Computer Asissted Teaching and Learning (CATL) to Improve Academic Achievement and Skill in Science-Physics

ABSTRACT

Computer assisted learning (CAL) has been implemented in schools to improve the quality of education. However, the application of CAL without the assistance of teachers in the teaching and learning of science-physics is not satisfactory. This study introduces computer assisted teaching and learning (CATL) which used the assistance of teachers in teaching and learning. Based on the post-test 68 students and 12 observational learning activities throughout the session learning the science-physics at several junior high schools in Aceh province Indonesia, obtained an average score of academic achievements of learning science-physics using CATL 74.79 is better than CAL 71.23. Assistance teachers in CATL can provide a meaningful impact on improving academic learning achievements. Based on interviews 16 students and 4 teachers can be seen that CATL better, easier, and fun. 87.5% of students then 100% of teachers want CATL applied in the subjects of science-physics. Thus CATL can satisfy students and can improve skills and academic achievements in teaching and learning science-physics.

Keywords: Computer, Teaching, Learning, Academic achievement,Skill, Science-Physics

1. INTRODUCTION

The development of information technology provides convenience in the learning process (Mayer & Moreno, 2005). The use of computers in learning processes has a positive influence, can improve academic achievements (Barnea and Dori, 2000; Kiboss, Ndirangu & Wekesa, 2004; Powell, Aeby-Aebyc & Carpenter, 2003). The use of video in learning science-physics can improve academic skills, facilitate learning, efficient, productive, and create a more pleasant classroom situations (Herlinawati, 2012; Darmayanti, 2006). The use of audio, text and images in the form of graphs, illustrations, photographs, maps can involve auditory and visual modality in the system memory of students. The cognitive processes in computer assisted learning are shown in Figure 1 below.
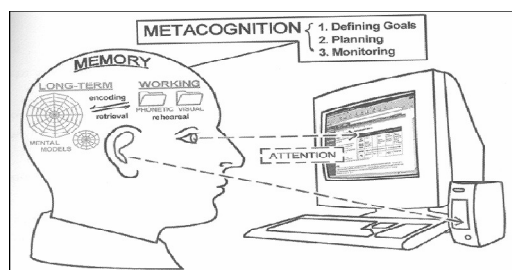

Figure 1. Cognitive Processes in computer asissted learning (Clark & Mayer, 2003)

Based on the responses of students to computer assisted learning, then several findings obtained as follows: (1) students feel comfortable with the situation of learning, (2) students active in expressing their opinions, ideas and arguments, (3) students more easily understand the concepts, (4) students are motivated to improve his skills and (5) the teacher are helped to make learning process effectively and efficiently (Kartimi, 2008). According to cognitive theory (Bates, 1995) learning by computer based on three assumptions: (1) active learning, (2) learning two channels wich are Word channel and the visual channel, and (3) learning with the integration of experience in long-term memory.Science-physics is a subject that must be studied in secondary schools. This course is the foundation for studying natural sciences disciplines. The lowest score of 7 (seven) in a scale of 10 (ten) is the academic achievements target of Directorate General of Secondary Education of Indonesia (2004). But now, academic achievements of students in the Aceh province are still lagging compared to other province Indonesia. Therefore the Aceh province requires improvements in education, particularly the teaching and learning process of science-physics. Based on the evaluation results of national examinations in 2006, Aceh is ranked 13th of 33 provinces in Indonesia. While academic achievements science-

physics is ranked 36th of 45 countries in the world (Republika online education news paper Friday, 24 December 2011). Average of academic achievements of science-physics lesson in 2009-2011 for two (2) junior high schools (SMP) within the city of Banda Aceh (SMP A and B) and two (2) junior high schools in the district of Pidie Jaya (SMP C and D) in the Aceh province, as shown in Table 1 below:

YEAR	SMP A	SMP B	SMP C	SMP D	AVERAGE
2009	74.5	66.8	60.65	64.6	66.64
2010	58.75	62.64	57.8	58.6	59.45
2011	72.84	68.48	62.8	66.8	67.73

Table 1: Average of academic achievements of science-physics lesson at 4 (four) SMP in Aceh Province.

Table 1 shows the average of academic achievements in science-physics lesson in 2009, 2010, and 2011 respectively which are 66.64, 59.45, and 67.73. It can be shown that academic achievement of physical science has not reached the targeted standard.

This study aims to determine the effect of computer assisted learning (CAL) without the assistance of teachers and computer assisted teaching and learning (CATL) with the assistance of teachers to the academic achievements, academic skills and the use of learning time.

2. METHODOLOGY

To achieve the objectives of this study, a case study approach is used (Taylor & Bogdan, 1984). Two study groups of 68 peoples who came from several junior high schools in Aceh province are used as sample in this study. Each group consisting of 34 peoples. Computer assisted learning without a teacher (CAL) and computer assisted teachning and learning with a teacher (CATL) applied to both groups. Instrument used in this investigation are: (1) Questions post-test to determine the enhancement of academic achievements, (2) interview protocol to capture the perceptions of students, (3) observation protocol for measuring the effective use of time for remembering lessons. Two methods of data analysis which are quantitative and qualitative analysis were carried out in this investigation. Both methods are used for a more accurate analysis. This method corresponded to the mixed-method design (Patton, 1990; Burn, 1995; Silverman, 2000) which combines quantitative and qualitative method. The experimental designs, pre-test and post-test

and control groups (Sekaran, 2003), are used in this investigation

To determine the increament of academic achievements science-physics lesson, then the post-test performed after each learning session. Post-test, interview and observation run in both groups. A total of 12 times post-test have been run, where 6 times post-test have been run for each group after the study session. To acquire knowledge of the perception of students in learning science-physics, the interview has been run. A total of 16 students and 4 teachers were interviewed separately. To measure the effetive use of time learning, then 12 observations are carried out in both groups. Structured oservation have been done, where researchers conducted observation with record based on several aspects of learning activities.

3. RESULTS AND DISCUSSION

The average and standard deviation of academic achievements of science-physics after the post-test in each group can be shown in Table 2

Tabel 2. Academic achievements of Science-physics Lesson

Model	n	Average of Academic achievements	Standard Deviation
CAL	34	71.23	2.67
CATL	34	74.79	5.26

The distribution of average of academic achievements was normal and homogeneous. Therefore t-test was performed with the 5% significance level. The t-test results are shown in Table 3 below

Tabel 3. The t-test Results

Model	t	df	Sig. (2-tailled)
CAL	3.487	48.531	0.001
CATL	3.487	66.00	0.001

Table 3 shows the 0.001 of Significance level which is less than 0.05, where the α level is 0.05. Thus it can be concluded that differences between academic achievements of CAL and CATL is significant. The average of academic achievements using CATL is 74.79 while using CAL is 71.23. Therefore CATL can be used to

2

improve academic achievements and better than CAL.

Based on the 21 item questionnaire regarding academic skills science-physics after application of CAL it can be showed the interval score is [4.35-4.79], where average is 4.61 and standard deviation is 0.63. The highest average score is 4.79 and standard deviation is 12.48. The lowest score is 4.35 and standard deviation is 0.69. This shows that students who attend CAL, can obtain high academic skills. While the interval score of academic skills of science-physic after application of CATL is [4.38-4.79], where average is 4.61 and standard deviation is 0.64. A very high academic score was obtained in all aspects, where the average is greater than 4.68. The highest score is understanding and also impression in the memory, where the average is 4.79, and standard deviation is 0.48.

The results of observation for 6 learning sessions using CAT can be summarized as follows: the use of time for each learning activity is more memorable. Aspects of student activities in the first session to fourth session is less memorable. While the sixth session more memorable, because the use of time less than the maximum time provided. While the results of observations for 6 learning sessions using CATL can be summarized as follows: the use of time for all aspect of learning activity was very memorable. Overall the results of the sixth session of observation are effective.

The results of the interview 8 (eight) students in the group CAL, are given as follows: (1) learning by CAL is memorable, (2) CAL facilitate understanding of learning science-physics in the group, (3) very beneficial to help students in remembering the lessons, (4) learning materials is suitable, (5) easy to follow and (6) more easily to understand. While the results of interviews with eight (8) students in the group CATL, are given as follows: (1) learning by CAL is more memorable, (2) a lot of benefits are received in the group learning (3) easier to complete the assignment task, (4) can make students feel challenge and provide new knowledge, (5) students can conduct a conversation and share knowledge among students, (6) learning materials are suitable for junior high school, (7) easy to understand and (8) memorable in memory.

4. CONCLUSION

Based on post-test can be concluded that both the use CAL and CATL can improve academic achievements science-physics in secondary schools in Aceh Province. However, CATL provides better results than CAL method in producing the academic achievements. Based on observations can be showed that the use of time for every aspect of learning activities on CATL is more effective. Based on the interview can be seen that CATL: (1) more memorable, (2) facilitate students in understanding the lesson, (3) facilitate the students to remember the lesson that has been learned, (4) memorable in memory, (5) there has been increased activity the group, (6) facilitate the students in discussion and sharing of knowledge, (7) facilitate the students to complete their assignment task, (8) The students feel fun and challenge. There are 87.5% of students, and 100% of the teachers want to apply CATL in all subjects. The CATL help improve academic achievements, improve academic skills and produce effective learning.

REFERENCES

[1] Dirjen Pendidikan Menengah (2004) *Kurikulum SMP mata pelajaran science: 1984, 1994, 2004-KBK,* Jakarta Indonesia

[2] Republika online Koran Pendidikan Jum'at 24 Desember 2011 dengan tajuk, Rendahnya Kemampuan Matematika

[3] Mayer, R. E., & Moreno, R. (2005). *Role of guidance, reflection, and interactivity in an agent-based multimedia game.* Journal of Educational Psychology, 97*, 117-128.*

[4] Barnea,N. &Dori,Y.J. (2000). *Computerized Molecular Modeling.* The new technology for enhancing model perception among chemistry educators and learners, Research report New Educational Tehnologies (NET).

[5] Kiboss, J.K., Ndirangu, M., & Wekesa, E.W. (2004). *Effectiveness of a computer-mediated simulations program in school biology on pupils' learning outcomes in cell theory.* Journal Science Education Technology 13 (2) :207–213

[6] Powell, J.V, Aeby, V.G. Jr., & Carpenter-Aebyc, T. (2003). *A comparison of student outcomes with and without teacher facilitated computer-based instruction.* Computer Education 40:183–191

[7] Herlinawati (2012). *Pemahaman Pelajaran Fisika dengan Pengguna Multimedia Sisiwa SMP Bandung Indonesia.*

[8] Darmayanti, T. (2006). *Penggunaan Multimedia Komputer Sebagai Pendukun Pembelajaran Ingkuiri Larutan Penyangga untuk Mengembangkan Potensi Siswa.* Tesis Program Pasca Sarjana UPI Bandung Indonesia.

[9] Clark, R.C., & Mayer, R.E., (2003). *E-Learning and the science of instruction: proven guidelines for consumers and designers of multimedia learning.* Jossey-Bass/Pfeiffer Edition.

[10] Kartimi (2008). *Pengembangan Model Pembelajaran Interaktif Berbasis Komputer Sebagai Wahana Pendidikan Siswa SLTP.* Laporan penelitian Sekolah Tinggi Agama Islam Negeri Cirebon, http://pkab.wordpress.com/2008/04/30/pengembangan-model-belajarinteraktif berbasis-komputer/

[11] Bates, A.W.T. (1995). *Technology Open Learning and Distance Education.* New York: TJ Press Ltd.

[12] Taylor, S. J., & Bogdan, R. (1984). *Introduction to qualitative research methods: The search for meanings (2nd edition).* John Wiley & Sons Inc.

[13] Patton, M.Q. (1990). *Qualitative Evaluation and Research Methods.* London: Sage Publications.

[14] Burn, R., B. (1995). *Introduction to Research Methods.* Melbourne: Longman.

[15] Silverman, D. (2000). *Doing Qualitative Research: A Practical Handbook*, London: Thousand Oaks, New Delhi: Sage

[16] Sekaran, U. (2003). *Research Methods for Business: A Skill Buillding Approach*, New York: John Wiley & Sons, Inc.