



Application of Flipped Classroom to Improve Learning Outcomes in Redox Reaction Lesson

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Abstract

The present study assesses the effectiveness of the flipped classroom learning model in enhancing the learning outcomes of 10th-grade students in the subject of redox reaction concepts. A quasi-experimental design was employed using a one-group pretest-posttest approach. The samples of 20 students were selected through purposive sampling. Data were collected through learning outcome tests, performance assessments on worksheets (LKPD), learning performance observations, and response questionnaires. Descriptive analysis and N-Gain techniques were used to analyze the data. The results of the study indicate that the flipped classroom learning model had a positive effect on the students' learning outcomes, as reflected by an average N-Gain of 0.56 and 0.62 with a medium criteria in the first and second meetings, respectively. The students' performance on LKPD showed an average percentage of 91.5% and 97.5% categorized as excellent in the first and second meetings, respectively. Observations showed that the students' learning performance improved by 51% (first) to 78% on the second meeting. The students' responses to the application of the flipped classroom learning model were positive, with an average percentage of 72.1%. The findings of this study suggest that the flipped classroom learning model can be an effective alternative learning model, particularly in the teaching of redox reaction concept material.

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INTRODUCTION

The learning process is a dynamic interaction between the teacher, the student, the subject matter, and the learning environment (Pane & Dasopang, 2017). A key outcome of this process is the learning result, or the learning outcome. Studies conducted in several countries have shown that students often struggle with science subjects, particularly chemistry and physics, due to their abstract concepts and calculations (Ristiyani & Bahriah, 2016). The nature of chemistry can negatively impact students' achievement in the subject, particularly in the topic of redox reactions. Research by Haryani et al. (2014) showed that redox reactions are considered a difficult material for 10th-grade chemistry students. This is supported by findings from studies conducted by Rezeki et al. (2015), Sulalah and Anis (2017), and interviews with high school chemistry teachers in Yogyakarta, which all indicated that students face difficulties in understanding the concepts of redox reactions, including the changes in oxidation states, oxidizers and reductors, and oxidation states.

External factors, particularly the teacher's approach, play a significant role in determining students' success in learning (Yakina et al., 2017). The selection of an appropriate learning model can greatly influence a teacher's ability to effectively deliver material (Utami & Hasanah, 2019). The use of an incorrect learning model can hinder students from achieving

better learning outcomes. A good learning model should actively engage students in the learning process. The flipped classroom learning model is an example of such a model, where students are provided with learning materials, such as videos or modules, before class, and participate in hands-on activities during class. This model is particularly relevant in the current Covid-19 pandemic, as it allows for creative and engaging learning experiences while maintaining social distancing protocols.

The flipped classroom model has the potential to address the challenges faced by teachers in choosing the right learning model during a time where face-to-face instruction is not possible. The effectiveness of this model is influenced by students' ability to understand and retain the material they are exposed to. By providing students with additional time to learn, the flipped classroom model can help deepen their understanding of the subject matter, making it especially beneficial for difficult topics such as redox reactions (Rusnawati, 2020).

Therefore, teachers have a responsibility to help students overcome their learning difficulties by choosing an appropriate learning model that supports student engagement and maximizes learning outcomes. This study aims to investigate the impact of the flipped classroom learning model on the learning outcomes of 10th-grade students in the topic of redox reactions. The study was conducted using a quasi-experiment with a one-group pretest-posttest design, and data was collected through learning outcome tests, performance assessments on worksheets (LKPD), learning performance observations, and response questionnaires. The sample was determined through purposive sampling and involved 20 students. The data was analyzed descriptively using percentage and n-Gain techniques.

METHOD

The research design used in this study was a quantitative quasi-experimental design with a one-group pre-test post-test design (Wardani, 2013). The study was conducted in a 10th-grade science class at a high school (SMA) in Yogyakarta, Indonesia. A purposive sampling technique was used to select the sample, with the consideration being students who were willing to participate in the study from start to finish and complete all the necessary research instruments. The sample consisted of 20 10th-grade science students from a high school in Yogyakarta.

Data was collected using a combination of testing the learning outcomes, performance appraisal using worksheet (LKPD), a questionnaire, and observation sheets. The data were analyzed using percentage and n-gain techniques and were categorized according to the results. The design of the study can be described as follows.



Note:

- L_1 = Pretest performance before flipped classroom
- L_2 = Posttest performance after flipped classroom
- X = Flipped classroom method of learning application

RESULTS AND DISCUSSION

The results of the study show that the implementation of the flipped classroom approach to the teaching of redox reaction concepts had a significant effect on the students' learning outcomes. This is evidenced by the analysis of the pretest, posttest, and LKPD performance assessments.

The N-Gain classification of the learners, as shown in Figure 1, demonstrates an improvement in the students' performance from the first to the second encounter.

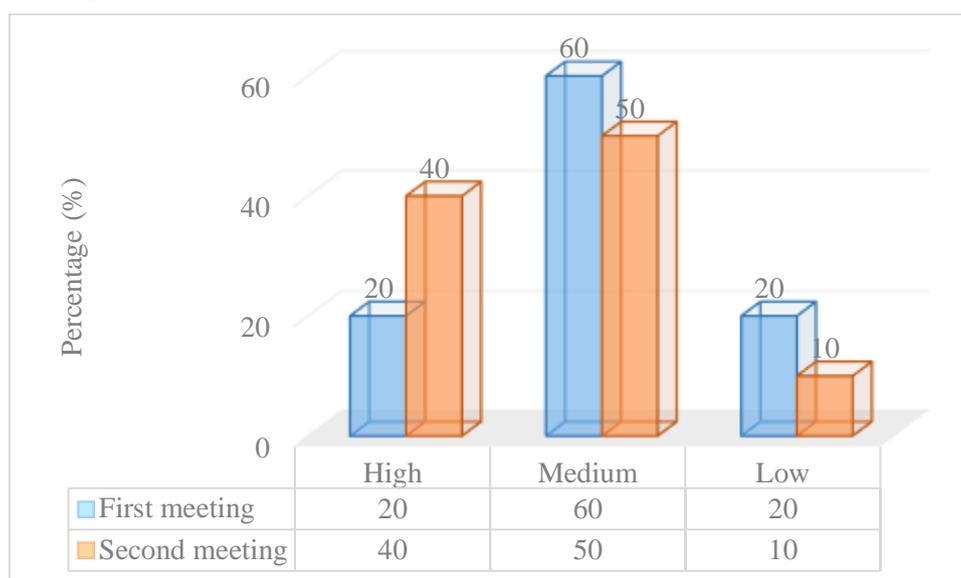


Figure 1. Number of students based on N-Gain criteria on lesson meeting.

In the first encounter, 20% of the students (4 out of 20) had N-Gain scores that fell in the high criteria category, while in the second encounter, the number increased to 40% (8 out of 20). In the medium criteria category, 60% of the students (12 out of 20) fell in the first encounter, while in the second encounter, this number reduced to 50% (10 out of 20). Similarly, the number of students with low N-Gain scores decreased from 20% (4 out of 20) in the first encounter to 10% (2 out of 20) in the second encounter. These results suggest that the flipped classroom approach was more effective in the second encounter, as evidenced by an increase in the number of students with high N-Gain scores and a decrease in the number of students with low N-Gain scores.

The low N-Gain scores of some students were found to be a result of two factors: insignificant differences in the pretest and posttest scores and low scores in both pretest and posttest. This is consistent with Dwiantara and Masi (2016), who stated that low N-Gain occurs when the pretest and posttest scores have no significant difference. This could be due to poor understanding of the material and the fact that students did not achieve optimal results in the pretest and posttest. The results of the group discussion analysts in the form of LKPD assessment are presented in Table 1.

Table 1. Analysis result of LKPD assessment

Students group	Lesson 1		Lesson 2	
	%	Criteria	%	Criteria
Alkali group (B6, B9, B12, B19, B26)	98	excellent	98	excellent
Alkaline earth group (B5, B15, B20, B23, B24)	82	excellent	96	excellent
Halogen group (B2, B16, B17, B27, B28)	94	excellent	100	excellent
Noble gas group (B1, B7, B13, B14, B18)	92	excellent	96	excellent
Rata-rata	91,5	excellent	97,5	excellent

Table 1 presents the results of the group discussion assessments in the form of LKPD. The average percentage of the group discussion results was 94.5% in both the first and second encounters, which is considered excellent according to Nurpratiwi et al. (2015). This result suggests that group discussions allowed students to have a deeper understanding of the material being studied, resulting in improved learning outcomes. This finding is supported by Nurrohma

and Adistana (2021), who stated that learning through group collaboration leads to better understanding and improved outcomes. The increase in the average percentage of the group discussion results from 91.5% in the first encounter to 97.5% in the second encounter is evidence of this. The improvement can be attributed to the exchange of ideas and opinions among students during group discussions, which can lead to better learning outcomes, as stated by Putriyanti and Fensi (2017). The results of the analysis of the observation sheet of students are presented in Figure 2.

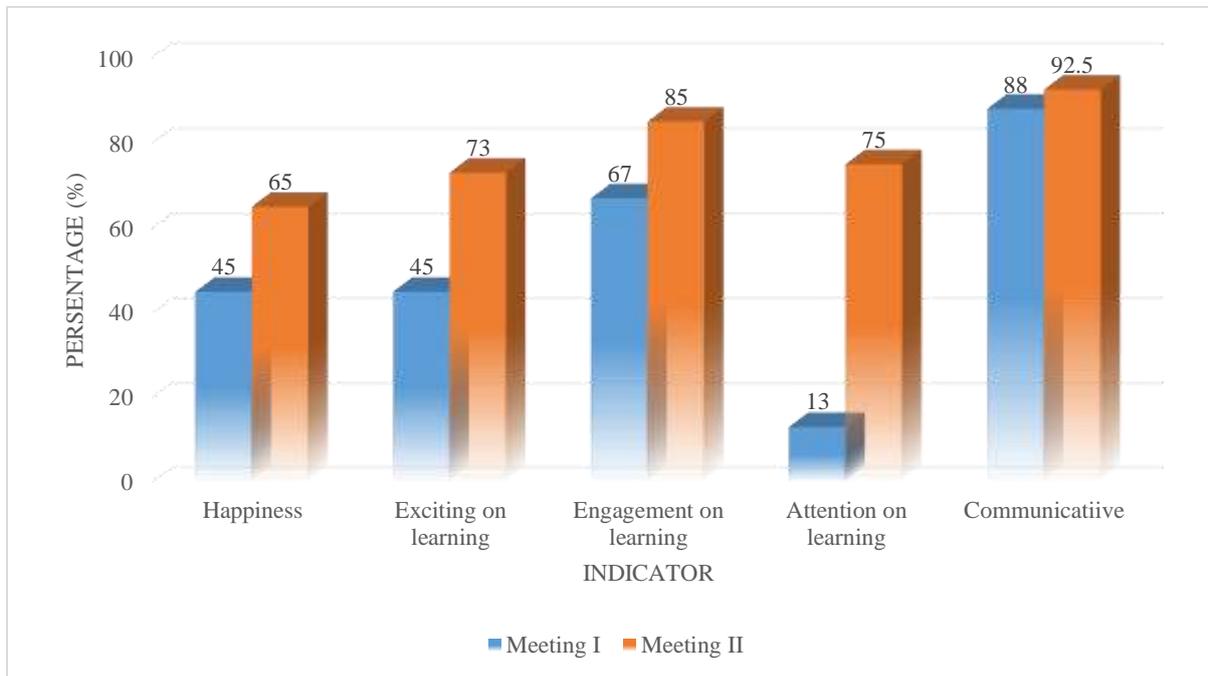


Figure 2. Students' learning performance based on observations.

The students' involvement in the learning process was measured using observation sheets, the results of which are presented in Figure 2. The analysis of the observation sheets showed an increasing trend in student involvement from the first to the second encounter, as evidenced by an increase in the average percentage of the observation sheet analysis results from 51% in the first encounter to 78% in the second encounter. This result is considered excellent according to Nurpratiwi et al. (2015).

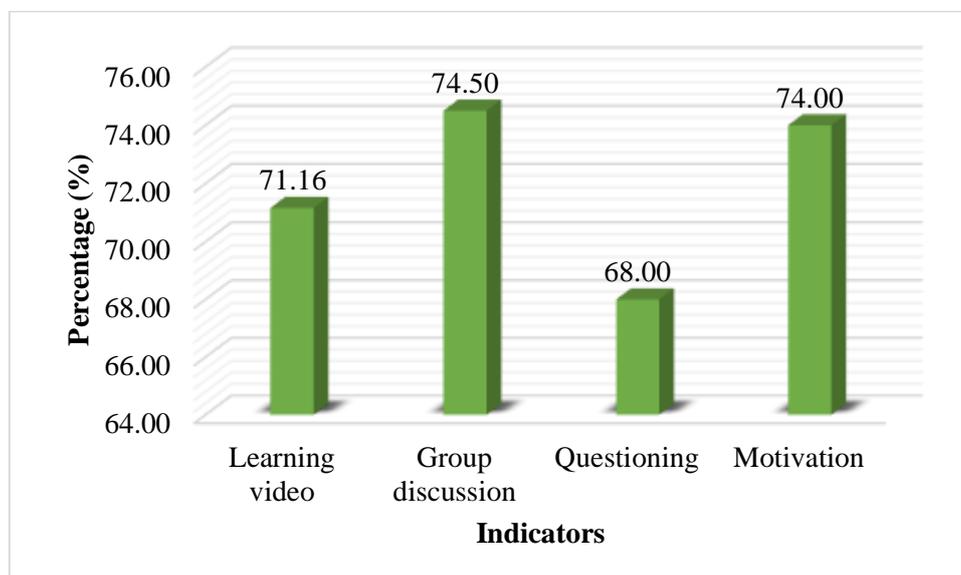


Figure 3. Students' respond to learning.

The students' response to the flipped classroom approach was measured using student response questionnaires (Figure 3). The average percentage for each aspect of 72.1% is included in the positive criteria (Nurpratiwi & et al, 2015). This percentage is a benchmark that the application of the flipped classroom learning model to the redox reaction concept material received a positive response from students. This is in line with the research conducted by Rusnawati (2020) which suggests that the application of flipped classroom learning to learning outcomes has received a positive response from students. Therefore, the flipped classroom learning model can be used as an alternative learning model to improve student learning outcomes, especially in the redox reaction concept material.

CONCLUSION

The flipped classroom learning model has an effect on student learning outcomes. This can be seen from the N-Gain at the first meeting of 0.56 and the N-gain in the second meeting of 0.62 which entered on the medium criteria. The results of the LKPD analysis for the first meeting of 91.5% and the second meeting of 97.5% were included in the excellent criteria. The application of flipped classroom learning to the redox reaction concept material received a positive response from students. This can be seen from the results of the questionnaire analysis which has an average percentage of 72.1% included in the positive criteria. The application of flipped classroom learning models to redox reaction concept materials can involve students very well in the learning process. This can be seen from the average percentage of observation results which is increasing with an average percentage of observation results of 51% entering on high criteria at the first meeting and 78% on excellent criteria at the second meeting.

RECOMMENDATIONS

The application of flipped classroom learning requires quotas and a stable internet network for students to participate in learning activities properly. Therefore, it is necessary to pay attention to the aspects of the internet network so that students can participate in learning activities both inside and outside the classroom properly. The application of the flipped classroom model to the redox reaction concept material can be combined with simple experiments that can be done independently at home by learners.

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