learning environment is best meet with simulation and virtual laboratories can simulate real-world behaviour in an engaging and intuitive graphic environment to help students acquire new knowledge and skills through learning by doing, Morozov et al. (2004).

The virtual laboratory allows students to experiment on their own, instead of having to follow instructions rigidly, as they would in a traditional lab. It also allows students to experiment more than they would be able to in a real lab. Because of time and safety constraints, students usually cannot freely experiment with real chemicals. On the other hand, the computer simulations in the virtual laboratory encourage students to experiment and have some fun, Dan Carnevale (2003).

Virtual laboratory that will be developed can get more attention by the student in their new way learning. Activity in the virtual laboratory is based on the interactive laboratory in order to ensure the understanding student in chemistry material process and also to do experiments. By that, virtual laboratory will reduce cost such as time in lab, material and component used in the experiment where it differs in conventional lab (Norasiken and Halimah, 2005). In other way, student and teacher can do the experiment as long as they want and it will avoid the student from using the dangerous material.

In order to make human-computer interaction more enjoyable and productive, an animated pedagogical agent was added to the interface of the laboratory. An animated pedagogical agent can be considered an extension of an intelligent tutoring system.An agent can have a positive impact as learning partners in a virtual world environment. It was found that the agent encouraged the use of explanation resources designed to help students generate more effective explanations. Agent might act as advisors in the process of generating explanations. Jeffrey Holmes (2005).

Propose of Research

The purpose of the research can be divided into two components:

i) Developing virtual laboratory for chemistry subject, alcohol for form 5 science students.
   a. Define methodology for virtual laboratory content.
   b. Creating Instructional Design Model (ID Model) for virtual laboratory content.
   c. Develop prototype of the content based on cognitive-constructivism approach.
ii) Do a research on the successfulness of virtual laboratory among students at MRSM Tun Ghafar Baba, Malacca.

Virtual Laboratory

The virtual laboratories is vary from static Web pages with didatic videos and texts, to dynamic pages with sophisticated environments, collaborative authoring (Emigh & Herring, 2005), videos on demand, virtual meetings,and many other features. These virtual laboratories may also allow remote access to measurement instruments, video cameras, microphones, electrical and mechanical circuits, chemical reactions, biological experiments, and so forth.

A virtual laboratory can be regarded as the simulation and extension of a real laboratory by means of computer support. Therefore, a virtual laboratory allows one, in principle, to evaluate real experiments and operations (Mahdavi et al. 2002). The laboratory based courses are being successfully delivered with limited or no travel required for the student (Lynn et al., 2005)

Educational Theories

Cognitive Theory

Cognitive theorist refers to the process of thinking that happened to someone while in the process of learning. It relate with short term and long term memory. Cognitive can produce learning by transferring information to the learner and helping them to organize it in such a way that they are able to recall it later.

One of the cognitive theories is information processing in learning computer. This theory offer active learning where students actively to get restructure and define knowledge in order to make learning more fun. It is because students need a transformation in learning and gain knowledge. The theory focused on new knowledge and past knowledge.

Based on cognitive theory, some guidelines have been used in creating and evaluate learning based on computer (Simonson and Thomson, 1990). The guidelines as below:

a. The willingness to study is important to start, maintain and ensure the objective of learning.
b. Structure and types of knowledge to teach. It is based on opinion, that student start to understand concrete operation, graphic display from reality and abstract expression and number system.
c. The sequences of learning material are important to define the type of student in processing the information they get. Knowledge of cognitive children style through parts of dominant brain and processing level are important to know style of learning.

Constructivism Theory

Through constructivism educational theory, students have their own mind that has been created by interaction with the environment. Concepts that own by each students are differing and mistake will be occurred if the concept created opposite with the concept accepted in the classroom. Through constructivism approach in classroom, students will actively involved in educational process and they have the chance to create their own knowledge based on their background, Roziah Abdullah (2004).

By helping student in their integration with experience and new knowledge they already have, the activity should be in the context of needed requirement and in different perspective. Jonassen 1994, Oliver 2000.

Theoretical Framework model

Theoretical framework model showed the structured profile that is Analysis and Design (I), Development (II) and Evaluation (III) for this virtual laboratory. The development model can be seen in figure 1, research on theoretical framework model. To achieve the purpose of research, some main question and research hypothesis is design as follows:

a) What kind of technique of Virtual Laboratory courseware is suitable for Form 5 students for learning Alcohol topic?

b) Is there any significant difference in student's result based on pre and post-test for the 'control group' and 'Experimental group' for Carbon Compound Topic?

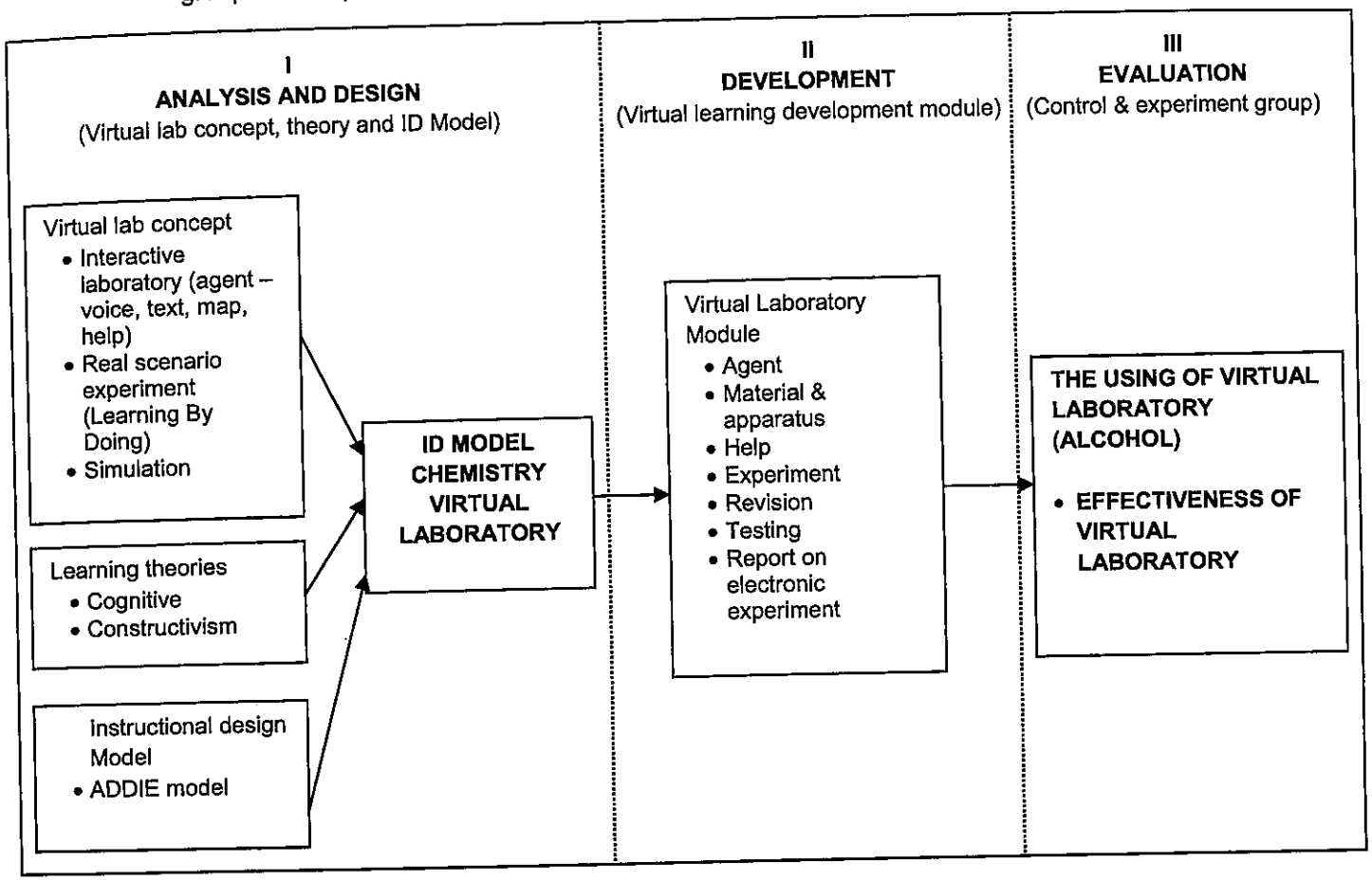

Figure 1 Research on theoretical framework model

ADDIE Model Life Cycle

The development of this virtual laboratory are based on ADDIE model

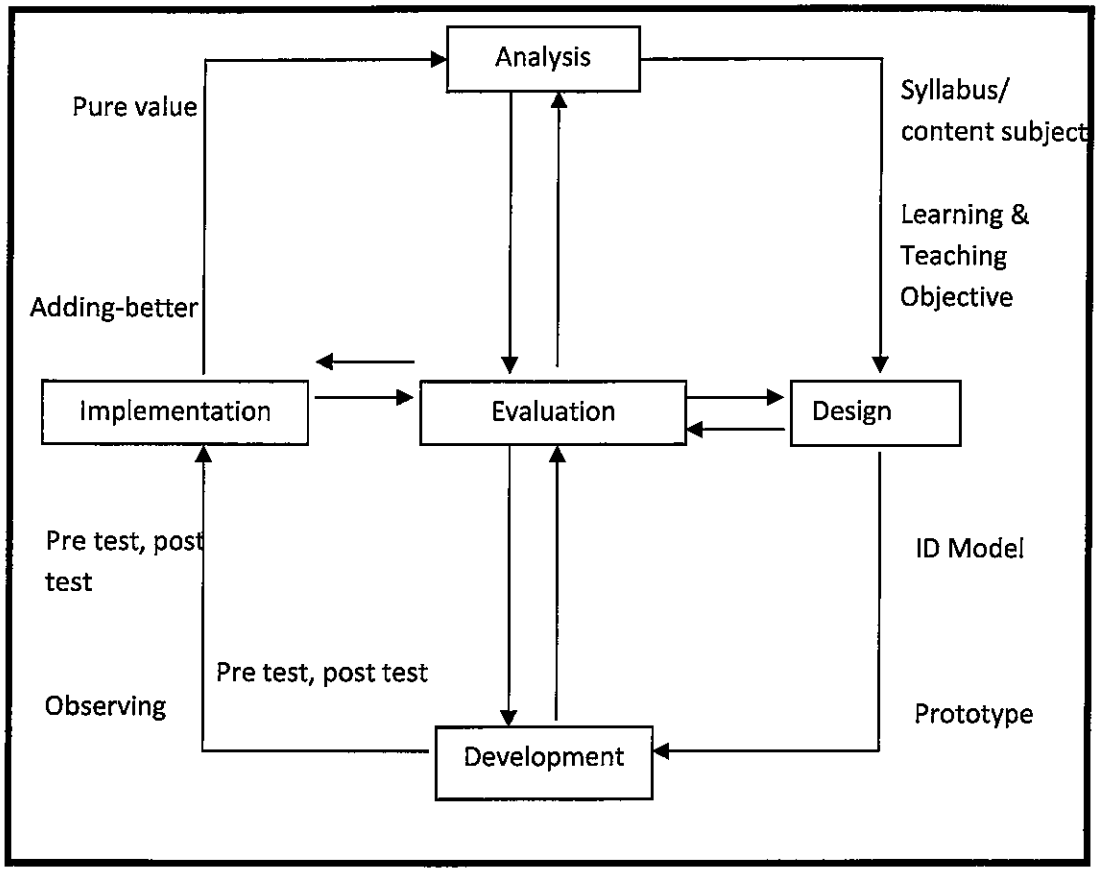

Figure 2 ADDIE Model Life Cycle

Phase 1: Analysis

Some elements have been listed during this phase to fulfill the requirements of this virtual learning development. The elements are as follows:

a. Target group
b. Learning and teaching objectives
c. Students background
d. Students existing knowledge
e. Domination of teaching and learning material
f. Constrain (hardware and software)
g. Pure value
h. Assessment planning

This research has been conducted by involving chemistry teacher and form 5 students.

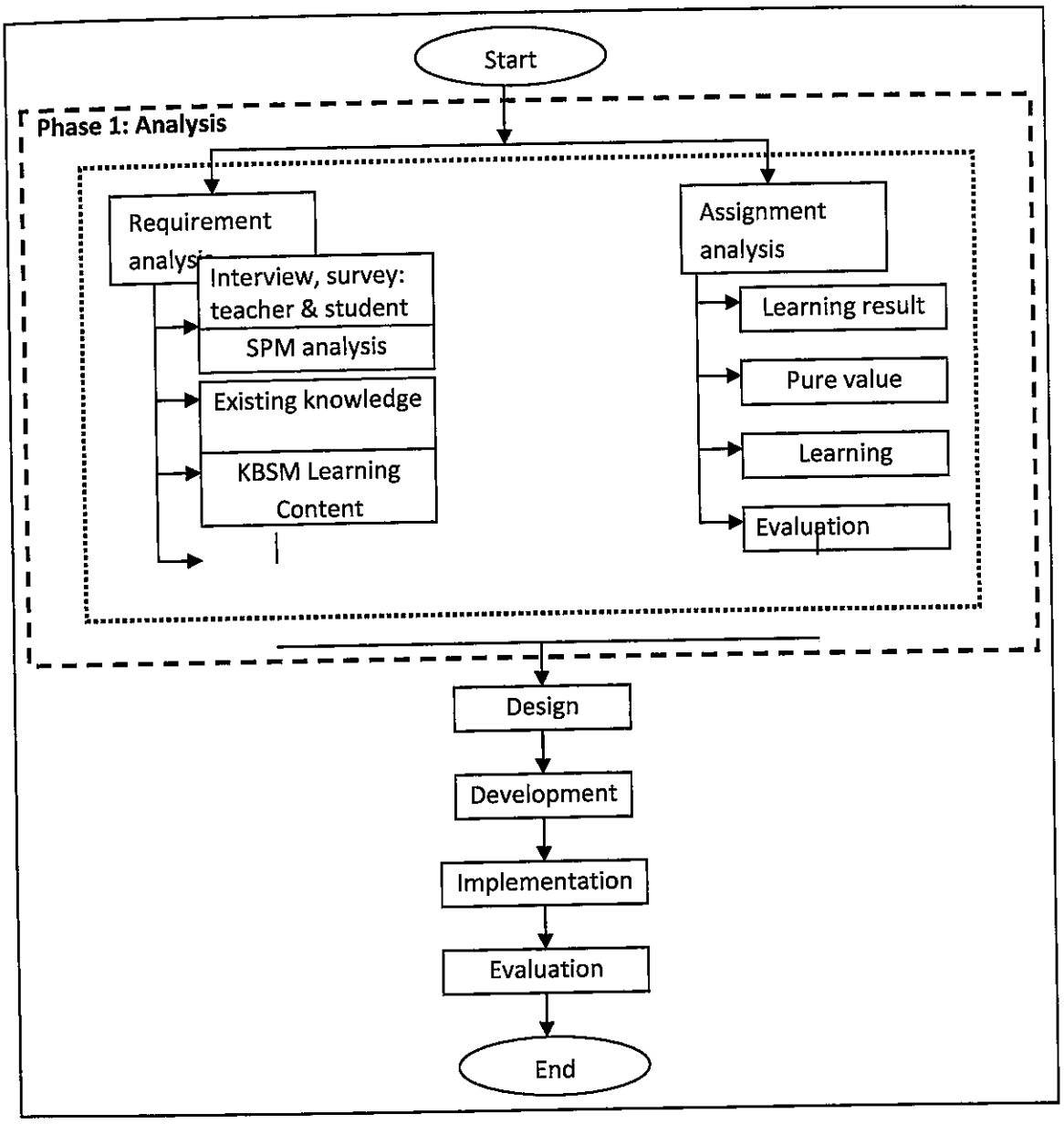

Figure 3 ADDIE: Analysis Phase

Phase 2: Design

The design phase involved elements that needed in virtual lab based on conceptual and theoretical model. Steps involved designing for the process as below:

a. Designing conceptual ID Model
b. Designing learning content

Conceptual ID Model for virtual learning involved some approach such as constructivism-contextual approach in teaching and learning process, science approach and the sequence of learning content.

Modules include in this virtual learning consists of Experiment Module, Revision Module and Mind Test Module. Figure below shows design phase of virtual learning.

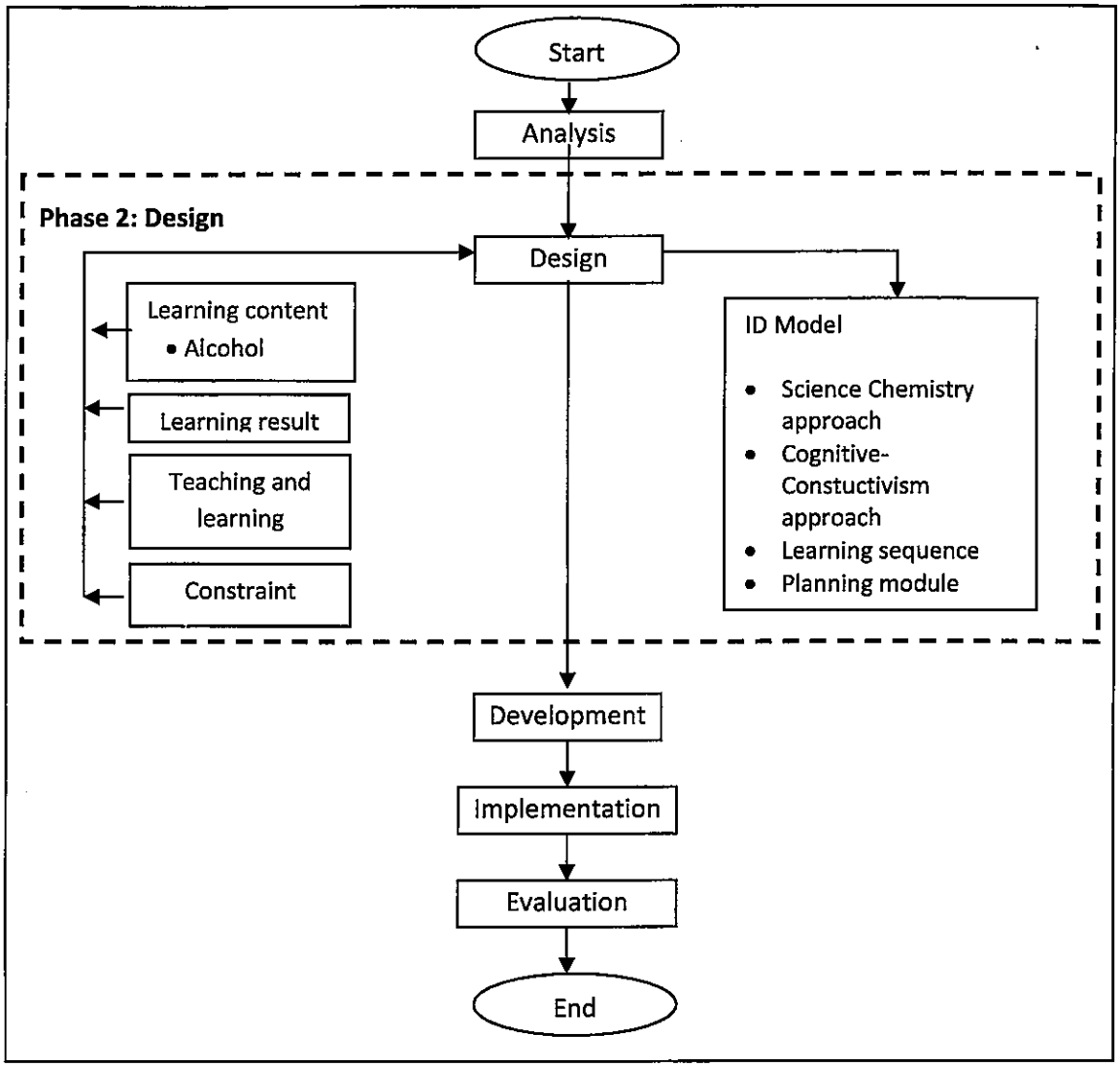

Figure 4 ADDIE: Design Phase

Phase 3: Development

The development phase of virtual learning involving 2 main elements:

- The development of virtual lab
- The development of software

During development phase, subjects that involved are:

- Storyboard development
- Authoring
- Graphics arrangement
- Recording and editing
- System integration

Figure 5 showed the development phase of virtual learning

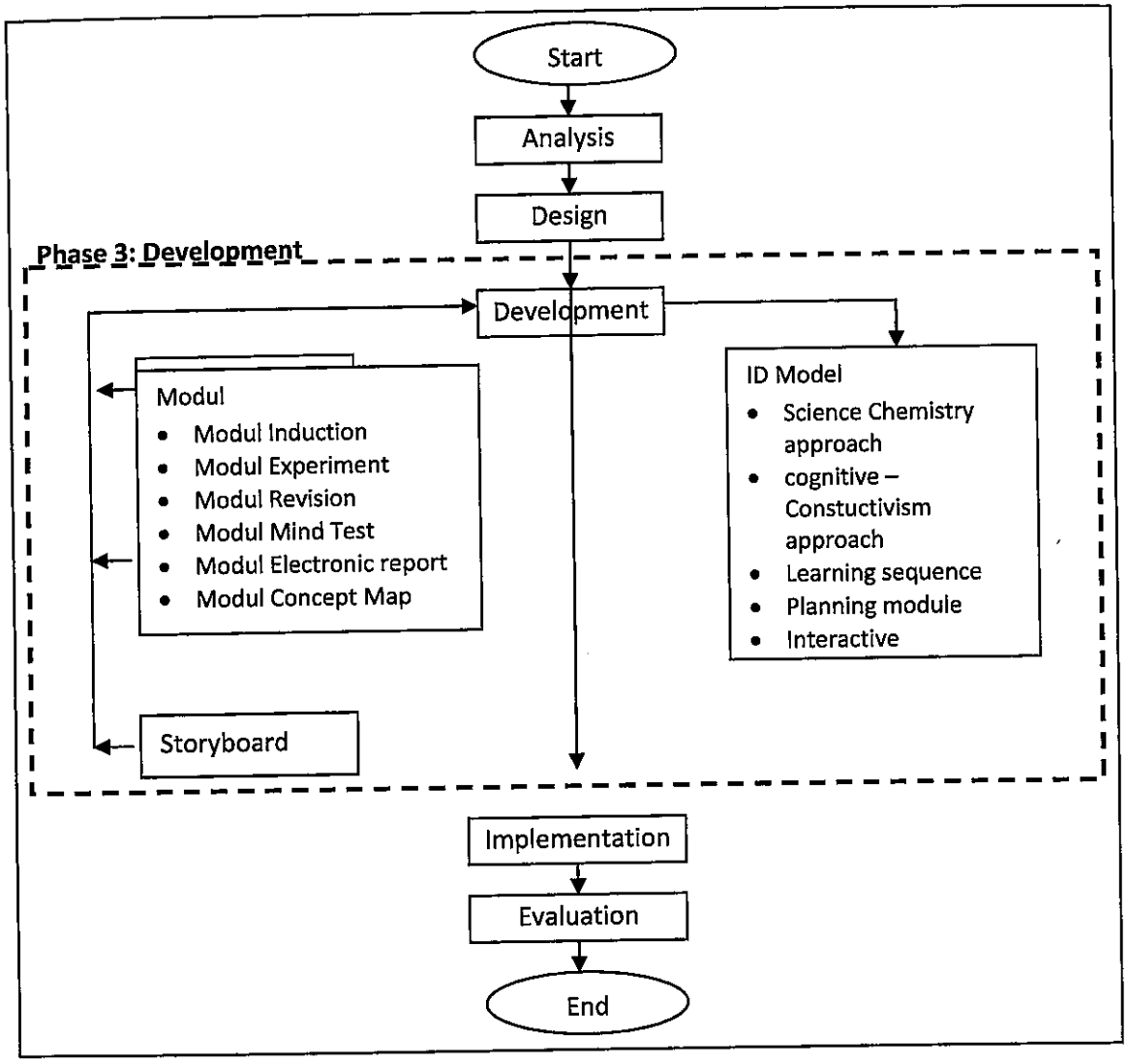

Figure 5 ADDIE: Development Phase

Phase 4: Implementation
Implementation phase involve testing for each unit that had been develop. During this phase, a prototype will be build and enable teacher to integrate their teaching by using computers.

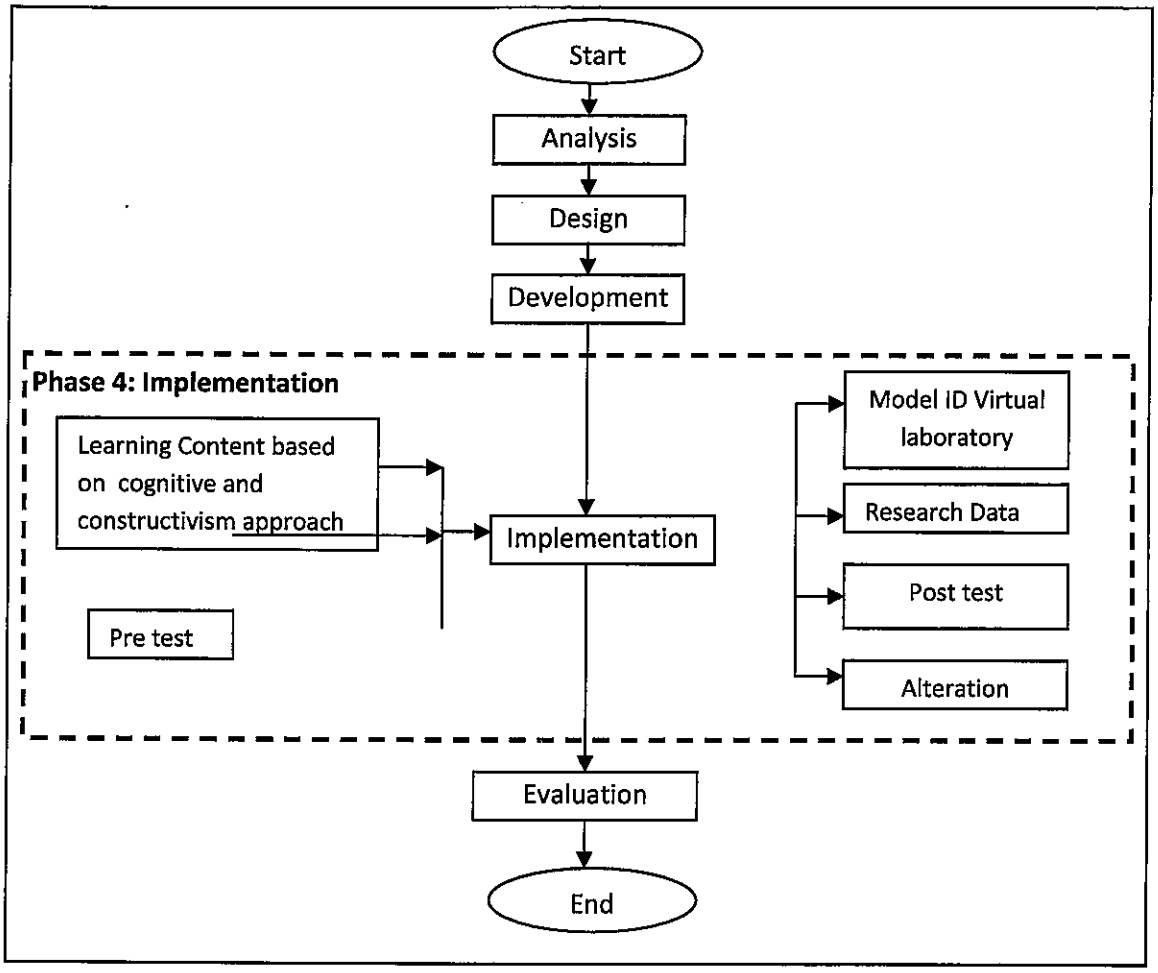

Figure 6 ADDIE: Implementation Phase

Phase 5: Evaluation

This is the last phase where researcher will get their result. This phase is the most important phase as it involves testing the effectiveness of virtual learning. Testing will be done at MRSM Alor Gajah. Figure shows that evaluation phase for this virtual learning.

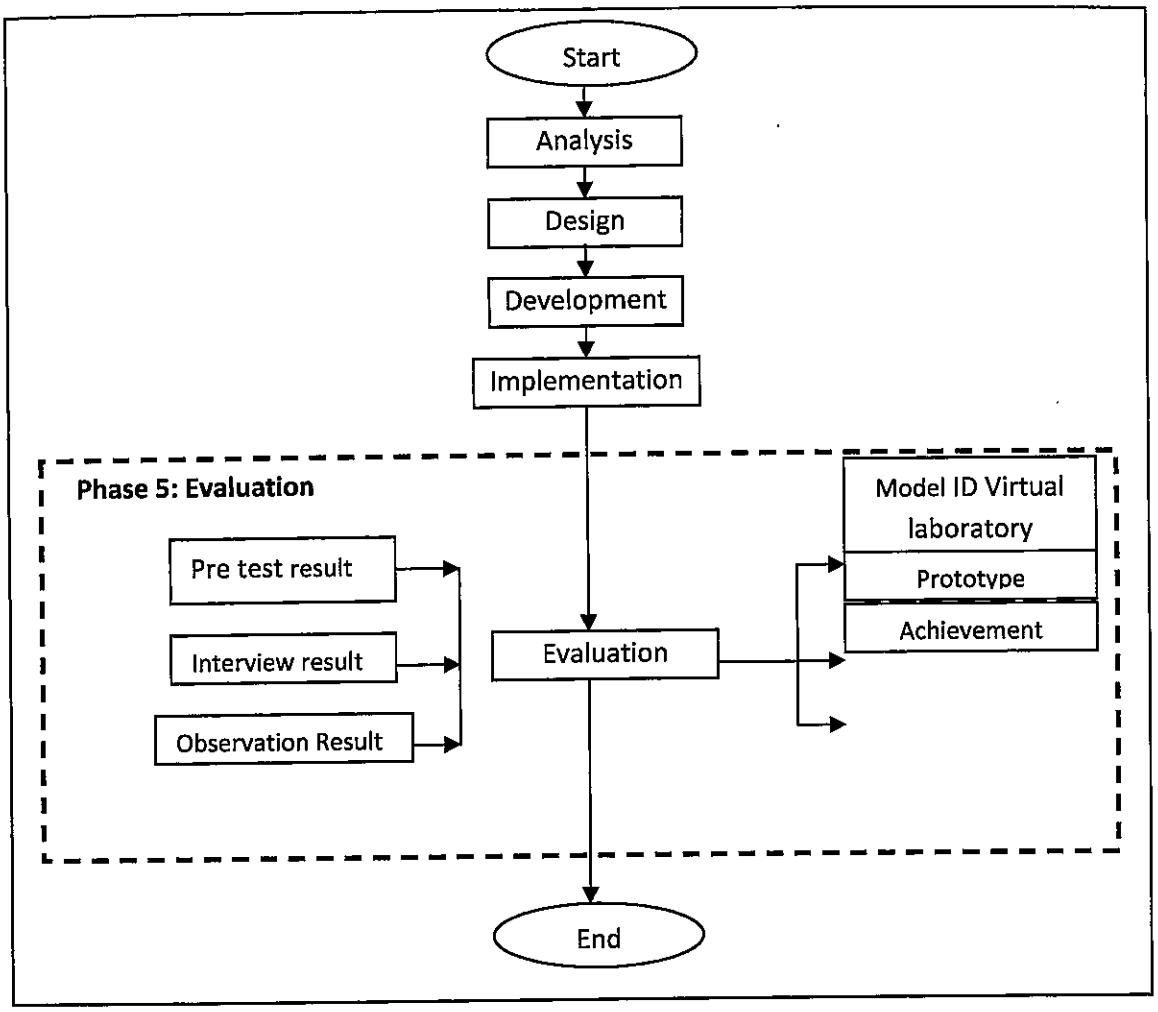

Figure 7 ADDIE: Implementation Phase

Conclusion

This paper presents the research methodology that will be the basis of development of virtual laboratory. The model use is derived from ADDIE model which is suitable for online virtual learning. Detail description phases involved in the development.

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