The Effect of STEM-Based Learning in Lesson Study to Improve Students Learning Outcomes under Chemical Equipment Material

Desri Wati, Budhi Oktavia*, Yerimadesi

Masters in Chemical Education, Faculty of Mathematics and Natural Sciences (FMIPA)
Padang State Universuty

Abstract – STEM-based learning is an interdisciplinary approach to learning in which students use science, technology, engineering and mathematics. Lesson Study is a method used to evaluate the learning process that has been done in class so that the learning process experiences changes and improvements in the future. This research is a quantitative study that aims to determine the effect of the implementation of STEM-based learning through lesson study activities on student learning outcomes in chemical equilibrium material.This research was conducted in November at SMA Negeri 5 Padang with 30 research subjects. The implementation of STEM-based learning in lesson study activities is carried out on the Chemical Equilibrium material with the stages of plan, do and see. At each stage improvements and improvements in the learning process have been carried out. The research data was taken using an observation sheet instrument and cognitive learning test results.Based on data analysis, the average lesson study implementation was 87 who were very well qualified. This means that the implementation of STEM-based learning through lesson study activities in chemistry learning can improve student learning outcomes with the results of the t-test is 0.031.

Keywords – STEM, Lesson Study, Learning Outcomes, Chemical Equilibrium.

I. INTRODUCTION

The world is entering the era of the industrial revolution 4.0 which is called the 21st century challenge. The era of the industrial revolution 4.0 requires human resources that do not only rely on technical abilities but must master the ability of science, technology, solve problems, collaborate and be able to think critically [1].One way that can be taken in dealing with 21st century challenges is through improving the quality of education. To improve the quality of education can be developed through the implementation of educational reforms [2].

Educational reform is a change that occurs in traditional learning towards learning that further enhances students thinking power [3]. One form of educational reform can be done by improving the quality of human resources through education by implementing STEM-based learning through well-designed lesson studies so that teachers become professional and innovative [4].This STEM based learning can be implemented in several subjects, one of them is Chemistry. Chemistry is the study of changes in matter and energy, structure, structure, properties, natural phenomena and mechanisms that occur therein. More simply can be said that chemistry is closely related to everyday life [5].

One of the chemicals studied in high school is chemical equilibrium. The characteristics of chemical equilibrium material emphasize concepts and calculations. Based on the results of an interview with one of the chemistry teachers at SMA Negeri 5 Padang, information was obtained that students had difficulty in understanding chemical

equilibrium material which was marked by the average acquisition of students learning outcomes for chemical equilibrium material at 64.83. Learning outcomes obtained by students are still below the KKM standard (Minimum Mastery Criteria), which is 78.

Basically, learning outcomes are closely related to the learning process. If the learning process is carried out optimally, the learning outcomes will also be optimal [6].The learning process undertaken by the teacher greatly affects the learning outcomes of students. Therefore we need an evaluation of the learning process that has been done so far so that it can be seen again the performance of teachers in conducting the learning process. One way that can be done to see the learning process is through lesson study [7].

II. LITERATURE REVIEW

STEM education provides practical reinforcement in developing approaches that integrate science, technology, engineering, and mathematics [8]. STEM-based learning focuses students on solving real problems in daily life or professional fields [9].

Lesson Study is a process to continuously improve the quality of learning to improve the learning process that has been done [10]. Lesson study was first developed in the basic education system in Japan which aims to make the teaching and learning process better and more effective.In the implementation of lesson studies involving a group of teachers to discuss the teaching and learning process that will be applied in the classroom, observing the teaching and learning process and reflecting on the learning conducted [11].

In the implementation of lesson studies there are 3 stages namely, Planning (Plan), implementation phase (Do), observation and reflection stage (See) [12]. At the plan stage the model teacher plans learning and the observer provides input, the do model teacher stages the learning then the observer observes the learning process and the collaborative see stage the model teacher and observer reflect the

effectiveness of learning and mutual learning with the principle of collegiality.

III. METHODOLOGY

The research conducted is a quantitative study conducted in November 2019 at SMA Negeri 5 Padang.The research subjects were 30 class XI MIPA 2 students.The implementation of STEM-based learning in lesson study activities is carried out on chemical equilibrium material.The instrument used in this study consisted of observation sheets and learning outcomes tests. The research design can be seen in Table 1.

Table 1. Pretest-posttest group research design

O_1	X	O_2
Pre-test	STEM based learning in lesson study	Post-test

Information:

O_1: pretest before the treatment is given
O_2:final test (posttest) after treatment is given
X: the treatment of the experimental group is by implementing STEM-based learning in teacher lesson study activities.

IV. RESULT AND DISCUSSION

A. Result

The results' of this study were drawn from the results of the observation sheet and the learning outcomes of students 'conducted in the XI MIPA 2 class of SMA N 5 Padang. The results of the lessons study were observed using an observation'format'consisting'off28questions as follows: stage plan 6 items, stage do 15 items and stage see 7 items. The quality of STEM-based learning in lesson study is seen from the percentage of observers who give positive responses sat each stage of lesson study. Based on the results of research on the implementation of lesson study on these three aspects can be seen in Table 2.

Table 2. Percentage of Observer Providing Positive Responses to STEM-Based Learning in Lesson Study

Step	Percentage of Observer That Provides Positive Response	Qualification
Plan	91	Verry Good
Do	84	Good
See	86	Verry Good
Average	87	Verry Good

Student learning outcomes in the chemical equilibrium material can be seen in Table 3.

Table 3. Description of Cognitive Competency Values

No	Pretest	Posttest	N-gain
Average	23.5	81.17	0.75

To determine the effect of the application of STEM-based learning through lesson study activities on chemical equilibrium material to improve student learning outcomes is done by hypothesis testing. This test is used to determine the difference in the average value before being given treatment (Pretest) with the average value after being given treatment (Postest).Before conducting the hypothesis test, normality tests are performed on the sample class to determine the average value of learning outcomes of the sample class. After the normality test is obtained, the sample class is normally distributed, where the significance value is> 0.05.Then a t-test is conducted to see the effect of STEM-based learning through lesson study activities on student learning outcomes. The following data on the results of hypothesis testing for student learning outcomes can be seen in Table 4.

Table 4. Paired Sampled T-Test Results for Students Cognitive Competencies

		Paired Differences					T	Df	Sig.
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				(2-tailed)
					Lower	Upper			
Pair 1	Pretest-Postest	-57.67	7.39	1.35	-60.43	-54.90	-42.70	29	.031

If the significance value> 0.05 then H_o is accepted and if the significant value <0.05 then H_o is rejected. The decision rejected by H_o means that there is no influence on the learning outcomes of students using STEM-based learning implementation through lesson study activities in learning chemistry. Decisions received by H_o mean that there is an influence on the learning outcomes of students using STEM-based learning implementation through lesson study activities.In the study showed that the significance <0.05, which means that H_o is rejected, it shows that there is an effect of the implementation of STEM-based learning through lesson study activities in chemistry learning for student learning outcomes.

B. Discussion

The positive impact of the results of STEM-based learning research through lesson study activities states that the learning outcomes of students are much better than before the study.Student learning outcomes here means the cognitive competence of students in terms of cognitive aspects. Based on research data, it is explained that this activity has been able to improve student learning outcomes.

Student learning achievement in STEM-based learning through lesson study activities can improve student learning outcomes for the better and achieve KKM.STEM-based learning in lesson study activities have contributed to improving the quality of learning.The positive impact of STEM-based learning through lesson study on student learning outcomes is caused because teachers can evaluate learning that has been done in class.From the evaluation conducted, the teacher can improve the learning process in the form of teaching methods, choose the appropriate method and model to use so that the next learning process has improved and become even better.The involvement of students who are active in learning activities also has an impact on students understanding of the material being studied.Students can explore the information that has been obtained through learning experiences facilitated by the teacher.Students are able to think critically, collaborate, and be actively involved in group discussions. This is supported by the results of research conducted by NailulKhoiriyah (2018) stating that the implementation of the STEM learning approach can improve student learning outcomes from the University of Lampung.DewiRobiatun (2017) in her

research also stated that there is an effect of STEM-based learning on improving student learning outcomes.

V. CONCLUSION

In the implementation of STEM-based learning through lesson study there is an influence that can be seen from the percentage of observers who gave positive responses at each stage of lesson study with 87 grades with very good qualifications. Therefore student learning outcomes have also increased with STEM-based learning through lesson study activities. This can be seen from the normalized gain value of 0.74 which is highly qualified.

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