ATLANTIS PRESS

Advances in Social Science, Education and Humanities Research, volume 299

5th UPI International Conference on Technical and Vocational Education and Training (ICTVET 2018)

Benefits of Using Animation Multimedia to Improve Students Ability in Mastering Phase Diagram Material of Engineering Subject between Higher and Lower Group Achievement

Mumu Komaro, Ariyano Ariyano, A Suherman, A Herdiansyah
Department of Mechanical Engineering Education
Universitas Pendidikan Indonesia
Bandung, Indonesia
mumu@.upi.edu

***Abstract*—Difficulty of understanding abstract concepts, complexity and dynamics are some problems faced by students in mastering materials of engineering subject, especially in the materials related to diagram phase. Data from a study conducted by an engineering lecturer indicates that 68.8% of students could solve problems related to engineering materials. Regarding this, research was conducted on the use of animation multimedia on the material diagram phase. This study aims to illustrate the students; ability to master concepts. The research method was pre-experimental design in from of one group pre-test post-test design. Data collection was conducted using pre-test post-test. The results after comparing the pre and post test showed that lower group students perform better in mastering phase diagram materials compared to the higher one by using animation multimedia (MMA). MMA application helped students more easily understand material content and facilitate their learning process. The response from the questionnaire also showed that student has positive attitude to the use of MMA in the learning process.**

Keywords—animation multimedia (MMA); concept mastery; engineering subject; phase diagram material

I. INTRODUCTION

A quality of education should be improved and updated since education takes an important part in human life to improve human resources quality. The development of education is not merely the government's responsibility but other parties such as teachers, parents, and students, also have a role to take a part and improve the education quality. Therefore, the improvement in education is urgently realized to produce good quality of students as learning outputs.

Among the weaknesses of science or physics teachers, being a communicative teacher is seen to be one of the hardest competences. In the classroom interaction, commonly they have a lack of verbal communication skill and ability to utilize visual aids as learning media [1]. Science teachers tend to teach monotonously through sequential teaching started from defining material, explaining formula, giving examples, and asking student to do exercises. In the reality, such learning activities lead students find difficulties in understanding materials of engineering study [2].

However, the students' difficulties in understanding the material phase diagram include identifying characteristics of the material which are abstract, complex and dynamic. In addition, the students need to understand the subjects well through showing some instructional media which can help teachers explain some practical usages of materials and the teachers did not directly give explanation about the application of material. Therefore, the teacher should give concrete instructional media which can be used to explain the material either for theoretical exposures or in practical ones. It is done to avoid the students' boredom in attending the lectures and difficulty. Thus, it is urgently implemented ICT as learning media with several programs such as in the form of e-learning, virtual reality, and interactive multimedia (MMI).

Some studies have been conducted previously, one of them was done by Prabowo who investigated browser-based e-learning by using JOOMLA content management system (CMS) program as learning media has brought positive impacts for the students who joined maintenance training and manual transmission and component services in vocational school [3]. According to Huang, Web-based e-learning does not only improve their learning efficiency but also it attracts the students to be interesting in learning this subject [4].

Moreover, another related research on the use of MMI was conducted and it investigated that MMI was evidenced to improve learning quality with improvement of learning efficiency. In addition, the interactive multimedia-based learning has been proven effectively in improving achievement and mastery of Primary Teachers Concept [5], the ability to read the image projection of vocational school students [6], and the learning achievement of assembly and brake system assembly of vocational school students [7].

Animation multimedia (MMA) of materials engineering has been made by Callister with limited use for several reasons

[8]: 1) the structure of crystal in the form of unit cell does not contain its characteristics of each unit cell that precisely determines the mechanical properties of the material; 2) the field and the direction of the crystal, doses not show the phase diagram precisely determining the ease of the material being formed, or the softness and hardness of the material[8]. In general, this study aims to create learning media focused on improving the concept mastery toward engineering materials subject by implementing animation multimedia (MMA) for students of vocational schools who will be experts in productive mechanical engineering.

II. Research Method

This study was an experimental study employing two instruments to portrait the concept mastery of the vocational students who will be experts in mechanical engineering. The subjects of the study involved to group of students, namely lower and higher achievement group. Lower achievement group consist of students who get lower scores in their pre-test, while the higher group is those who get higher pretest score. The pre-test was conducted before the treatment to the experimental group was given whereas the post one was administered after the treatment. The research method and design is used in this study due to selective sample in accordance to the researcher's need [9].

In addition, that pretest before treatment given is intended to get an accurate data which can be compared to the previous result. The experimental research design can be seen in following table (table) adopted [9].

TABLE I. One-Group Pretest-Posttest Design

Group	Pre-test	Treatment	Post-test
Lower	OL1	X	OL2
Upper	OU1	X	OU2

Notes:

O_{L1} = the pre-test result of *lower group*.
O_{U1} = the pre-test result of *higher group*.
X = *Treatment: implementing* animation multimedia as a learning model .
O_{L2} = the post-test result of lower group after the treatment
O_{U2} = the post test result of higher group after the treatment

There were two groups – lower and higher achievement groups that were not selected randomly. Each group is given treatment through using animation multimedia as the learning media. Pre-test was conducted to know students' mastery toward the learning material before treatment. After the treatment, a post test with the same level of difficulty as the pre-test was done to know whether there were different learning outcomes of the two groups.

The different averages of two samples was used to determine N-Gain (gain tenormalization) between upper and higher achievement groups in accordance to Hake [10], namely: (% Gain%) = (% posttest score% / pretest score) / (100-% pretest score).

In this research, N-Gain descriptive analysis using N-Gain criterion according to Hake [10], result: 1) "High-gain" improvement if (N-Gain)> 0,7; 2) "Medium gain" improvement if 0.7 ≥ (N-Gain) ≥ 0.3; and 3) "Low gain" improvement if (N-Gain) <0.3.

III. Findings and Discussions

The result of preliminary study shows that the students who take the engineering subject have some difficulties in mastering abstract materials such as in accountant, atomic motion, and diagram phase materials. Consequently, instructional media is important to understand learning materials for content, practical, economical, accessible (teachable) purposes. In addition to meet criteria of accessibility, the theoretical learning model is transformed to be the practical one by using multimedia. Here are the examples of animations used in learning process:

Fig. 1. The main home of MMA phase diagram.

Fig. 2. Issomorphous binary phase diagram materials.

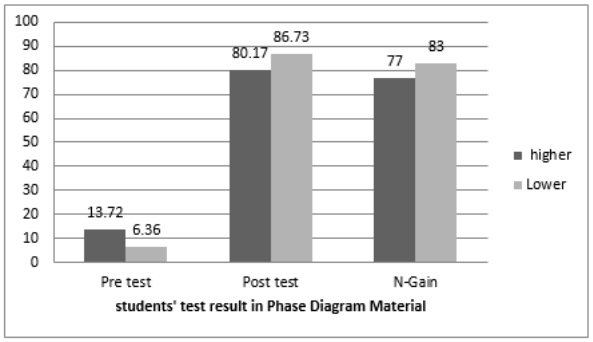

Fig. 3. Graphic of pre test, post test, and N-gain result in mastery of phase diagram concept.

The average improvement in material mastery of the lower group using MMA reaches 83% categorized as "High". This number is higher than the average improvement of the upper group of 77% categorized as "average". MMA implementation is proposed to understand how students learn and create an instructional model more easily [11]. Regarding this, many scholars in education have created various educational media with different specifications. They consist of several aspects namely type, principles used for multimedia, spatial closeness, temporal proximity, coherence, modality, redundancy, and individual differences [12]. In this case, the multimedia for phase diagram material is specifically created by considering accessibility. It is due to the characteristics of the materials that cover atomic structure, and abstract and dynamic atomic motions. Therefore, MMA is an appropriate media that can help students to understand very small and abstract size of micro structure.

In terms of design, MMA for engineering material is composed through considering student-centered learning. It is intended to involve learners in thinking simulation so that the learning outcomes can increase depends on the students' involvement in the simulation stage [13]. The use of MMA is mainly aimed at achieving a better learning outcomes and creating meaningful learning for students. Moreover, the use of live images or animation in the MMA also has positive impacts on the better learning outcomes [14]. In addition, overall reading only take 10% of students' performance, while 60% of students' performance is the result of using multimedia [15], which combines readable texts, audible sounds, images and motions or animated views. In fact, the deep understanding and mastery of learning is also obtained from long-term memory activation (Long-term Memory) as reported by Mayer [11], and Berk [16].

IV. CONCLUSIONS

Considering based on the findings of the study, some points can be concluded. First, lower achievement group performed better than higher achievement group through using MMA in their learning process which is indicated from the average improvement grade of 83% categorized as high meanwhile the higher achievement group reached 77%categorized as average. Second, MMA in phase diagram material tend to increase the ability of students' mastery toward the materials. It can be seen from N-gain of the lower class group which is higher than the higher achievement group. From this average, the students may improve their understanding toward learning materials through MMA as the learning media.

ACKNOWLEDGEMENT

In particular, the authors express their greatest gratitude to UPI and the Ministry of Research, Technology and Higher Education (KEMENRISTEK DIKTI) as the two institutions who give financial contributions through the scheme of Applied Research on Superior Higher Education Grant *(Penelitian Terapan Unggulan Perguruan Tinggi)*.

REFERENCES

[1] Sarwanto, "Analisis Kemampuan Representasi Mahasiswa Pendidikan sains PPS UNS," Jurnal Materi dan Pembelajaran Fisika, pp. 16-24, 2012.

[2] S.M. Leksono, N. Rustaman, and S. Redjeki, "Kemampuan profesional Guru Biologi dalam Memahami dan Merancang Model pembelajaran Konservasi Biodiversitas di SMA," Cakrawala Pendidikan, Th. XXXII, No. 3, pp. 408-419, November 2013.

[3] R.S. Prabowo, A Budi, and W. Aryadi, "Pembuatan Media Pembelajaran Berbasis Broser Training dengan menggunakan software Content Management System JOOLLA pada Mata Diklat Pemeliharaan/Servis Transmisi Manual dan Manual," Jurnal Pendidikan Teknik Mesin, vol. 9, No. 2, pp. 107 – 113, Desember 2009.

[4] C.H. Huang, "A Web-based E-learning Platform for Physical Education," Journal of Network, vol. 6, No. 5, pp. 721-727, May 2011.

[5] T. Masitoh, "Efektivitas Pembelajaran IPA Kelas Tinggi Berbasis Multimedia Interaktif untuk Meningkatkan Keterampilan Pemecahan masalah Mahasiswa Calon Guru SD," Seminar Nasional Pendidikan MIPA, Unila, 2011.

[6] C. Anam, M. Khumaedi, and Basyirun, "Pembelajaran Ceramah dengan Media Animasi untuk Mengingkatkan Kemampuan Siswa Dalam Membaca Gambar Proyeksi," Jurnal Pendidikan Teknik Mesin, vol. 9, No. 1, pp. 7-13, Juni 2009.

[7] B. Harsono, Soesanto, and Samsudi, "Perbedaan Hasil Belajar antara Metoda Ceramah Konvensional dengan Ceramah Berbantuan Media Animasi pada Pembelajaran Kompetensi Perakitan dan Pemasangan Sistem Rem," Jurnal Pendidikan Teknik Mesin, vol. 9, No. 2, pp. 71-79, December 2009.

[8] W.D.Jr. Callister, Material Science And Engineering, An Introduction, Utah: Salt Lake City, 2004.

[9] Sugiyono, Educational research method: a quantitative, qualitative, and R&D approach (Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D). Bandung: Alfabeta, 2014.

[10] R.R. Hake, "Relationship of Individual Student Normalized Learning Gains in Mechanics with Gender, High-School Physics, and Pretest Scores on Mathematics and Spatial Visualization. The Physics Education Research Conference [Online]. Retrieved from: http://www.physics.indiana.edu/~hake, 2015.

[11] R.E. Mayer, "Applying the science of learning: evidence-based principles for the design of multimedia instruction," The American psychologist, vol. 63, No.8, pp.760–769, 2008.

[12] R.E. Mayer, "Principles of multimedia design," Multimedia Learning, pp. 5–10, 2001.

[13] C. Fadel Multimodal Learning Through Media: What the Research Says [Onine]. Retrieved from: www.cisco.com/web/strategy/docs/education, 2008.

[14] Y. Munadi, Media Pembelajaran (Sebuah Pendekatan Baru). Jakarta: Referensi, 2013.

[15] Munir, Kurikulum Berbasis Teknologi Informasi dan komunikasi, Bandung: Alfabetha, 2010.

[16] R.A. Berk, Multimedia teaching with video clips: TV, movies, YouTube, and mtvU in the college classroom," International Journal of Technology in Teaching and Learning, vol.5, No.1, pp. 1–21, 2009.