

Comparing Lab-Work Learning Assisted with Vee Diagram and Lecturing-Demonstration in Improving Students Learning Motivation and Outcomes on Buffer Solution Topic

Ardian Trio Wicaksono^{1)*}, Subandi²⁾, Siti Marfu'ah²⁾

¹⁾Tadris Kimia–Universitas Islam Negeri Antasari

²⁾Chemistry Education–Universitas Negeri Malang

Jl. Ahmad Yani Km. 4,5 Komp. IAIN Antasari Banjarmasin 70235, Indonesia

E-mail: ardian_wicaksono88@yahoo.com *

Abstract: This study aims at confirming and proving the comparison of two learning method, lecturing-demonstration and lab-work assisted with Vee Diagram, in buffer solution topic to students' learning motivation and learning outcomes. This study is a quasi-experiment with balanced control group design. The subject of this study was XI Graders of IPA 1 and IPA 3. The results of this study indicate that lab-work learning assisted with Vee Diagram could motivate more the students as well as generating students high-order thinking skills than lecturing-demonstration learning method.

Key Words: lecturing-demonstration, lab-work assisted with Vee Diagram, motivation, learning outcomes, buffer solution topic

Abstrak: Tujuan penelitian ini adalah untuk mengetahui perbandingan keefektifan pembelajaran larutan penyangga menggunakan ceramah demonstrasi dan praktikum berbantuan Diagram Vee terhadap motivasi dan hasil belajar siswa. Penelitian ini merupakan *quasi experiment* dengan *balanced control group design*. Subjek penelitian adalah siswa kelas XI IPA 1 dan IPA 3. Hasil penelitian menunjukkan bahwa pembelajaran larutan penyangga menggunakan praktikum berbantuan Diagram Vee lebih memotivasi siswa dibandingkan dengan pembelajaran ceramah demonstrasi, dan praktikum berbantuan diagram Vee menghasilkan kemampuan berpikir tingkat tinggi yang lebih baik.

Kata kunci: ceramah demonstrasi, praktikum berbantuan diagram Vee, motivasi, hasil belajar, topik larutan penyangga

INTRODUCTION

There are numerous typical problems in learning chemistry in high school. In chemistry learning, the object is abstract and highly contextual and requires multiple approaches simultaneously in learning. In interviews with the chemistry teacher in a Senior High School in East Java, it is known that there are some problems in chemistry learning, namely: (1) lab-work rarely done because of the limitations of the equipment and materials, (2) in 2012 only 14% of students at each grade XI really reach KKM (Minimum Mastery Standard) for buffer solution topic, and (3) during the measurement of student learning outcomes using only the questions of type C3.

The limitation of lab-work instrument and material could be resolved by employing demonstration learning method. By employing demonstration learning model, it promotes an interesting learning process since it allows students to not only listen to the explanation, but also allows students to directly observe the practice conducted by the teacher. In addition to demonstration learning method, there is another alternative method that can be used to support the learning called Vee Diagram. The utilization of Vee Diagram in learning could solve several issues related to Chemistry Learning in high school. It is because the phases in Vee Diagram allow students to develop metacognitive thinking strategy, learn worthwhile and meaningful information, establish conceptual structure, and reduce students'

misunderstanding on the learned topic (Passmore, 1998).

Based on the aforementioned explanation of the problem, it requires conducting a research using lectures and practical demonstrations assisted with Vee Diagram in order to increase motivation and student learning outcomes. Therefore, the purpose of this research is to determine: (1) the effectiveness of the learning of the buffer solution using a lecture demonstration and assisted with Vee Diagram on the students' motivation, and (2) the effectiveness of the learning of the buffer solution using a lecture demonstration and assisted with Vee Diagram on the students' learning outcomes.

METHOD

This research was posttest only comparative group design. The subject of this research was 38 students of XI IPA Class Academic Year 2013/2014 which were divided into two classes. One class con-

sisted of 19 students. One class was given a lecture-demonstration learning method and one other class was given lab-work learning assisted with Vee Diagram. The data obtained within this research was comprise of students learning motivation which was collected by using questionnaire learning motivation developed by Ramahlape (2004) and Demirtas (2006) and students' learning outcomes score by using multiple choices test consisted of seven items with the content validity of 91.7% and the reliability coefficient which was calculated using Spearman-Brown, amounted to 0.69. The data obtained were analyzed using ANOVA.

RESULTS AND DISCUSSION

First, the results of this study are regarding the students' learning motivation score on buffer solution topic. According to the results of learning motivation questionnaire, it obtained gain score of students' learning motivation which is presented in Table 1. The results indicated that the average score of students' learning

Table 1. Average Score of Students' Learning Motivation

No	Questions		Average Score	
	Control Class	Experiment Class	Control Class	Experiment Class
1	Has ever use lecturing-demonstration learning	Has ever use lab-work assisted with Vee Diagram	28.9	25.0
2	Understand the difference between lecturing-demonstration and lab-work assisted with Vee Diagram	Understand the difference between lecturing-demonstration and lab-work assisted with Vee Diagram	27.6	39.5
3	Understand the assignment and responsibility in the lecturing-demonstration learning method	Understand the assignment and responsibility in lab-work assisted with Vee Diagram learning method	47.4	90.8
4	The stages you favor the most in the lecturing-demonstration learning method	The stages you favor the most in lab-work assisted with Vee Diagram learning method	68.1	80.3
5	The stages you dislike the most in the lecturing-demonstration learning method	The stages you dislike the most in lab-work assisted with Vee Diagram learning method	63.2	86.8
6	Benefits of lecturing-demonstration learning method	Benefits of lab-work assisted with Vee Diagram learning method	72.4	80.3
7	The urge in using a lecturing-demonstration learning method	The urge in using lab-work method assisted with Vee Diagram learning method	47.4	59.2
8	Observing each skill process in the lecturing-demonstration learning method	Observing each skill process in lab-work assisted with Vee Diagram learning method	46.1	52.6
9	The opinion regarding lecturing-demonstration learning method contribution to the science development	The opinion regarding lab-work method assisted with Vee Diagram learning method contribution to the science development	67.1	77.6
Average Score			52.0	65.8

motivation on experiment class is better than control class, it obtained respectively 65.8 and 52.0. These results indicate that the learning of the buffer solution employing lab-work assisted with Vee influences students' motivation.

In addition, it showed that the learning in experiment class on buffer solution topic was effective since it employed lab-work learning method assisted with Vee Diagram. Learning process through lab-work allows students to actively participate in observing the studied phenomenon in the classroom and thus students will obtain new information and it will last longer in their mind. White (1996) argues that individual experience will generate a memory of the event, a depiction of experience which has a long-term effect. Krischner (1992) explains that lab-work learning basically has three elemental reasons to be conducted: (1) it allows to develop the particular ability, (2) it serves as appropriate channel of learning employing academic approach, and (3) it provides direct experience to students in observing a certain phenomenon and its implementation.

On the other hand, different from experiment class, control class was taught by lecturing-demonstration learning method. The learning method given presumably influences the learning motivation of students, and therefore, the learning motivation of students in control class is lower than experiment class. Further, it presumably because lecturing-demonstration learning method provides a limited chance to students to do direct observation. In addition, it only allows the student to put attention to the process explained without direct practices (Depdiknas, 2008).

Students' learning motivation could be revealed further from students' answer on the given questionnaire. According to Table 1, it is clearly stated that experiment class learning motivation is higher than control class. It further indicates that lab-work learning method assisted by Vee Diagram influences students' learning motivation.

According to Table 1, it also clearly stated that students' learning motivation score average on question item 1 and 2 have no significant difference between control and experiment class. It presumably because students have never done Chemistry Learning employing constructivist approach, in this case lab-work learning method assisted with Vee Diagram. Therefore, students could not differentiate between lecturing-demonstration learning method and lab-work learning method assisted with Vee Diagram.

Meanwhile, when it comes to the items number 3, the results are significantly different between control and experiment class. It presumably because on experiment class was taught by employing lab-work learning method assisted with Vee Diagram and it allowed students to conduct lab-work individually and it influences students' learning motivation. The following Table 2 presents students' learning motivation score in both experiment and control class.

Lab-work activity assisted with Vee Diagram which influenced on students' learning motivation is in line and relevant to the results of a study conducted by Tekes and Gönen (2012). They conclude that Vee Diagram could be used to motivate and encourage students to be cooperative in group work. Meanwhile, in control class, the learning was only conducted by employing lecturing-demonstration which was represented by the teacher and only two students. As a result, the rest of the students could not the lab-work independently by themselves. It is presumably the reason for the low score of students' learning motivation in control class. Depdiknas (2008) explains that if the demonstrator possesses no sufficient ability in communicating, the demonstration will be boring and students will not be a focus on the learning process.

The average score of students' learning motivation on questions number 4 and 5 are significantly different between control class and experiment class. It because most of the students in experiment class preferred the entire phases of learning within lab-work method assisted by Vee Diagram which is able to train the student in learning and communicating with their peers. This is in line with the results revealed by Luft, Tollefson, and Roehrig (2001). They explain that the phases of lab-work assisted with Vee Diagram allows students to enhance their communication skill and promotes communal learning among students. In control class, most of the students only preferred certain learning phases. Thus, it makes students' learning motivation in control class is low.

The average score of student motivation in question 6-9 between control class and experimental class did not differ significantly. This is because most of the students in both classes declare that: (1) lab-work assisted with Vee Diagram or lecturing-demonstration is helpful in a learning process, only a few students who stated that lab-work assisted with Vee Diagram and lecturing-demonstration are very useful in a learning process; (2) there is a possibility for them to use lab-work assisted with Vee Diagram or lecture-dem-

Table 2. Students' Score in Solving Buffer Solution Items

No	Remarks	Class	
		Control	Experiment
1.	Total number of students	19	19
2.	Average Score of Students' Learning Outcomes	58.5	70.2
3.	Average Score of Students' Learning Outcomes in C3 question items	86.6	81.1
4.	Average Score of Students' Learning Outcomes in C4 and C5 question items	30.4	59.3

Remarks:

C3 deals with application ability, moderate level

C4 deals with analysis ability, difficult level

C4 deals with evaluation ability, difficult level

onstrations on other topics; (3) by only looking at peer demonstration using lab-work assisted with Vee Diagram and lecturing-demonstration it enhances students' thinking skills (critical thinking, creative thinking, problem-solving), social aspects (participation, interaction, taking over responsibility, cooperation); and (4) lab-work assisted with Vee Diagram and lecturing-demonstration contribute to education, only a few students who stated that lab-work assisted with Vee Diagram and lecturing-demonstration greatly contribute to education.

The subsequent research results are in the form of student learning outcomes in the material buffer solution. The overall average score of student learning outcomes, the average score of student learning outcomes in type C3 items, and the average score of student learning outcomes in type C4 and C5 items can be seen in Table 2.

Based on Table 2, it is known that the average score of student learning outcomes of experiment class is better than the control class, with the score respectively 70.2 and 58.5; which indicates that the learning of the buffer solution using lab-work assisted with Vee Diagram influence the ability of students in solving buffer solution. In general, the average score of student learning outcomes in experiment class is better than the control class. It is allegedly because in the experiment class the learning was done by using lab-work assisted with Vee Diagram which consists of several stages. Therefore, students can understand the material being taught. The results are consistent with the results of research Lebowitz (1998) which states that the use of Vee Diagram make students understand the material and topic better. Unlike the experiment class, the control class learning is done by using a lecture-demonstration which also consists of several stages, but these stages only help students in the process of linking the theory that has been accepted by the phenomenon that occurred during the demonstra-

tion (verification). Susiwi (2003) states that the chemistry lab and demonstration performed by the teacher generally aims to verify. Learning which is done in a way that is informative or practical verification could result in a slower student's intellectual development.

According to Table 2, it also indicates that the students' learning outcomes average score using question items type C3 in experiment class is lower than control class, with the score respectively 81.1 and 86.6. it further means that lab-work assisted with Vee Diagram did not contribute significantly to students' ability in solving fair question items. Both lecturing-demonstration and lab-work assisted with Vee Diagram did not effective in enhancing students' learning outcome since at the beginning up to now students in SMAN 1 Grati are only given a conventional learning method and only use exam question items of C1 and C3. As a result, students did not encounter a difficulty in answering all items within the test or examination which comprises of the implementation of the certain formula of the principle of material. This is relevant with Anderson and Kratwholl (2001) who explain that C3 question items deal with thinking process stages which measures students' ability to choose or use appropriately certain formula, method, concept, principle, law, or theory in a new situation. In addition, Anderson and Kratwholl (2001) also state that C3 question items are lower than C4 question items which deal with analysis.

In addition, according to Table 2 it also presents the average score of students' learning outcomes in answering C4 and C5 question items. In experiment class the results are higher than control class with the score respectively 59.3 and 30.4. It confirms that lab-work method assisted with Vee Diagram influences students' ability in solving difficult question items. Additionally, the effectiveness of learning in experiment class due to cognitive processes in the learning method which help students in constructing their cognitive

processes. This result is relevant with the results discovered by Alvares and Risko (2007) which state that Vee Diagram helps students in the process of students' metacognitive to generate an explicit relationship between the initial knowledge they obtained and the new one.

CONCLUSION

The results of this study indicate that within buffer solution topic learning which employs lab-work learning assisted with Vee Diagram motivates students more than lecturing-demonstration. Further, such lab-work learning assisted with Vee Diagram generates better high-order thinking skill among students.

According to the aforementioned explanation of results and discussion, several suggestions can be made as follows: (1) it requires further study to examine the learning method in other Chemistry topics, and (2) considering that lab-work learning assisted with Vee Diagram provides better improvement to the students, this is should be taken into account by Chemistry teacher in other topics.

REFERENCES

- Alvarez, M. C., & Risko, V. J. (2007). *The Use Of Vee Diagrams With Third Graders As A Metacognitive Tool For Learning Science Concepts*. Retrieved from <http://e-research.tnstate.edu/pres/5>.
- Anderson, Lorin W. & Krathwohl, David R. (2001). *A Taxonomy for Learning, Teaching and Assessing: a Revision of Bloom's Taxonomy*. New York: Longman Publishing.
- Depdiknas. (2008). *Strategi Pembelajaran dan Pemilihannya*. Jakarta: Departemen Pendidikan Nasional.
- Krischmer, P. A. (1992). Epistemologi, Practical Work and Academic Skill in Science Education. *Science Education, 1*, 273–299.
- Lebowitz, S. J. (1998, April). Use of Vee Maps in a College Science Laboratory. In *Annual Meeting of the National Association for Research in Science Teaching*, Sandiego.
- Luft, J. A., Tollefson, S. J., & Roehrig, G. H. (2001). Using an alternative report format in undergraduate hydrology laboratories. *Journal of Geoscience Education, 49*(5), 454–460.
- Passmore, G. (1998). Using Vee Diagrams to facilitate meaningful learning and misconception. *Radiological Science and Education, 4*(1), 11–28.
- Ramahlape, K. (2004). *Effect of Vee-diagramming on grade 10 township learners understanding of some electrical concepts* (Unpublished doctoral dissertation). University of the Western Cape, South Africa.
- Susiwi. (2003). *Laporan Program Pengalaman Lapangan di SMU, Laporan Kegiatan Dosen Tetap PPL Kependidikan*. Jurusan Pendidikan Kimia: FPMIPA UPI.
- Tekes, H., & Gonen, S. (2012). Influence of V-diagrams on 10th grade Turkish students' achievement in the subject of mechanical waves. *Science Education International, 23*(3), 268–285.
- White, R. T. (1996). The link between the laboratory and learning. *International Journal of Science Education, 18*(7), 761–774.