MISEIC UNESA Universitas Negeri Surabaya

CERTIFICATE

OF APPRECIATION

No: 43415/UN38.I/DL.01.02/2020

is presented to

Fitroh Annisaul Mubarokah

as ***Presenter***

in Virtual Conference of Mathematics Informatics Science Education International Conference

with theme:

"Advancing Research on Mathematics, Informatics, Science, and Education for Building a Better Society"

on October 3rd, 2020

Vice Rector I of Unesa

Prof. Dr. Bambang Yulianto, M.Pd.

Conference Chair

Enny Susiyawati, Ph.D.

MISEIC

ATLANTIS PRESS
Advances in Engineering Research, volume 196
International Joint Conference on Science and Engineering (IJCSE 2020)

Improvement of Self-Efficacy and Student Learning Outcomes on Acid Base Material Using 9E Learning Cycle Model

Tukiran[1,*] Fitroh A. Mubarokah[1], Harun Nasrudin[1]

[1]*Science Education, Post Graduate, Universitas Negeri Surabaya, Indonesia*
[*]*Corresponding author: tukiran@unesa.ac.id*

ABSTRACT
The aim of the research was to find the effectiveness of developed teaching materials to increase students' self-efficacy and learning outcomes using 9E learning cycle on acid base matter. The teaching materials was applied in SMAN 7 Surabaya toward 36 students of grade XI-6. This research used 4D model from Thiagarajan. The application steps during learning activity used pre-experimental, pretest–posttest question. The evaluation steps in this research used self-efficacy questionnaire, pretest–posttest questions, and motivation questionnaire. As a results, average self-efficacy and motivation of students increased up to 0.71 and 0.65. The average of learning outcomes increased with 0.75 score and in high category. The conclusion is the developed teaching instrument can improve self-efficacy and learning outcomes of students effectively.

Keywords: *Teaching materials, 9E learning cycle model, Self-efficacy, Learning outcomes*

1. INTRODUCTION

The process of interaction between students and teachers is a learning class activity. The success of the learning process is not only influenced by the teacher's role, but also the students. One of important thing in learning activities is student's self- efficacy. The previous study found higher self-efficacy can improve student learning outcomes and academic achievement [1]. But the result of pre-testing or pilot testing of a survey in Surabaya showed that 80% of students had low self-efficacy.

Based on previous research, learning cycle model application could improve students' self-esteem [2] and high self-esteem will increase self-efficacy [3]. So, the 9E Learning Cycle model can be possible to improve students' self-efficacy. In addition, the previous researcher showed that learning cycle model could significantly improve learning outcomes of student [4], improve science process skills [5], and improve students' scientific attitudes [6].

Learning cycle model is closely related to constructive theory [7]. Constructive theory is based on the fact that students build their own knowledge, not from reproducing other people's knowledge [8]. This learning model emphasizes the importance of exploring, initial knowledge, and transfer of learning [9]. The 9E learning cycle model is a development of the 7E learning cycle model which contains a series of nine planned and interconnected phases where students go through various scientific investigations by exploring teaching material, building concepts after arriving at conclusions and applying concepts or principles that have been held to a new problem. Thus instilling a sense of learning by stimulating students' desire to explore, think and gain experience. The 9E learning cycle model also supports intellectual abilities of students [10].

The 9E learning cycle model is considered suitable to be applied to chemistry learning in senior high school. As we known, chemistry is a complex subject which not only about calculating but also a series of experiment in order giving the students a meaningful learning experience directly for everyday life. This experience can be present in several sub-chemicals belonging to be acid-base matter.

The application of the 9E learning cycle model would require students to observe, classify, analyze, conclude, and communicate the results of the experiments that had been carried out. This process would increase student self-efficacy as students were

Copyright © 2020 The Authors. Published by Atlantis Press B.V.
This is an open access article distributed under the CC BY-NC 4.0 license -http://creativecommons.org/licenses/by-nc/4.0/.

directly involved in learning. By experiencing the material, it was hoped the students could understand the concept of acid base and learning outcomes increased.

2. METHOD

The research design used is experimental design using 4D development learning method. This method was established on 3 stages, namely define, design, and develop [11]. The subject of the research was grade XI-6 of SMAN 7 Surabaya with 36 students. The effectiveness of teaching instruments was observed from the motivation questionnaire, self- efficacy questionnaire and pretest-posttest. The collected data was analyzed using descriptive and quantitative methods. The following are the techniques of data analysis for each aspect that has been decided.

2.1. Self Efficacy and Motivation Questionnaire Analysis

The self-efficacy and motivation questionnaire are categorized as follows:

0 10 20 30 40 50 60 70 80 90 100

never sometimes always

Scores of self -efficacy and motivation questionnaire gained was then categorized as presented in Table 1.

Table 1. Category of self -efficacy and motivation [12]

Score	Category
81 -100	Very High
61 – 80	High
41 – 60	Enough
21 – 40	Low
0 – 20	Very Low

The difference between self- efficacy and motivation questionnaire in pretest and posttest after the application of 9E learning cycle model was analyzed by calculating the average used the following formula:

$$< g > = \frac{Spost - Spre}{Smax - Spre} \quad (1)$$

Note:
< g > = gained score
Spre = pretest score
Spost = posttest score
Smax = Maximum score

n-gain will be converted using categories as presented in Table 2.

Table 2. Category of normalized gain [13]

Score *n*-gain	*normalized gain* Category
0,7 < *n*-gain	High
0,3 ≤ *n*-gain	Medium
n-gain < 0,3	Low

2.2. Learning Outcomes Analysis

Analysis on the learning outcomes is a posttest after finishing the project. The accumulation of score is formulated as follows:

$$final\ score = \frac{score\ gained}{\max score} \times 100\% \quad (2)$$

The converted score was cited based on the decision letter of SMAN 7 Surabaya. The score range was categorized as presented in Table 3.

Table 3. Range value of knowledge competence (Decree of SMAN 7 Surabaya, 2015)

Minimum Criteria of Mastery	Predicate			
	D (poor)	C (average	B (good)	A (excellent
70	< 70	70 – 79	80 – 89	90 – 100

The student learning ability is analyzed using *n*-gain. The result of n-gain will be converted using the category on Table 2.

3. RESULTS AND DISCUSSION

3.1. Self-efficacy Questionnaire

The self-efficacy questionnaire was answered by 36 students of Grade XI-6 in order to know the increase of students' self- efficacy. It seemed that the increase of self-efficacy was present in as presented in Fig 1.

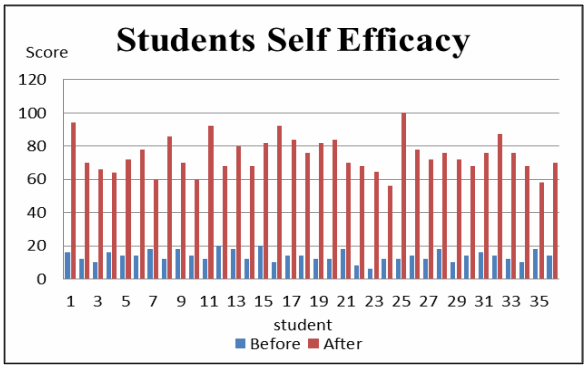

Figure 1. Self-efficacy of student before and after learning process

Figure 1 showed that the average score of self-

efficacy before the learning process is 13.78 and the self-efficacy after the process is 74.66 with raise of score at 0.71.

The results of the research explained that posttest score was higher than pretest score (Figure 1). The result of analysis showed that before the treatment, the average score is 13.78 with very low category. After the treatment done, the average score is 74.66 with high category. The score increase was evaluated using *n*-gain calculation. The average increase was 0.71 with high category. The increase of self-efficacy was gained by the application of 9E learning cycle model, which contains a series of nine planned and interconnected phases. In this learning model, students conducted scientific investigations by exploring teaching material, building concepts, and applying concepts or principles previously known to a new problem. All phases made self-efficacy of students higher than before. This is in line with the previous research, in which self-efficacy have four sources, which are performance experience, vicarious experience, social persuasion, and emotional state [3]. In 9E learning cycle model, four sources of self-efficacy were trained.

3.2. Motivation Questionnaire

The motivation questionnaire was filled by 36 students of grade XI-6. This process was aimed to find the increase of students' motivation. The following was the data of students' motivation in the form of graphic. Based on the graphic above, the students' motivation before the learning process is 30.56 and after the learning process is 75.17. The score reflected the increase of motivation. As shown in Figure 2, the raise is 0.65 in average.

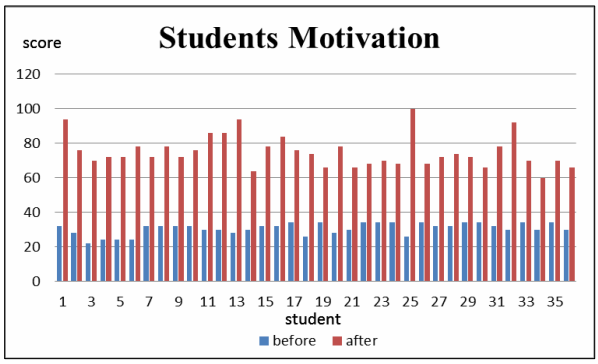

Figure 2. Students motivation before and after learning process

The result of motivation questionnaire analysis was used to support self-efficacy improvement. Based on the score of students' motivation, it can be explained that students' motivation increase during learning activities (Fig 2). Before learning activities using 9E learning cycle model, the average score is 30.56 with low category and after the treatment the score is 75.15 with high category. The score was calculated using *n*-gain and indicated the increase 0.65 with medium category. Self-efficacy had an important role in shaping motivation of someone [3]. Self-efficacy has a huge correlation with motivation, academic choice, changes, and achievement [14]. In addition, motivation is part of activation self-efficacy [3].

3.3. Learning Outcomes Analysis

The increase of the student self-efficacy was expected to increase the result of learning outcomes as well. The knowledge ability test (pretest) was proposed before the treatment and the posttest was given after the learning process. Figure 3 showed the result of analytic test of 36 XI-6 students in the form of graphic.

Students got higher score in post-test than pretest. Raise of score proven the effectiveness of 9E Learning cycle model in increasing the result. The increase was in the aspect of knowledge and accumulated using *n*–gain. The average score of rising is 0.75 with high category. Before the pretest done, there is 97.2% complete. After the post-test done, a very significant raise gained.

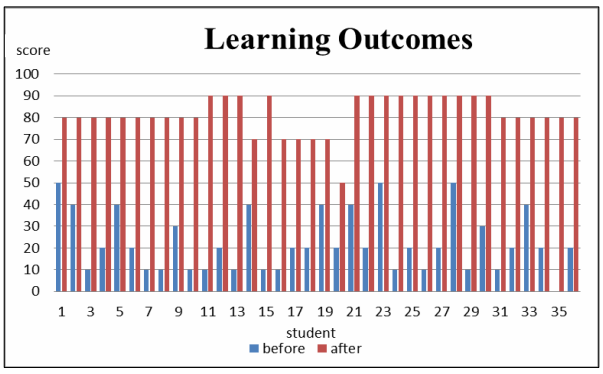

Figure 3. Learning outcomes before and after learning process

Cognitive aspect on learning process was aimed to know the students' understanding on subject. For this research, pretest was done in the first meeting and post-test was conducted in the third meeting after the treatment using 9E Learning Cycle model on the material of acid base. Based on learning outcomes analysis, score of pretest and post-test were calculated using *n*-gain. The score is 0.75 with high category [13]. The *n*-gain of learning result showed that 9E learning cycle model could effectively develop self-efficacy in cognitive aspect. Cognitive process was needed in shaping a strong self-efficacy dealing with the situation of analytic thinking of doing right action [3] and can increase students learning outcomes significantly [15]. In addition, 9E learning cycle model required students to observe, classify, analyze, conclude, and communicate the results of the experiments, which is impacts on learning outcomes [10].

4. CONCLUSION

By using 9E learning cycle model, applied to students in SMAN 7 Surabaya showed there is the increase of self-efficacy, motivation, and learning outcomes for them. Therefore, development of teaching materials can increase students' self-efficacy and the learning outcomes. However, be careful with time management and teacher must prepare all of the materials very well.

ACKNOWLEDGMENTS

We say thanks to the headmaster of SMAN 7 Surabaya, Indonesia, for the facilities provided to research activities.

REFERENCES

[1] M. Jamaldini, "The causal relationship of self efficacy. self-concept, and attitude towords mathematics with academic achievement in mathematics by meditation of approaches to learning," *Int. J. Rev. Life Sci*., vol. 5, 2015.

[2] Firdaus, "An Implementation of 7E learning cycle model to improve student self-esteem. international conference on mathematics and science education," *J. Phys.: Conf. Series*, vol. 895, 012084, 2017.

[3] A. Bandura, "Social cognitive theory: an agentic perspective," *Ann, Rev. Psych*., vol. 52, 2001.

[4] H. Sarac, "The effect of learning cycle models on achievement of students: a meta-analysis study," *Int. J. Edu. Method*., vol. 4, 2018.

[5] I.N. Suardana, "Students' critical thinking skills in chemistry learning using local culture-based 7E learning cycle model," *Int. J. Instruct*., vol. 11, 2018.

[6] I. Sayuti, "Penerapan model pembelajaran learning cycle 5E untuk meningkatkan sikap ilmiah dan hasil belajar biologi siswa kelas XI IPA 4 SMA Negeri 5 Pekanbaru," *Jurnal pendidikan*, vol 3, 2012.

[7] Y. Suleyman, "Effects of learning cycle models on science success: a meta-analysis," *J. Baltic Sci. Edu*., vol. 17, 2018.

[8] Moussiaux and Norman, "Constructivist teaching practices: perceptions of teachers and students," 2003.

[9] A. Eisenkraft, "Expanding the 5E model: a proposed 7E model emphasizes: transfer of learning and the importance of eliciting prior understanding," *The Science Teacher*, vol. 70, 2003.

[10] P. Kaur, and A. Gakhar, "9E model and e-learning methodologies for the optimisation of teaching and learning," *Innovation and Technology in Education (MITE), IEEE International Conference*, 2014.

[11] S. Thiagarajan, D. Semmel, *Instructional Development for Training Teachers of Expectional Children*. Minneapolis: University of Minnesota, 1974.

[12] S. Arikunto, *Penilaian Program Pendidikan Edisi III*. Jakarta: Bina Aksara, 1997.

[13] R.R. Hake, *American Educational Research Association's Division D, Measurement and Research Methodology: Analyzing Change/Gain Scores*. USA: Woodland Hills, 1999.

[14] F. Pajaes, "Self-efficacy beliefs in academic settings," *Rev. Edu. Res*., vol. 66, 1996.

[15] Y. Sumiyati, "Penerapan model learning cycle 7E untuk meningkatkan hasil belajar siswa pada materi daur air." *Jurnal Pena Ilmiah*, vol. 1, 2016.