

The Instructional Model Development Based on Interactive Multimedia on Technical Mechanics Competence of Vocational High School Students of North Sumatera Province

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ABSTRACT

This research is aimed to: (1) find interactive multimedia based instructional model, (2) examine the effectiveness of interactive multimedia based instructional model.

This study is developmental research uses Borg and Gall model. The first design model of development of this instructional product is designed programmatically and student centered learning with the processed in five steps: i.e. instructional design, developing preliminary instructional model, validating, trying out, and revising of preliminary instructional model. The subject of preliminary field testing are three experts in technical mechanical material, one experts in instructional design, four students for one to one try out, twelve students for small group try out and twenty five students for classroom group try out. The instrument employed in this study is a questionnaire and analyzed by using descriptive statistics.

The study to the students of class XI semester 4 academic year 2012-2013 take place in SMK Negeri 2 Balige to examine the effectiveness of interactive multimedia based instructional model. The method used in this study with compare pre test and post test student learning outcomes. The first design of this interactive multimedia based instructional model is effective with continues improvement.

The finding of study are: (1) the quality of instructional model viewed from the expert in educational technologies is *good* (75.00%), (2) in the one to one try out of the three student observation indicated that the product is *good* (75.46%), (3) in the small group try out of twelve students observations indicated that the product is *good* (87.04%), (4) and in the classroom group try out of twenty five students observations indicated that the product is *good* (mean pretest = 31.39; mean posttest = 32.54).

Keywords: Instructional model development, Interactive multimedia.

Introduction

The emerging of global trend is the growing use of the results of the technology industry and information technology. Another challenge arises in the wave of globalization is universalizing the value of competition. So the most important requirement is the availability of human resources (HR) that should be able to manage the technological advances. Thus HR is the deciding factor of progress of a nation or state. On the other hand, Indonesian Human Resources are still far behind compared to other ASEAN countries. From the reports submitted by the Human Development Index (HDI), Indonesia ranks position 108 with HDI value = 0.600 from 169 countries under the Singapore which ranks position 27 with HDI value 0.846; Brunei ranks position 37 with HDI value 0.805; Malaysia ranks position 57 with HDI value 0.744; Thailand ranks position 92 with HDI value 0.654, and Philippines ranks position 97 with HDI value 0.638. Above Indonesia, there is Vietnam that ranks position 113 with HDI value 0.497 ; Cambodia ranks position 124 with HDI value 0.494 and Myanmar that ranks position 132 with HDI value 0,451 (Ministry for the People's Welfare, 2010).

Along with the development of the use of technology in learning, the school will be equipped with the Information Communication Technology (ICT) in accordance with developed learning innovation. In 2012, it is targeted that 40 % elementary school, 80 % junior high school and 100 % senior high school and vocational high school has possessed library with adequate number of books, access to ICT and adequate laboratory facilities as well (Depdiknas, 2006) .

In connection with learning tools and problems in the learning process, the development of multimedia and computer technology has brought a revolutionary change in the field of industrial and communications, data processing, and various areas that affect human life. Multimedia can also be utilized for the development of science and technology, as well as the transformation of education. Interactive multimedia -based learning is something possible efforts as a learning paradigm in the form of learning service focuses on student learning and the development of human resources in education, especially teacher who serve as a motivator and a facilitator.

Review of Literature

Kimble defines learning as a relatively permanent change in behavioral potentiality that occurs as a result of reinforced practice (Hegerhahn & Olson, 2008). It is clear that learning needs to be focused as a form of potential behavioral on what problems humans do with the information they receive, and what they did after obtaining the discrete information to reach an understanding that gives them the ability, so that it is necessary to do reinforcement. Bruner in Gredler (1991) suggests there are four learning themes, namely: (1) the importance of the knowledge structure. This is necessary because the structure of our knowledge helps the learners to see how the facts seem to be no relationships can be connected to one another and to the information he had. (2) Readiness to learn. Readiness consists of mastering simpler skills to allow one to acquire higher skills. (3) The value of intuition in the educational process . it means that intuition of intellectual techniques is used to find out a tentative formulations without going through the analytical steps to determine whether the formulations are valid conclusions or not . (4) The motivation or desire to learn and the ways from teachers to stimulate it. Educational experiences that stimulate motivation is the experiences in which learners participate actively dealing with nature.

According to Clark & Feldon in Mayer (2005). "Multimedia usually Refers to the capacity of computers to provide real-time representations of nearly all existing media and sensory modes of instruction. "Understanding of interactive related to interactive two-way communication or more of the components of communication. Component of communication in interactive multimedia (computer-based) is the relationship between human beings (as users / users of products) and computer (software / applications / products in a particular file format, usually in the form of a CD). Thus the product / CD / application are expected to have a two-way relationships / interrelationships between software / applications to the user. Interactivity in multimedia is restricted by these following things: (1) the user is involved to interact with an application program, (2) interactive information applications intended that users can get only the information they want without having to come up with these all.

The models are developmental patterns proposed for fieldwork and development (Joyce, 1991). According to Good & Brophy (1990), model is the real world abstraction or representation of complex events or systems, in the form of narrative, mathematical, graphic or the other symbol. Model as described by Richey (1986) is an idea arising from the fact that having a particular arrangement of sequences. He pointed out that model can be used to organize knowledge from various sources and then used as a stimulus for developing hypotheses and build theory into terms/conditions, so that it can be applied to concrete practice or test the theory.

Gustafson (1984) emphasize the practical function models: a means to facilitate communication, or a regular user (algorithm) that is prescriptive to decision-making, or planning guidance for management activities. Further Nadler (1988) explains that a good model is a model that can help the user to understand what is a thorough process fundamentally. The basis of a good model is the relevance of theories. It is said there are several benefits of model to the user, among others: (1) to explain some aspects of human behavior and interaction, (2) to integrate what is known through observation and research, (3) to simplify complex human processes, (4) to be guidelines to conduct activities.

Kaufman (1972) distinguishes three (3) types of model development to determine which one is right and appropriate to use, namely: inductive model that derived from the experience of the learners behavior this moment, which is grouped , compared , developed and finally evaluated to ultimately held revisions, (2) deductive models which begins with the general goal setting, determining criterion, looking for linkages between existing elements/partners, data collection, formulation of specific objectives, developing and implementing, then proceeding with evaluation and revision, (3) the classical model , starting with some general requirements of the goals, program development, program implementation, evaluation and subsequent revision .

Twelker, et al (1972) said that the development of instructional model is a systematic way of identifying, developing, and evaluating a set of materials and strategies aimed at achieving specific learning goals. The end result of the instructional development is a system of learning, namely learning materials and teaching strategies that are developed empirically and are consistent that can achieve specific learning goals.

Thus it can be explained that the development of the instructional model consists of a series of activities which include the design, development, and evaluation of the instructional model

developed. In the end, the after a couple of revisions this instructional model can be effective, efficient and attractive.

Research approach

This type of research is the developmental research (Research and Development) using the model of product development by Borg and Gall. This instructional product development model is a model that is structured in program and student-centered learning in a systematic order. This model includes five (5) stages, namely: designing a lesson plan in accordance with the competence and structure of learning materials; design and development of a model as the initial product, expert validation, testing, and revision of the preliminary product. Subject test consists of three technical mechanics subject matter experts, one expert in instructional design, three students for individual testing (one to one try out), twelve students for small group testing (small group try out), and twenty five students for field testing (classroom group try out). Early conduct of the research is the preparation and development of research instruments used in data collection that include , questionnaires, interviews, records and documents. Data analysis technique in the first stage is descriptive analysis of research data conducted through surveys.

In accordance with the research model of research and development approach, the execution of this study followed the steps, preliminary surveys, planning the model, test the model, model validation and dissemination. While determine the effect of instructional model. It is conducted a quasi-experimental research design with control group pre test-post test.

Population and Sample

The population of this study was all vocational high schools which in Indonesian language is known as *Sekolah Menengah Kejuruan* (SMK) in North Sumatra Province with the target population include students and teachers. Sampling technique appointment in accordance with the criteria and characteristics of the schools that become the study treatment namely vocational schools which have competence in skill of structural drawing engineering with technical mechanics as the subject of those schools. This study sample was five state vocational high schools namely SMK Negeri 2 Balige Toba Samosir, SMK Negeri 2 Pematang Siantar, SMK Negeri 2 Lubuk Pakam, SMK Negeri 1 Percut Sei Tuan Deli Serdang and SMK Negeri Padang Sidempuan of North Sumatra Province.

Research Results and Discussion

Data Description of Results of Design and Development

Conceptually the development of interactive multimedia instructional model is assembling the components of learning in the scheme implementation steps interactive multimedia-based learning that is the computer -assisted learning program with face to face learning. In this case 30-70 % of learning materials already available on the computer and can be used as a learning support facilities are implementation in the classroom, the material presented directly in the display. In the pattern learning interaction, students can study in groups to seek a solution to the problem of learning from a variety of different sources and can communicate using the internet facility. Learning theory that is used in this study is constructivism learning theory as reference to learning system model

developed by Dick and Carey that emphasizes on student-centered learning (Student Centered Learning).

Instructional model development used in this study is ADDIE model (analysis, design, development, implementation and evaluation). The following were the results that were successfully developed in each stage:

Analysis stage (Analysis)

At this stage, need analysis of interactive multimedia-based instructional model development was done. After the analysis, it was found the need for further instructional model development. As a result, decision was made to continue the development of the instructional model.

Design Stage (Design)

At the stage of the analysis it was found that there was a need to develop a model of interactive multimedia in technical mechanics subjects in vocational high schools, therefore it is proceeded to the next step namely the design stage.

Development Stage (Development)

Development of interactive multimedia instructional model was developed by combining a variety of models as well as by using student-centered learning approaches that already exist , such as: Contextual Teaching Learning that is used to introduce the topic of learning contextually; Problem Based Learning is used to explain problems of learning and how the problem solving that will be performed by the students ; Cooperative Learning is used to classify students in group; and Project Based Learning is used to give a particular shape to serve as the object of student learning and be continued with explanation in the front of class as a discovery response from students (Discovery Learning) . The results of the preliminary development of interactive multimedia instructional model can be seen as shown below:

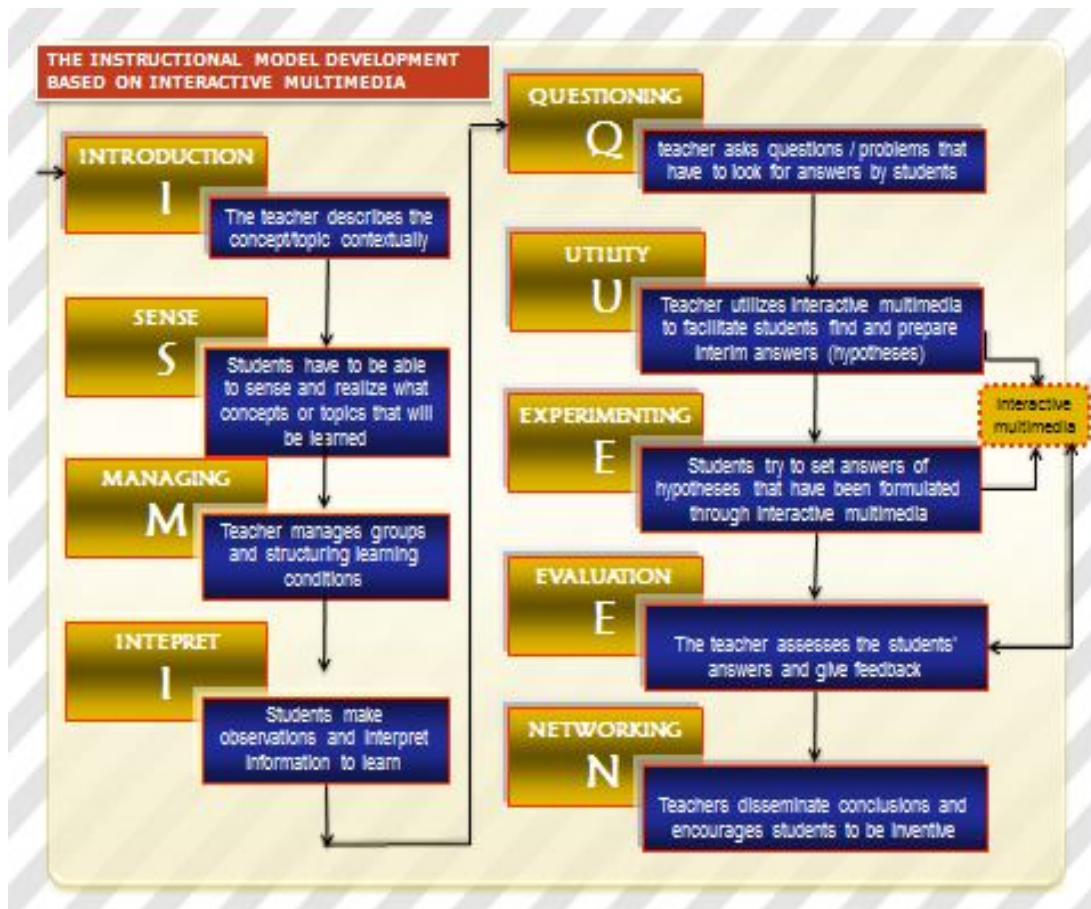


Figure 1. Preliminary Design of Interactive Multimedia-Based Instructional Model "IS MI QUEEN" model

The results of the preliminary design of interactive multimedia based instructional model as shown above is called the " IS MI QUEEN " model, with nine (9) steps of learning, namely: 1) Introduction: The teacher describes the concept/topic contextually; 2) Sense: Students have to be able to sense and realize what concepts or topics that will be learned; 3) Managing: Teacher manages groups and structuring learning conditions; 4) Interpret: Students make observations and interpret information to learn; 5) Questioning: teacher asks questions/ problems that have to look for answers by students; 6) Utility: Teacher utilizes interactive multimedia to facilitate students find and prepare interim answers (hypotheses); 7) Experimenting: Students try to set answers of hypotheses that have been formulated through interactive multimedia; 8) Evaluation: The teacher assesses the students' answers and give feedback; 9) Networking: Teachers disseminate conclusions and encourages students to be inventive.

Implementation Stage (Implementation)

Model implementation stage is a stage where the results of the instructional model are applied. Then, it is proceeded by the test of model to determine the effectiveness of it. The implementation as the test phase of this preliminary instructional model has been done in SMK Negeri 2 Balige, with the lesson topic of calculating equation pedestal reaction with certain static construction. By

using interactive multimedia through powerpoint and guidance sheets for students in problem-solving steps to calculate equation pedestal reaction.

Evaluation Stage (Evaluation)

Evaluation stage is a process to determine whether the learning model successfully developed, according to initial expectations or not. The instructional model is evaluated by three experts covering materials experts, software experts (IT) and learning media expert. All three experts stated that the learning model has been eligible to apply but still need improvement in the integration of the power point into interactive multimedia instructional model. Furthermore, this model will be evaluated on an individual test stages, small group testing and field trials (testing) at the second stage of the research.

The results showed: (1) test of subject matter experts in technical mechanics are well qualified (70.83 %), (2) educational technology experts test on the learning model are in good qualifying (75.00 %), (3) the individuals test are in a good qualifying (75.46 %), (4) small group trials are also in good qualifying (87.04 %), (5) the trial classes are well qualified (average of preliminary test value = 31.39; average value of the final test=32.04), thus interactive multimedia-based learning model developed is effective in improving student learning outcomes of technical mechanics .

Discussion of Research Results

The results of the preliminary analysis are to analyze the needs of the development of the instructional model as a reference of needs in the development of interactive multimedia-based instructional model in technical mechanics subjects. Based on the study on the need analysis of instructional model development and theoretical studies it was concluded that the interactive multimedia learning model needs to be developed and can improve the learning outcomes of technical mechanics.

In accordance with the phases of the instructional design of Dick and Carey (2005), in which before designing the module learning / teaching materials, the first thing to be done is to define learning objectives, instructional analysis, identification of students' prior knowledge, determining a criterion-referenced test, and determine the learning strategies laid out in the lesson plan and the development of teaching materials. Instructional materials that are designed based on the curriculum of 2013 and from a variety of sources of technical mechanics books and Internet sites. Next is to develop a flowchart to notice what must be the flowchart elements such as: specific structure with the purpose and content, branching systems, label elements, used symbols as well as easy to follow and understand by the reader.

The use of interactive multimedia-based instructional model in learning allows students to have direct control and interact directly to the resources, so that students can control and discuss directly with the group about what their need as individual or as a team. Interactive multimedia -based learning model also allows teachers to be flexible and to interact with the students so that the learning becomes interactive which makes learning focused on the problem and the subject matter being studied. Therefore, the role of the teacher in this case is required to master the technique of searching the information using internet, guiding the students to find sites that are relevant to learning materials, presents the material through a variety of learning sources that are attractive and

desirable, as it serves the guidance and internet communications and other skills required (Haughey, 1998).

Instructional analysis of the research data proves that the use of interactive multimedia-based learning model is better in improving the knowledge of students in learning technical mechanics than before the use of interactive multimedia-based learning model . This is consistent with previous research that has been conducted by Kozma (1991), in which he has shown that the presentation of the combination of media (video) compared with any audio or visual presentation of the same material, is able to produce the ability to remember information better than just look at the pictures, reading, or listening. Computer technology, can provide greater benefits in helping to improve the capabilities and productivity rather than technologies such as radio, television, and tape recorders. This technology is sometimes even able to exceed the capacity of human brain. Technology, as cognitive means and thinking tools are able to develop cognitive function during the learning process takes place by involving the learner actively in abundance and cognitive activities (Jonassen, 1995).

Although in this study the data obtained generally mean that the learning outcomes of students of technical mechanics is higher if they were taught by the use of interactive multimedia-based learning model than the average learning outcomes before the use interactive multimedia-based instructional model. The implementation of interactive multimedia-based learning model is still need improvement in terms of implementation, including teacher's mastery in terms of explanation of the topic so that students are easier to interpret the content of the subject matter that was given to them.

Conclusions and Implications

Conclusions

1. Development of interactive multimedia-based instructional model is needed in the classroom which made on the availability of resources educators and students who have the ability and motivation to interact in the learning as well as the support of learning and networking devices that can be accessible to students in a classroom.
2. Results of the preliminary design of interactive multimedia -based learning model called " IS MI QUEEN " model , with nine (9) steps of learning , namely : 1) Introduction: The teacher describes the concept/topic contextually; 2) Sense : Students have to be able to sense and realize what concepts or topics that will be learned; 3) Managing: Teacher manages groups and structuring learning conditions; 4) Interpret : Students make observations and interpret information to learn; 5) Questioning : teacher asks questions / problems that have to look for answers by students; 6) Utility : Teacher utilizes interactive multimedia to facilitate students find and prepare interim answers (hypotheses); 7) Experimenting : Students try to set answers of hypotheses that have been formulated through interactive multimedia; 8) Evaluation : The teacher assesses the students' answers and give feedback; 9) Networking : Teachers disseminate conclusions and encourages students to be inventive .
3. Interactive multimedia learning model developed is effective in improving students learning outcomes of technical mechanics subject.

Implications

Based on the conclusions and findings, the research and development of interactive multimedia-based instructional model interactive has some implications in the learning process at school, including:

1. Every school should be able to provide trained educators who have high motivation in multimedia -based instructional pattern that is supported by the availability of learning and networking devices that can be accessible to students in a classroom.
2. Implementation of interactive multimedia -based learning model contributes to changes in teacher-centered learning paradigm into a student-centered learning . Educational paradigm developed at this time is that students construct their own knowledge through experience gained from interaction with the environment. The roles of teacher change into a facilitator , an evaluator and a motivator. Interactive multimedia-based instructional model facilitate students so that they can study according to their learning needs and their learning styles. The model of interactive multimedia learning is the learning process that utilizes the development of information and communication technology with the philosophy of constructivism . This instructional model makes the process of learning becomes a student-centered learning and adhere to the philosophy of constructivism which is so highly precise as one option to implement the learning process
3. Implementation of interactive multimedia -based instructional model can change the mindset of students who aim to form creative thinking skills that encourages students to learn interactive collaborative both fellow students and to access a variety of quality teaching materials and enables students to learn everywhere and whenever they want.

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