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Message from President of
Rajamangala University of Technology Thanyaburi

On behalf of Rajamangala University of Technology Thanyaburi, It is my great pleasures to welcome you most cordially in the opening of the 2nd International Symposium on Innovative Education and Technology (ISIET) 2017.

I would like to express my appreciation to our distinguished keynote speakers for giving us special lectures, updating us about the latest trends on technology innovation and educational change today to provide us broader range of advance skills that something we can teach to our students that will be able them to learn more effectively and they can use when they enter the workforce.

Technology integration truly is an international partnership. In the knowledge economy and information society, students need to be able to search for, analyze and manage huge amount of information; they also must be able to use that information to solve complex problems and create new knowledge and cultural products. Therefore, the application of ICT on innovative education to manage information and solve problem is an important set of skills. Also, various applications of information technology can support the pedagogical changes that are needed to implement new curricular visions.

This symposium marks another important step in enhancing updated current development trends in the world on how technology dominates every aspect of education and innovation in the digital economy including TVET. Digital economy has changed the whole world. Information technology is reshaping today's economy and transforming the field of education as well as the teachers and students.

I would like to take this opportunity to express my sincere appreciation to all the distinguished keynote speakers, distinguished guests and participants for their valuable contributions that make this symposium successful. Lastly, may I also express my sincere thanks to the Faculty of Technical Education for hosting this event.
Once again my warmest welcome to everyone.

P. pinpathomrat

Associate Professor Prasert PINPATHOMRAT, Ph.D.
President of Rajamangala University of Technology Thanyaburi (RMUTT) and
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Developing Learning Media in Engineering Material Course on Crystal Defects Using Multimedia Animation in Indonesia of Education University

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ABSTRACT

This study aims to develop learning media in engineering material course on crystal defects material in Indonesia University of Education, specifically in the Department of Mechanical Engineering Education. This study is closely related to the efforts to improve the educational qualityof engineering material learning, specifically crystal defects. This study intends to compare the learning quality improvement of the students who used multimedia animation and picture media. The research method is experimental method conducted to two classes, namely an experimental class, that used multimedia animation, and a control class, that used picture media. Data collection was conducted using tests, namely pre-test and post-test. Research results show that there is significant difference between the improvement on the students who use multimedia animation and picture media, and the higher improvement is on the use of multimedia animation. This is because there is long-term memory resulted from learning using multimedia animation.

Keyword : Learning Media, Engineering, Multimedia Animation

1. INTRODUCION

Prospective teachers are not only equipped with pedagogical and solid professional knowledge, but they are also required to master lesson competencies that will be taught during teaching. Everywhere around the globe, the weaknesses of prospective teachers in learning are caused by the limitations of humans,who possess separate visual and verbal processing systems. The capacity of visual and auditory working memory is considerably limited, thus learning that involves only visual or verbal information does not last long, and is not effective in absorbing much information (Mayer, 2009).

Previous research results in Indonesia University of Education, especially in the Department of Mechanical Engineering Education show that there are learning media delivered only by briefly explaining the materials, without considering if the students have already understood or not. Consequently, the students experience difficulties in understanding the given materials. In other words, the learning is considered ineffective since the students encounter difficulties in comprehending the materials taught and do not optimally absorb the materials. During the learning, the students only write and summarize the materials without understanding the given materials, so that during drawing practice, the students feel confused in completing the given assignments caused by inadequate mastery of Engineering Material course on Crystal Defects material.

Learning is effective if it is conducted in pleasant atmosphere and emphasizes communication in learning activities, meanwhile the basic potentials possessed by students include learning to observe, listen, move and touch. Individual care and guidance can be properly performed by teachers while the information can also delivered clearly, interestingly, and carefully through learning media. Multimedia-based instructional developmental model explained by Lee (Lee & Owens, 2004), consists of the stages of analysis, design, development & implementation, and evaluation.

Difficulties encountered by students in understanding Crystal Defects material, apart from the learning process, are caused by the abstract, complex and dynamic characteristics of Crystal Defects material. With these characteristics, students are required to master material concepts in order to comprehend it. Learning constraints surely happen in all fields.

includingin the examined problems related to the weaknesses of students/prospective teachers in Engineering Material course, where all material properties are determined by their micro-atomic structures. The explanations of these concepts are represented through pictures and theories that generally describe abstract events which cannot be observed directly by human eyes because of the extremely microscopic size of atoms.The difficulties in understanding abstract, complex and dynamic concepts are problems in engineering material learning.

Interactive multimedia is a type of multimedia that is equipped with controlling device that can be operated by users so that user can choose what it will do in the next process. Meanwhile, interactive multimedia learning is a media combination of text, images, graphs, sound, animation and video integrated in a single system and is equipped with controlling device that can be operated users so that users can chose what it will do based on particular learning objectives. Multimedia in learning is widely used because it has many advantages (Berk, 2009). Its alternative utilizations include its use in the form of e-learning, virtual reality and interactive multimedia (MMI). The use of interactive multimedia is more effective compared with learning activities that use media delivered through printed media with face-to-face activities and is more effective than the media delivered through web using online learning (Dikshit et. Al. 2013).

Based on the explanation above, it is required to develop Crystal Defects learning media using Multimedia Animation in order to improve students' learning-teaching process, to make the given learning effective and to create interesting learning media that can attract students' attention. The purpose of this study is to examine the effectiveness of the implementation of multimedia animation learning media on Crystal Defects learning.

2. EXPERIMENT

Subjects in class A and B are Mechanical Engineering Education students in their first semester in Indonesia University of Education. The subjects are 62 students consisting of 29 males and 2 females in class A and 30 males and 1 females in class B. Research method used is quasi-experimental method. Quasi-experimental research design used is Nonequivalent Control Group Design. The experiment was conducted on two classes, namely an experimental class using multimedia animation and a control class using picture media. In this research design, there are two groups consisting of an experimental group and a control group. Both groups were given pre-test to determine their initial condition if there is any difference between the experimental group and the control group. Design pattern of this study can be seen as follows:

Table 1. *Nonequivalent Control Group Design*

Group	*Pre-test*	Treatment	*Post-test*
Experiment	T_{E1}	X	T_{E2}
Control	T_{K1}	Y	T_{K2}

Information:
T_{E1}/T_{K1} = Initial test given to the students.
X = Learning using *E-Multimedia Animation*.
Y = Learning through the use of *Handout*.
T_{E2}/T_{K2} = Final test given to the students.

Research was conducted in two classes with class A being the control class that used Handout learning media in the learning, and class B being the experimental class that used multimedia animation in the learning. First, the subjects were given questions in the form of essay questions on Crystal Defects Fields material that had been previously learned. The subjects had 30 minutesto answer the questions. This test was given to discover students' initial ability. After the data about students' initial ability was obtained, the control class was given treatment in the form of learning using handout learning media, while the experimental class was given treatment in the form of learning using multimedia animationon Crystal Defects Fields material. Multimedia animation learning was conducted with guide in order to facilitate the students in understanding the material.

Figure 1. Crystal Defects Multimedia Animation

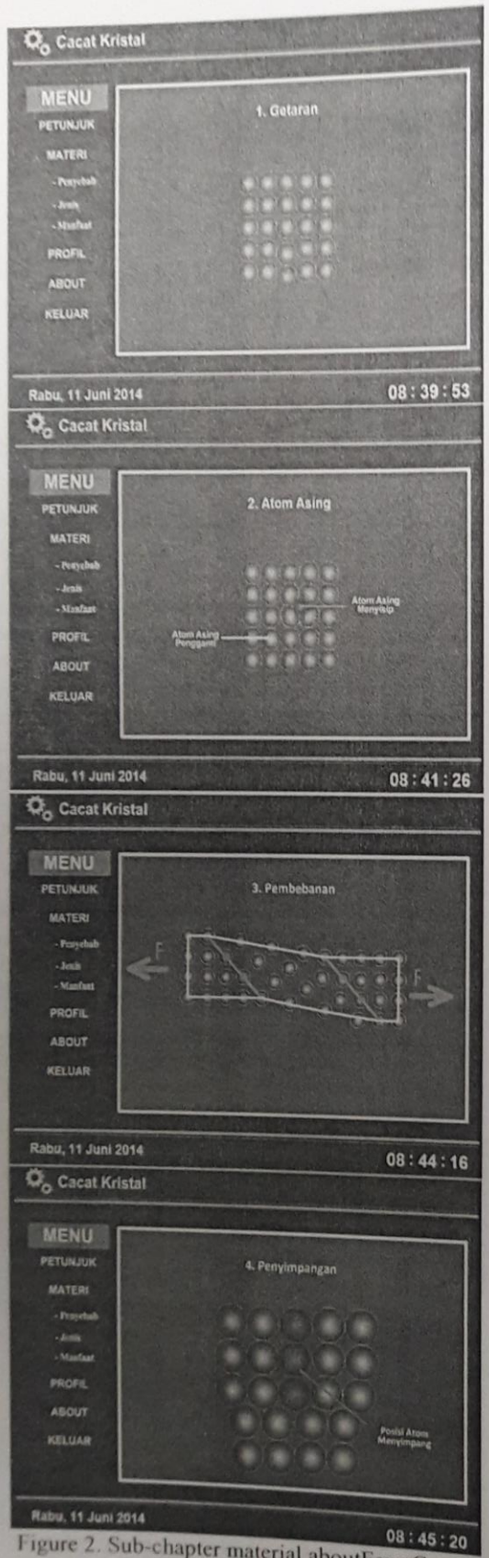

Figure 2. Sub-chapter material aboutFour Causes of Crystal Defects on multimedia animation

First, the students were given multimedia animation learning about Four Causes of Crystal Defects. The animation describes the causes of crystal defects as shown in figure 2. At the end of the animation, the students were allowed to start asking questions. After those questions were answered, the students watched the next animation.

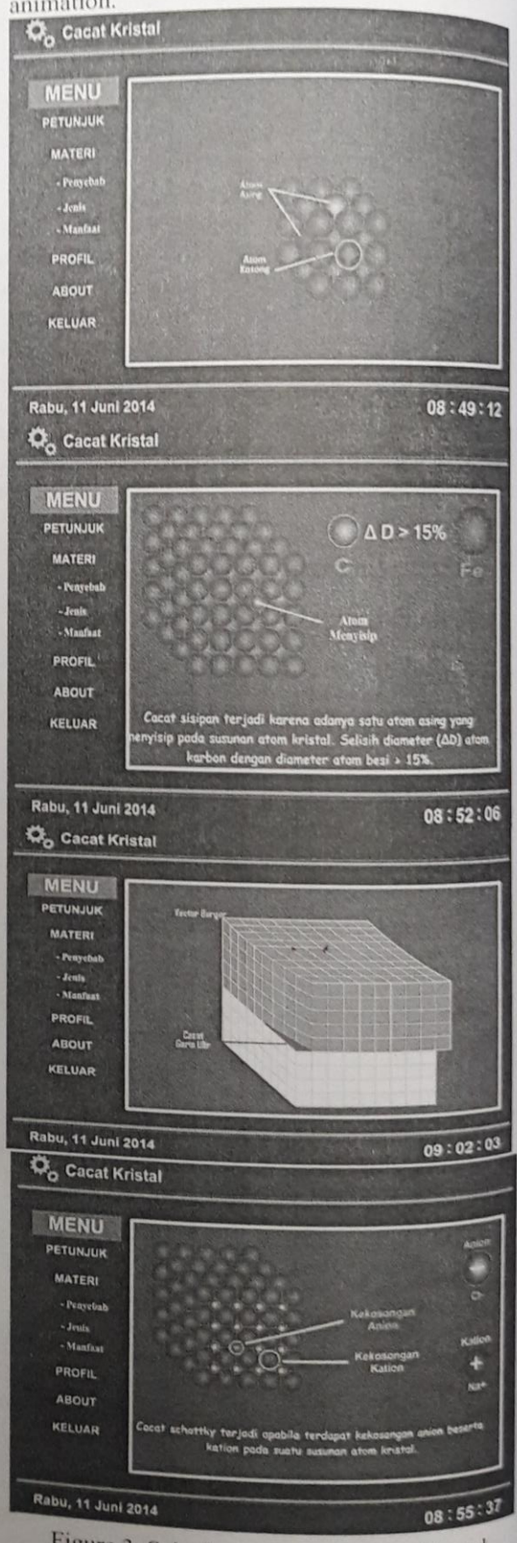

Figure 3. Sub-chapter material aboutCrystal Defects Types on multimedia animation

Subsequently, the students were given multimedia animation learning on Crystal Defects Types. The animations describes the types of crystal defect asshown in figure 3. At the end of the animation, the students were allowed to start asking questions. After these questions were answered, the students watched the next animation.

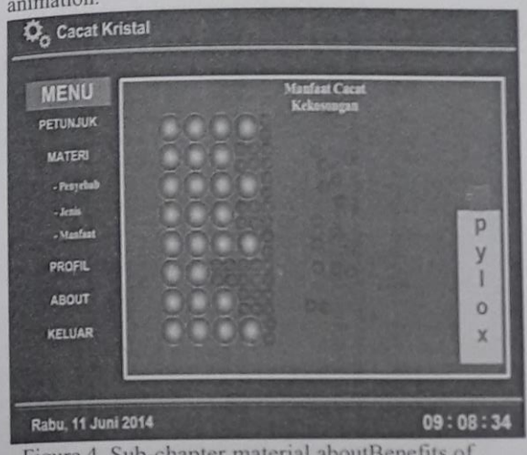

Figure 4. Sub-chapter material aboutBenefits of Crystal Defects on multimedia animation

The students were subsequently given multimedia animation learning on Benefits of Crystal Defects. The animation describes the Benefits of Crystal Defects as shown on Figure 4. At the end of the animation, the students were allowed to start asking questions.

After all students in both control class and experimental class were given treatment, they were given the same essay test as before the treatment. The test is a measurement device for the learning of Crystal Defects Concept Mastery using multimedia animation. The students had 30 minutes to answer the questions.

3. RESULT AND DISCUSSION

Based on the data resulted from the processing of pretest and posttest data on the control class and experimental class consisting of Mechanical Engineering Education prospective teachers in Indonesia University of Education, the following results were obtained: The increase of N-Gain in the control class is 0.1255 and the experimental class 0.5897. Higher increase was found in the experimental class that used multimedia animation in the learning which reached the average of 58.97%. This is higher compared with the increase of the class that used picture media and reached the average of 12.55% or on the medium category. Therefore, Crystal Defects MMA is proved to be able to improve the understanding on crystal defects material since it is higher and is on high category.

Table2.Data processing of control and experimental class

Group		N	Mean	Std. Deviation	Std. Error Mean
Gain	Control	31	.1255	.14111	.02534
	Experiment	31	.5897	.18736	.03365

The development of science aims to understand how students learn. In the efforts to implement learning science, the challenges in education is to develop instructional science that aims to understand how to present materials in ways that can facilitate students to learn. To achieve that objective, the educational experts created numerous educational media with various emphasis, accompanied with suitable principles. For multimedia research and creation, Meyer formulated seven principles of multimedia design, these are: multimedia, spatial closeness, temporal closeness, coherence, modality, redundancy and individual difference (Mayer & Mayer, 2001).

Meanwhile, distinctive principle that characterizes Engineering Material multimedia animation-based E-book isaccessible by learners' reasoning. This is the main emphasis related to the characteristic of the course of Engineering Materialwhose properties are determined by its micro properties, namely atomic structure, and dynamic and abstract movement of atoms. Microscopic and abstract size of micro-structure of atoms needs suitable media to be understood. Therefore, E-MAA is a media that can meet that requirement. Meanwhile, the development procedure of E-MMA consists of general steps conducted, namely: analysis, early development, expert validity, limited testing and final product testing. Deeper learning result is caused by Long-Term Memory as stated by Mayer (2008)and Berk (2009).

4. CONCLUSION

The improvement of Concept Mastery on Crystal Defects Material in the experimental class using MMA reached the average of58.97%. This is higher compared with the improvement in the control class using picture media or handout which reached 12.55%. Therefore, atomic Crystal Defects MMA is proven to be able to improve the learning of atomic Crystal Defects material up to the level of high category.

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