

The Pilot Test of e-Audio Visual Biology for Teaching and Learning in Senior High Schools of Indonesia

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Abstract-- This paper defines an e-Audio Visual framework dealing with both instructional design topics and, the design of computer-based application or Hypermedia design, addressing educational audio visual framework for Biology. The framework is described in four main levels of activities: The Educational Context Level, the Requirements Level, the Design Level and the Learning Outcomes Level. The details of these criteria will be explained.

This paper considers the design and development of a web-based courseware for biology education in Indonesia Senior High Schools, using an innovative and integrated instructional framework. The new teaching module, namely e-AV BIOLOGY, is being developed as a new teaching approach in science education. e-AV BIOLOGY had been developed in an integrated way by combining Problem Based Learning (PBL) and Constructivist approach. Some PBL and Constructivist features had been applied in the design of e-AV BIOLOGY to produce integrated and comprehensive Assignment, Quizzes, and Discussion Modules for supporting the student learning process. The later part of this paper presents the evaluation data from a pilot test conducted with students in one Senior High School in Semarang, Indonesia. The findings from pilot test are also discussed.

Keywords: e-Audio Visual, Conceptual Framework, Biology, Learning Outcomes.

I. INTRODUCTION

This paper considers the design and development of a web-based courseware for biology education in Indonesia Senior High Schools, using an innovative and integrated instructional framework. The new teaching module, namely e-AV BIOLOGY, is being developed as a new teaching approach in science education. The later part of this paper presents the evaluation data from a pilot test conducted with students in one Senior High School in Semarang, Indonesia.

According to a preliminary observation in classrooms, we observed that many students in Indonesia have difficulties in learning biology. They thought that learning biology is just to memorize the subject, and they found it not interesting. Fig. 1

shows a graph of the average grade value of biology of different classes, acquired through a survey in some classes at a Senior High School of Indonesia. The graph shows the standard grade value of the school in dashed-line, which are 68. However, the grade values of all classes are below the standard grade value.

According to [3], students have difficulties in learning biology because the subject matter is not relevant to their daily live. This is in line with [14], who mentioned that most students are learning biology as a set of facts, which are unrelated to the workings of the world and are simply to be memorized without understanding. This notion is also supported by [11] who mentioned that students' daily test grade did not achieve their teachers' standard grade and their motivation on biology was low [11].

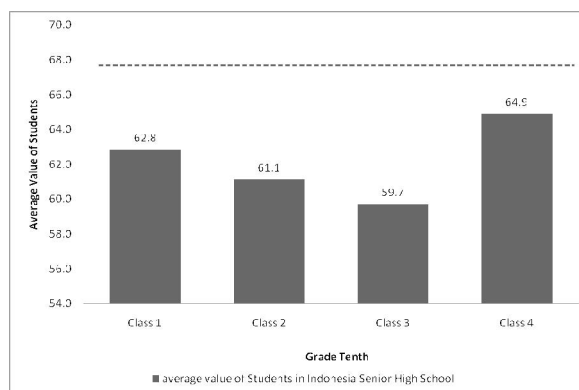


Fig.1 Class average values of Biology were not able to meet the standard grade value (Source: Based on a survey data in a Senior High School of Indonesia, 2009).

Explained by [11], many students in Indonesia did not have interest to learn biology and their participation in biology classes were low. This could be due to the reasons mentioned above such as low interest and low engagement in classes. In

addition, the traditional teaching method is also the cause for the students to become passive.

Biology teachers should have the abilities to make learning atmosphere interesting and rewarding for the students. The teaching aids have been considered as an urgent necessity for the teacher to explain biology subject in the classroom. Reference [12] stated that the roles of media in the teaching and learning process are getting more important in education.

Electronic Audio Visual (e-Audio Visual) BIOLOGY media is one of the alternative aids for biology classes, to bring more media elements and visualization into classrooms, and to improve students' learning experiences for biology. e-Audio Visual in this research means electronic Audio Visual and interactive Audio Visual. It is e-Learning which focuses more in audio and visual. e-Learning has become a trend in educational environment. The new wave of e-Learning brought to a complete integration of technologies in education. Educational Web sites have become an almost standard feature of a large part of Higher Education courses [8]. Internet Website can be used for delivering materials such as the syllabus, lecture slides, readings and assignments, shared learning space (for group work, interaction with the instructor or the tutor, or discussion forum), and also for organizing structured activities such as [4].

II. INSTRUCTIONAL DESIGN

Teaching or Instruction has been influenced by cognitive holistic psychology, which put the students as the source of the activities. Teaching is also influenced by the technology, facilitating the students to learn something using various media, such as printed materials, television, internet, pictures and audio, and others. All of those technology aspects could support the changing of teachers in managing the teaching and learning process, from the source of learning to the facilitator of teaching and learning process. Reference [5] stated that teachers' roles are more emphasized on how to design and arrange various sources and facilities provided to be utilized by the students in learning something, such as biology.

A more formal and systematic ways of thinking about the teaching and learning process are explained by [10], as follows:

- The activities with the students in the classroom that enhance their new knowledge by using teaching media and allow them to practice with it.
- The evaluation programs that help students demonstrate their understanding

A. A Framework for the Instructional Design

Framework consists of "a conceptual map that identifies the channels and might influence teaching practice and subsequently student learning, and a set of guiding questions that can be applied to various policies, programs, and practices within the system and to outside influences that may affect the education system" [3]. Framework is also able to provide a set of organizing categories, presumed relationships among them, and questions to prompt inquiry. It lays out a complex domain

of interacting forces and conditions that affect teaching and learning.

Reference [1], [2] describes Instructional Design (ID) process as the production of learning material. The assumption behind Greer's model is that ID is learning material design, or at least that the activities are developed as a part of the learning materials. The general point of Geer's framework is that it defines a specific phase for material development, as an advantage over traditional ID. Reference [1], [2] stated that "Traditional ID models do not explain what its connections with other phases are". The Greer model is explained below:

- The instructional design by Greer is the methods of instruction which contains learning materials and learning activities
- There is a sequence of flow, for producing learning materials and learning activities
- Yet, this instructional design does not explain about the teaching media

B. A Framework for Hypermedia Design

The Hypermedia Instructional Design explains about teaching media. The research on hypermedia design models stem from past results of software engineering, database and link, management system fields, merged with the peculiarities of a unique and multifaceted process such as the development of multimedia contents and navigation based interaction ([2], [9]).

Fig. 2 sketches the integrated model by [2]. In this model, they propose to consider three main levels of activities: "The Educational Context Level, The Requirements Level and The Design Level" ([2], p.3).

III. E-AUDIO VISUAL BIOLOGY INTEGRATED FRAMEWORK

E-Audio Visual Framework in this paper was adapted from Armani's Integrated Framework. We describe four main levels of activities, The Educational Context Level, the Requirements Level, the Design Level, and the Learning Outcomes Level. We will explain these levels and their connections. The following paragraphs are to explain this framework:

The Educational Context Level consists of all the traditional elements, grouped in two sets: learners and instructors. The learners have these elements: the learning styles, motivational aspects, the domain background and learning abilities, while the instructors have these four elements: the Domain, the Learning Objectives, Time/Space constrains, and Evaluation constrains. In the case of Biology teaching and learning in Indonesia, the Education Context Level has to be designed using the respective situation of the students and teachers. The data from the educational context level, especially from two set— learners and instructors, will be used in the Requirements level.

The Requirements Level will influence the Design Level. The e-AV BIOLOGY Requirements will influence e-AV BIOLOGY Application Design, while the Learning Biology will influence Learning Activity Design.

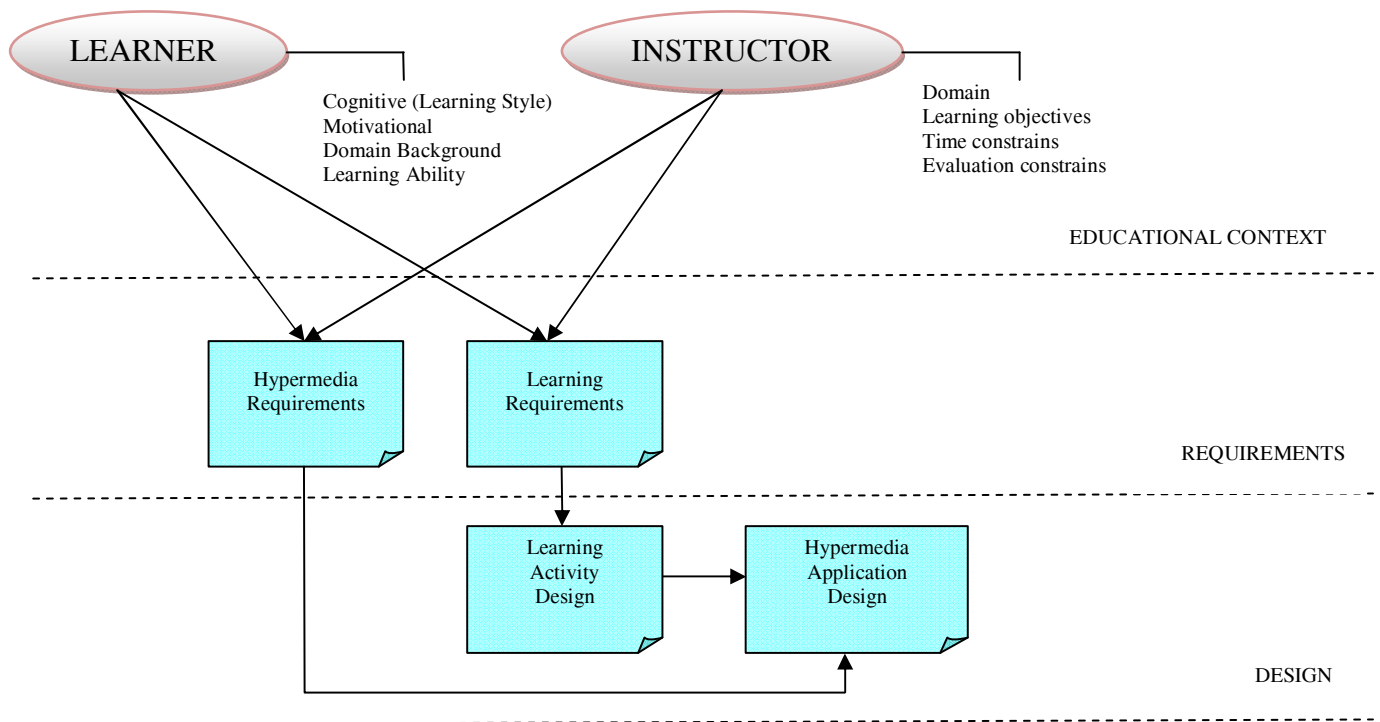


Fig. 2 Integrated Framework developed by [2]

All of the three levels—educational context, Requirements, and design—will simultaneously influence Learning Outcomes Level consisting attitude, knowledge and skill of the students.

A. The Educational Context Level

The learners include four elements: the learning styles, motivational aspects, the domain background and learning abilities [2], as follows:

1. The learning styles, preferred modes of perceiving and processing information.
2. Motivational aspects, i.e. the perceived importance of the instruction and the perceived possibility of success.
3. The domain background, i.e. the previous knowledge that the learners have of the specific content to be taught.
4. Learning abilities, i.e. how learners are able to learn by themselves or with specific learning materials, respectively how much guidance they need.

The instructors include four elements: The Domain, The Learning objective, Time/Space constrains and Evaluation constrain [2]:

1. The Domain is an indication of the specific content of the instruction. This might range from a simple indication of the discipline (e.g. literature) to a more detailed “editorial plan” and a specification of the information sources (books, course notes, etc).
2. The Learning objective is a statement of the goals of the instruction, i.e. a description of what the learners should know or be able to do after they completed the activities. Goals can be defined according to several guidelines,

such as those classified by types using Bloom’s taxonomy (Bloom et al., 1950 cited in [2]). Reference [1] state that revising Bloom’s taxonomy can also be used for classifying the goals by its type.

3. Time/space constrains, i.e. the total amount of hours of instruction, number of sessions and duration in weeks or months.
4. Evaluation constrains, often instructional activities in institutional setting have constrains, such as the presence of a mandatory final written exam, or a mid-term evaluation, etc.

B. The Requirements Level

The information collected on the Educational Context level provides an input for the definition of specific requirements; these are e-AV BIOLOGY requirements, and learning requirements for biology education. Indonesia has the Kurikulum Tingkat Satuan Pengajaran (KTSP) as the Curriculum for teaching and learning process requirements, and the KTSP includes the learning requirements for biology education.

C. The Design Level

The Learning Activity Design will be done by building group of learners, and then followed by discussing and understanding on scientific notion among the learners and group members. The e-AV BIOLOGY Application Design has many advantages i.e. visual, auditory, media rich, interesting and attractive. Multimedia technology will be used as the main tool for developing it after the design stage. In the

design level there are two activities: The design of Learning Activity and The design of e-Audio Visual Biology Application.

D. The Learning Outcomes Level

The Learning Outcomes Level is measured by the attitude, knowledge, and skill of the students. The motivation changes after using e-Audio Visual explains the attitude outcome. Biology grade can represent the knowledge of the students.

IV. E-AUDIO VISUAL BIOLOGY AS WEB-BASED COURSEWARE FOR TEACHING AND LEARNING PROCESS

The teaching and learning process of Biology in Senior High School of Indonesia was tested using the e-AV BIOLOGY Framework. Website was used as the Multimedia technology to support the framework. The website included the interactive video about Biology contents, such as Industrial Biotechnology.

e-AV BIOLOGY had been developed in an integrated way by combining Problem Based Learning (PBL) and Constructivist approach. Some PBL and Constructivist features had been applied in the design of e-AV BIOLOGY to produce integrated and comprehensive Assignment, Quizzes, and Discussion Modules for supporting the student learning process.

e-AV BIOLOGY had been developed to be an innovative teaching media for Biology. The use of animations, motion images, and videos was intended to make a scientific phenomenon easily comprehended by students.

There are six modules available in e-AV BIOLOGY, as follows:

- **Module 1: Introduction**
This module aims to introduce students about the e-AV BIOLOGY. It starts with a description of how-to-use and register to become users of the e-AV BIOLOGY, followed by a short description of e-AV BIOLOGY menu and continued by an information about e-AV BIOLOGY features.
- **Module 2: Videos**
This module contains various videos. Students are provided with contents in the form of audios, videos and animation that enables them to explore the module. The integration of various media elements such as diagrams, audio, video and animation in this module adds more value to this web-based courseware.
- **Module 3: Lesson**
This module contains articles related to Biology. It provides the materials for students to learn more easily.
- **Module 4: Assignment**
This module contains assignments to be undertaken by students, associated with the material being taught by teachers.
- **Module 5: Quizzes**
This module aims to test the learner's understanding through a set of multiple choice questions. The questions are taken from the Lesson Module in the respective session.

- **Module 6: Discussion**
This module facilitates the students to share the knowledge in the relevant content. The discussion module tries to improve the workgroup brainstorming skill as part of problem solving process.



Fig 3 e-Audio Visual Biology Website

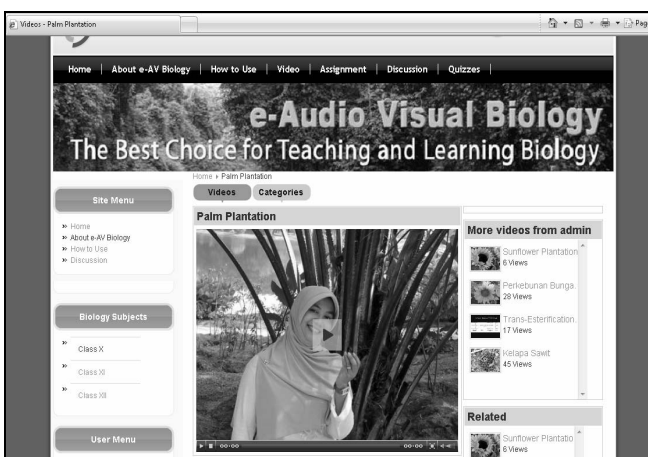


Fig 4 e-AV BIOLOGY Videos

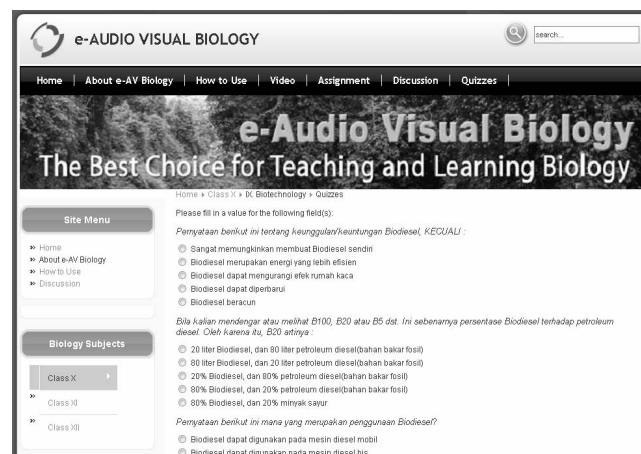


Fig 5 e-AV BIOLOGY Quizzes

V. THE NATIONAL EDUCATION NETWORK (JARDIKNAS) OF INDONESIA

Indonesia has Jardiknas, the education network of information, to support the technology infrastructure of e-Audio Visual Biology. Indonesia Government built a program called “Jardiknas” (Jejaring Pendidikan Nasional Indonesia or “The Indonesia National Education Network”), teaching models based on multimedia can be delivered to schools through the network.

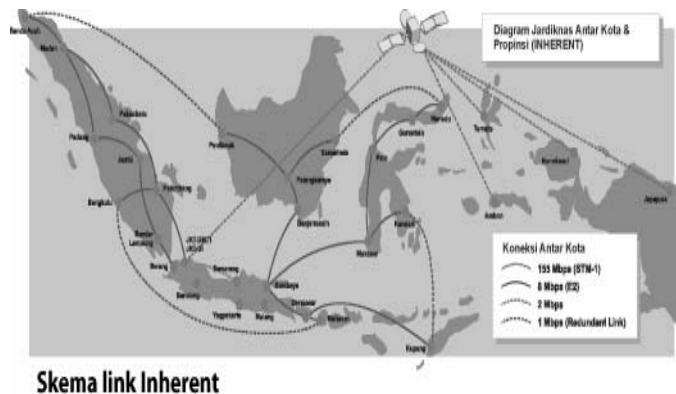


Fig 6 The Indonesia National Education Network (Jardiknas)

VI. PILOT TEST OF E-AV BIOLOGY

The pilot test subjects were Senior High School students undertaking Biology subject, accounted of 24 students. The researcher used several types of instrument to measure the courseware.

- Questionnaire for Attitude measurement
- Questionnaire for Interest measurement
- Perception and Evaluation to the media namely, e-AV BIOLOGY feedback.

The questionnaires were completed by the students in the trial before and after they finished the teaching and learning session using e-AV BIOLOGY.

E. The Technical Procedure of Pilot Study

Test Drive will be performed on classes in different school from experiment schools. Three topics of industrial biotechnology will be done to see the performance of the e-AV BIOLOGY media and the learning outcomes after the students conduct their learning by using the e-AV BIOLOGY website.

The procedure of pilot study is as follows:

1) Teacher's explanation

The teacher explains to students about the steps of the study program in the computer laboratory. Sequentially, pre-Test, e-AV BIOLOGY explanation, and post-Test are mentioned to the student in detail. For the e-AV BIOLOGY, the teacher explains how the student can use each function of the e-AV BIOLOGY media, including *how to use*, *audio links*, *video links*, *assignment*, *discussion forum*, and *quiz media*. Duration for the explanation is expected to be approximately 15 minutes.

2) Pre Test

Set of questions are given to the students as pre-Test. The duration for the test is 25 minutes.

3) e-AV BIOLOGY usage by Students

The students start using the e-AV BIOLOGY media for learning process with the sequence of:

- How to Use
How to Use will guide student for each step of the e-AV BIOLOGY usage, including the explanation of each functions.
- Video/Audio
Video and audio of respective topic are seen by the student.
- Lesson
The materials of biology for each topic are provided in some articles. Students are able to learn the material by choosing the menu *Lesson*.
- Assignment
Students will select the menu *Assignment* and have to finish several activities as assignment to improve the understanding. The duration is flexible.
- Quizzes
Next step, students will select the menu *Quizzes* (Class X -> Chapter IX Biotechnology -> Quizzes), to do the quiz in accordance with the material. After doing all the questions in the quiz, then click the Submit button to automatically appear the score results of the quiz. The duration is flexible, ending 30 minutes before the end of the class meeting.

4) Post Test

At the last 25minutes, student activities are stopped, and set of question is given. The questions are the same with the questions of pre-Test.

The test drive will also verify the technical specification, especially for the networking performance. Two networking test will be done, using internet and intranet, to check their significant difference of the connection speed.

Analysis of the answers to the questionnaire made during the pilot test study reveals that the questionnaires should be appropriate for the main research. The statistical processing of the data was using statistical program of SPSS for each of the dimension. Three tests were conducted for the instrument data, including validity, reliability, and t-Test. The reliability measurement was using the value of Cronbach's Alpha.

In the pilot test, the questionnaire was applied two times, before and after the teaching and learning session. The significance test (t-Test) was performed to know the difference mean between before and after, for understanding the effect of e-AV BIOLOGY as a new learning media. The student generally felt very comfortable and enjoy the interactivity of the e-AV BIOLOGY courseware. Most of students agreed with the use of e-AV BIOLOGY as a medium of instruction in the classroom.

The preliminary findings of the validity and reliability test, which indicate an acceptable alpha value for the research construct is shown in Table I.

The result of the pilot study data analysis shows that the value of Cronbach's Alpha was greater than 0.700, which indicate the instruments of research is reliable to be used on the main research.

TABLE I. ALPHA VALUE OF THE PILOT TEST

| No. | Dimensions | Cronbach's Alpha |
|-----|--|------------------|
| 1. | Attitude | 0.797 |
| 2. | Teaching Media of Biology | 0.800 |
| 3. | Navigation and GUI of e-AV BIOLOGY | 0.711 |
| 4. | Features and Interactivity of e-AV BIOLOGY | 0.746 |
| 5. | Overall Feedback of e-AV BIOLOGY | 0.736 |

VII. CONCLUSION

This work presents a framework for designing educational audio visual applications that intends to set a bridge between instructional and hypermedia aspects. Audio and Visual media is defined in the framework as educational applications in hypermedia environments.

The contribution that we have at this point is to propose the integrated framework for Biology Teaching and Learning media using the e-Learning method to deal with the explained educational problem in Indonesia. Integrated Framework of e-Audio Visual Biology have designed and developed, consisting four levels: the educational context level, requirements level, design level and learning outcomes level.

The advantages of the Integrated Framework of e-Audio Visual Biology Design are expected to increase the Teaching and Learning quality in Senior High School, especially in Biology content. e-AV BIOLOGY had been developed in an integrated way by combining Problem Based Learning (PBL) and Constructivist approach. Some PBL and Constructivist features had been applied in the design of e-AV BIOLOGY to produce integrated and comprehensive_Assignment, Quizzes, and Discussion Modules for supporting the student learning process. The result of the pilot study data analysis shows that the value of Cronbach's Alpha was greater than 0.700, which indicate the instruments of research is reliable to be used on the main research. Student generally felt very comfortable and enjoy the interactivity of the e-AV BIOLOGY courseware. Most of students agreed with the use of e-AV BIOLOGY as a medium of Teaching and Learning Biology.

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