

LEARNING OF REACTION RATES MATERIALS WITH CURRICULAR STRUCTURING NESTED ASSISTED BY SCHOOLGY APPLICATION TO IMPROVE STUDENTS CRITICAL THINKING SKILLS AND LEARNING OUTCOME

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Abstract

This study aimed to evaluate the learning process of reaction rate materials with curricular structuring nested which the implementation of this learning that assisted by schoology applications. Evaluation of this learning was based on two variables, which were the improvement of students critical thinking skills and learning outcome in the reaction rate materials. The learning is designed and implemented using a scientific inquiry model. This study was pre-experimental and followed one group pretest-posttest design. The subjects of this study were 36 students of 10th grade at State of Senior High School 1 Manyar Gresik (SMAN 1 Manyar Gresik). The results showed that the learning of reaction rate materials with curricular structuring nested assisted by schoology applications was can be carried out with quality in the good to very good category to the lesson plan. Students critical thinking skills and learning outcome have increased significantly, but there were students who get posttest scores that not reached passing grade. This learning of reaction rate materials with curricular structuring nested assisted by schoology applications can be well received by students based on the responses of students with gave positive response was 94,44%.

Keywords: Learning Outcomes, Critical Thinking Skills, Scientific Inquiry, Curricular Structuring Nested, Schoology

INTRODUCTION

Education of 21st century must produce student competence of critical thinking skills, so they can competitive in the global era. The 21st century itself is a century based on science and technology that requires human resources to dominate various forms of skills. In other words, various skills in the frame of science and technology that need to be dominated by human resources are the key words for a nation to participate in the world arena [1]. This was supported by the US-based Apollo Education Group and the US-based Partnership for 21st Century Skills (P21) which identified that one of the competencies needed in the 21st century was critical thinking skills [2].

Critical thinking is thinking that has a purpose (proving a point, interpreting what something means, solving a problem), but critical thinking can be a collaborative, noncompetitive endeavor [3]. There are six indicators of critical thinking skills namely interpretation, analysis, evaluation, inference, explanation and self regulation. In this study, four indicators were selected among the six indicators mentioned above were interpretation, analysis, inference, and explanation.

Ministry of Education and Culture (Kemdikbud) states that one of the aims of science learning is to create students who are capable of

critical thinking [4]. This is supported by the 2013 curriculum chemistry syllabus which also states that in the framework of dominating 21st century skills, chemical learning in high school is seen not only for the transfer of knowledge and skills to students, but also to build high-level thinking skills, one of which is critical thinking skills [5].

Chemistry is part of science which is obtained and developed based on experiments to find answers to the questions of what, why, and how about natural phenomena especially those related to composition, structure, properties, transformations, dynamics and energetics of substances [5]. One of the materials in chemistry learning is the reaction rate material which studies the reaction of chemistry. The reaction rate material has characteristics that include mathematical calculations, involving relationships expressed by graphs and involving multiple representations that are macroscopic, microscopic and symbolic representations [6]. In the factors that affected reaction rate sub material, the characteristics of the sub-material are involving relationship expressed by the graph and involving multiple representations. Therefore, it is necessary to have critical thinking skills to solve problems in the sub-material factors that affected reaction rate.

Based on the analysis of high school national examination results in 2016/2017

academic year by Education Assessment Center-Ministry of Education and Culture (Puspendik-Kemdikbud), it is known that the critical thinking skills that needed to solved the problem in examination is categorized as low. The average of that results is below the passing grade by Kemdikbud which is 55.00, included in SMAN 1 Manyar Gresik. Therefore, it was need the learning process that can improve students critical thinking skills. One of them is curricular structuring nested. Learning by curricular structuring nested can be improve students critical thinking skills, even better than connected and integrated which is also included in integrated learning [7] [8].

Curricular structuring nested is the learning that integrated curriculum in a subject specially focus of integration on various learning skills that want to trained by teacher to the students in a learning unit to achieved content. The nested of integration views the curriculum through three dimensional glasses, targeting multiple dimensions of a lesson [9]. Curricular structuring nested can be used if learning has a purpose other than embedding the concept of a material but also other aspects of skills into a whole. The advantages of nested are prioritizing student learning experiences that must be enriched and enhanced [10].

Based on the results of interview with chemistry teachers at SMAN 1 Manyar Gresik was known that teachers often lack time in teaching. Based on this fact, it is necessary to did learning activities outside to learning meeting in class in order to maximize learning time with utilizing existing technology. Especially for students this time who can't get away from the gadgets that they have, including students at SMAN 1 Manyar Gresik based on the results of pre-research is known to use gadgets or the internet in their daily activities even the average student uses it every day. One of the technologies that can be used in the learning activities outside the classroom to maximize time of learning meeting in class is schoology application.

Schoology is a social networking service and virtual learning environment for K-12 school and higher education institutions that allows users to create, manage, and share academic content [11]. This schoology application also provides access to teachers and students for attendance, assignment of tasks, practice questions and media learning resources that can be accessed anytime and anywhere and also provide access for parents to monitor the learning development of students

in school [12]. The learning using schoology allows teachers to hone the mindset of students to think critically and creatively [13]. Learning used e-learning with schoology affect to improving n-gain of students learning outcome in higher order thinking skill level [14]. Therefore, the learning of reaction rate materials with curricular structuring nested can be assisted by schoology application to maximize time of learning meeting in class. The other hand it also can improve students critical thinking skills. Students critical thinking skills also influence to the learning outcomes of students, where there is a significant relationship between critical thinking skills and students learning outcome [15].

Based on Kemdikbud, succesfull of indicator learning achievement can be seen in various positions in the stages and learning systems. One indicator of learning successfull is from the learning process stage. The learning process stage can be described from the stages of opening, core and closing learning [16]. One of the factors that influence the successfull of learning is the teaching activities that stated in the lesson plan [17] and the successfull of learning influenced by teachers ability to can implement learning [18]. The attitude of students also affects the successfull of learning. This attitude is affected by feelings of pleasure or displeasure at the teacher's performance, lessons or the surrounding environment [19]. These attitudes can be interpreted as responses of students or the impact given to students on understanding, knowledge, motivation and other long-term effects after the learning is carried out. Based on the students responses will be known whether learning with curricular structuring nested assisted by schoology applications accepted by students well or not.

Based on the description above, a study of reaction rate material learning was conducted with curricular structuring nested assisted by schoology application. The aims of this study are to improve students critical thinking skills and learning outcome.

METHOD

The study that conducted was pre-experimental research. Subject of the study were 36 students of 10th grade at SMAN 1 Manyar Gresik who have not received the reaction rate material yet. Design of the study that used in this study is one group pretest-posttest design. This design can be described as follows:

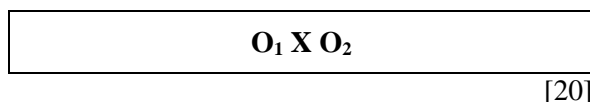


Figure 1. One Group Pretest-Posttest Study Design

Information:

O₁: Students critical thinking skills and learning outcomes before learning of reaction rate materials with curricular structuring nested assisted by schoology application

X: Learning of reaction rate materials with curricular structuring nested assisted by schoology application to improve students critical thinking skills and learning outcomes

O₂: Students critical thinking skills and learning outcomes after learning of reaction rate materials with curricular structuring nested assisted by schoology application

Based on the design of this study and the data to be obtained, the details of the research procedure consisted of four stages namely the preparation, the implementation of learning activities, data collection and data analysis stages. The learning tools used in this study were syllabus, lesson plan and student worksheets. The instruments used in this study were several sheets of observation, critical thinking test, learning outcome test and student responses. Tests of critical thinking skills and student learning outcomes are carried out before and after learning, while student response questionnaires are given after learning.

The learning tools used in this study were validated by three validators consisting of two chemistry lecturers and one chemistry teacher who were analyzed descriptively with a rubric found on a Likert scale which can be seen in Table 1.

Table 1. Rubric of Learning Tools Validity

Score	Category
1	Invalid
2	Less valid
3	Valid enough
4	Valid
5	Very valid

[21]

The agreement between observers on the validation of learning tools can be seen from a percentage of agreement. The value of the percentage of agreement can be calculated using the following formula:

$$\text{Percentage of agreement} = 100 \left(1 - \frac{A-B}{A+B} \right)$$

[22]

Observer reach agreement on validation of learning tools if percentage of agreement $\geq 75\%$ [22]. The percentage of learning tools validity can be calculated using the following formula:

$$\text{Validity percentage} = \frac{\text{Obtained score}}{\text{Maximum score}} \times 100\%$$

The results of the learning tools validity percentage then converted based on the validity criteria in Table 2.

Table 2. Interpretation of Learning Tools

Percentage (%)	Criteria
0 – 20	Invalid
21 – 40	Less valid
41 – 60	Valid enough
61 – 80	Valid
81 – 100	Very valid

[21]

Based on the criteria in Table 2, learning tools said to be valid if result of validity percentage $\geq 61\%$. Implementation of learning was observed by three observers and analyzed descriptively with criteria adapted from the Likert scale in Table 3.

Table 3. Modification of the Likert Scale for Learning Implementation Rubrics

Score	Implementation
4	The teacher carries out coherent and complete learning stages in each phase
3	The teacher carries out the learning stages completely but is not coherent in each phase
2	The teacher carries out the coherent but incomplete stages of learning in each phase
1	The teacher carries out the stages of learning in a non-coherent and incomplete manner in each phase
0	The teacher not carries out all the stages of learning in each phase

The agreement between observers on the validation of learning tools can be seen from a percentage of agreement. Based on the assessments of the three observers, the modus score will be taken against the assessment of the learning implementation which will be converted based on the criteria adapted from the Likert scale. Implementation criteria can be classified into very

less (if modus is 0), less (if modus is 1), enough (if modus is 2), good (if modus is 3) and very good (if modus is 4). Based on the criteria, learning with curricular structuring nested assisted by schoology application said to be carried out if get minimum good category.

Critical thinking skills and students learning outcomes were analyzed statistically, where based on the pretest and posttest results conducted the normality test with Kolmogorov-Smirnov test using the SPSS program to determine whether the sample used in this study was normally distributed or not. The basis for decision making to determine the normality of data is as follows:

- 1) If significance < 0,05 then the data is not normally distributed
- 2) If significance > 0,05 then the data is normally distributed

The next hypothesis testing is conducted using parametric statistics with paired sample t-test if the sample is normally distributed and uses non-parametric statistics with the Wilcoxon signed rank test if the sample is not normally distributed. This test is conducted to find out whether critical thinking skills and student learning outcomes increase significantly or not.

The study hypothesis formulated in this test for analysis of critical thinking skills is as follows:

H₀ : There was no significant improvement in critical thinking skills after learning with curricular structuring nested assisted by schoology applications

H_a : There was significant improvement in critical thinking skills after learning with curricular structuring nested assisted by schoology applications

The study hypothesis formulated in this test for analysis of learning outcomes is as follows:

H₀ : There was no significant improvement in learning outcomes after learning with curricular structuring nested assisted by schoology applications

H_a : There was significant improvement in learning outcomes after learning with curricular structuring nested assisted by schoology applications

The basis for decision making to accept or reject H₀ in the paired sample t-test and Wilcoxon signed rank test is as follows:

- a) If probability (Asymp.Sig) < 0,05 then H₀ is rejected and H_a is accepted.
- b) If probability (Asymp.Sig) > 0,05 then H₀ is accepted and H_a is rejected.

If analyzed further, it can be seen that the quality of the improvement in learning outcomes is stated with the predicate. From the analysis, it is known the student learning outcome posttest reach passing grade or not, which passing grade is ≥80. Predicate the improvement of student learning outcomes based on the posttest results can be seen in Table 4.

Table 4. Predicate of Learning Outcomes Posttest

*MCC	Predicate			
	A (Very Good)	B (Good)	C (Enough)	D (Need Guidance)
80	94 - 100	87 - 93	80 - 86	< 80

*MCC: Minimum Completeness Criteria [23]

The response of students is analyzed by calculating the positive response of each positive question item with the following formula:

$$\% \text{Positive response each item} = \frac{\sum \text{'yes' answer}}{\sum \text{Respondent}} \times 100\%$$

The response of students is analyzed by calculating the positive response of each negative question item with the following formula:

$$\% \text{Positive response each item} = \frac{\sum \text{'no' answer}}{\sum \text{Respondent}} \times 100\%$$

Positive responses on each item are then calculated to get the percentage of students' responses to the formula:

$$\% \text{Positive response} = \frac{\sum \text{Positive response each item that obtained}}{\sum \text{Positive responsess each item totally}} \times 100\%$$

The results of the positive responses percentage are then converted based on student response criteria in Table 5.

Table 5. Interpretation of Students Response Score

Percentage (%)	Criteria
0 - 20	Very Bad
21 - 40	Bad
41 - 60	Enough
61 - 80	Good
81 - 100	Very Good

[21]

Based on the data in Table 5, if the student percentage that give positive response ≥ 61%, so the learning with curricular structuring nested assisted by schoology applications said accepted well by students.

RESULTS AND DISCUSSION

Students of 10th grade in this study were taught pre-requisite material first namely the material of basic laws and stoichiometry and also thermochemistry that taught outside the hours of learning before carrying out learning. The learning tools, sheet of pretest posttest of critical thinking skills and learning outcomes that used in this study has been reviewed by chemistry lecturers and validated by three validators first. The learning implementation observation sheet and student response sheets have been reviewed by chemistry lecturers.

Based on the validation carried out by the validator, the percentage of construct validity of the lesson plan was 98.18%; percentage of construct validity of worksheets was 95,83%; percentage of content validity of worksheets was 100%; percentage of pretest posttest critical thinking skills validity was 100% and percentage of pretest posttest learning outcomes validity was 100%. Percentage validity of learning tools, critical thinking skills pretest posttest and learning outcomes pretest posttest $\geq 61\%$. Therefore, it was said valid and can be used in this study.

Implementation of Reaction Rate Materials Learning with Curricular Structuring Nested Assisted by Schoology Application

The learning of reaction rate materials with curricular structuring nested assisted by schoology application held for two meetings. The learning held followed scientific inquiry syntax which suggests five steps or phases, phase 1: ask a question about objects, organisms, and events in the environment; phase 2: plan and conduct a simple investigation; phase 3: use appropriate tools and techniques to gather and interpret data; phase 4: use evidence and scientific knowledge to develop explanations; and phase 5: communicate investigation procedures, data, and explanations to others [24].

Based on the assessment result of the learning implementation in each phase of the first and second meetings of the three observers, a percentage of agreement was obtained between observers $\geq 75\%$. The absence of a percentage of agreement value below 75 is proof of the agreement and the used of the modus score for assessing each phase of the learning implementation gets reinforced. The modus score from the assessment of learning implementation can be seen in Figure 2.

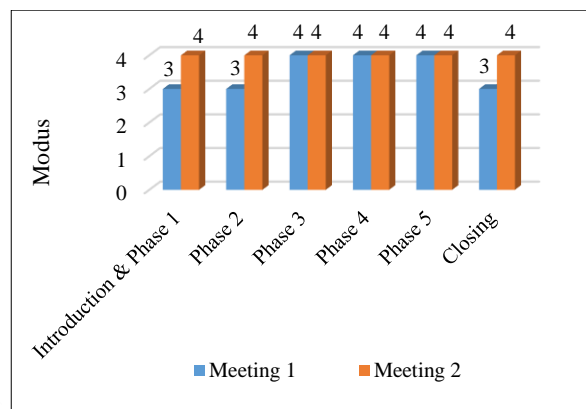


Figure 2. Diagram of Learning Implementation Assessment

Based on the data in Figure 2, it is known that the learning of reaction rate materials with curricular structuring nested assisted by schoology application that followed scientific inquiry syntax on each phase in meeting 1 and 2 obtained in the good to very good category. This means that the learning of reaction rate materials with curricular structuring nested assisted by schoology application can be said to have been carried out very well.

Critical Thinking Skills Improvement

The improvement of critical thinking skills as one of the aim in this study is known from pretest and posttest results. Based on the pretest and posttest that were conducted, the data obtained from the test of critical thinking skills in each student has improved. The data can be seen in Figure 3.

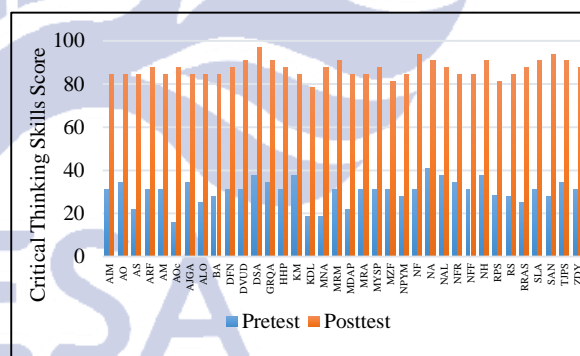


Figure 3. Diagram of Student Critical Thinking Skills Test Improvement

Based on the data in Figure 3, it was can seen that the critical thinking skills of all students have increased, but it is necessary to know whether the increase occurs significantly or not. Therefore, statistical analysis is done because it is necessary to did an initial test to determine what statistical method to use. The first step was to did normality tests using the Kolmogorov-Smirnov

test through the help of the SPSS program. The normality test results of critical thinking skills test data using the Kolmogorov-Smirnov test with the help of the SPSS program can be seen in Table 6.

Table 6. Normality Test Result of Critical Thinking Skills Test

One-Sample Kolmogorov-Smirnov Test			
		Pretest KBK	Posttest KBK
N		36	36
Normal	Mean	30.2275	83.0978
Parameters ^{a,b}	Std. Deviation	5.63971	3.52959
Most Extreme	Absolute	.239	.171
Differences	Positive	.148	.169
	Negative	-.239	-.171
Test Statistic		.239	.171
Asymp. Sig. (2-tailed)		.000 ^c	.010 ^c
a. Test distribution is Normal.			
b. Calculated from data.			
c. Lilliefors Significance Correction.			

Based on the data in Table 6, a significance value was obtained on the pretest data was 0,000 and a significant value on the posttest data was 0,010. Significance value of both pretest and posttest data $<0,05$; this means that study data was not normally distributed. Therefore, the statistic method used was non parametric statistics with the Wilcoxon test as an alternative because the requirements for carrying out analysis with parametric statistics were not fulfilled. The results of the Wilcoxon test data on critical thinking skills with the help of the SPSS program can be seen in Table 7.

Table 7. Wilcoxon Test Result of Critical Thinking Skills Test

Test Statistics ^a	
Z	Nilai Posttest KBK - Nilai Pretest KBK
	-5.235 ^b
Asymp. Sig. (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

Based on Table 7 probability (Asymp.Sig) obtained $<0,05$ was 0,000 it can be concluded that H_0 was rejected and H_a was accepted, which means that there was a significant improvement in critical thinking skills after learning with curricular structuring nested assisted by schoology applications.

Learning Outcomes Improvement

The improvement of learning outcome as one of the aim in this study is known from pretest and posttest results. Based on the pretest and posttest that were conducted, the data obtained from the pretest and posttest of learning outcomes

in each student has improved. The data can be seen in Figure 4.

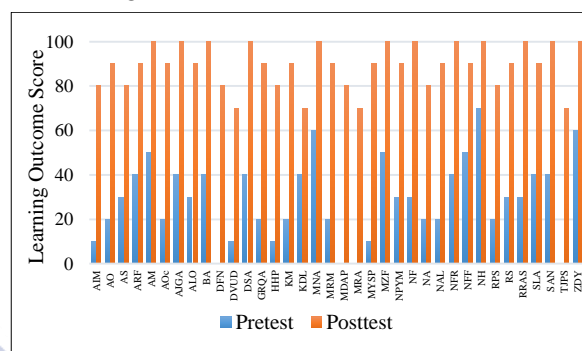


Figure 4. Diagram of Student Learning Outcomes Test Improvement

Based on the data in Figure 4, it can be seen that the results of learning outcomes of all students have improved, but it is necessary to know whether the increase occurred significantly or not. The steps taken were the same as the steps in the analysis of critical thinking skills, where normality tests were carried out by the Kolmogorov-Smirnov Test. The normality test results of critical thinking skills test data using the Kolmogorov-Smirnov test through the help of the SPSS program can be seen in Table 8.

Table 8. Normality Test Results of Learning Outcomes Test

One-Sample Kolmogorov-Smirnov Test			
		Pretest HB	Posttest HB
N		36	36
Normal	Mean	28.8889	89.1667
Parameters ^{a,b}	Std. Deviation	18.01234	9.96422
Most Extreme	Absolute	.134	.228
Extreme	Positive	.134	.138
Differences	Negative	-.120	-.228
Test Statistic		.134	.228
Asymp. Sig. (2-tailed)		.104 ^c	.000 ^c
a. Test distribution is Normal.			
b. Calculated from data.			
c. Lilliefors Significance Correction.			

Based on the data in Table 8, then obtained a significance value on the pretest data was 0,104. Significant value of data pretest $>0,05$; this means the study data was normally distributed. Significance value in the posttest data was 0,000 where the significance value of the posttest data was $<0,05$; this means that study data was not normally distributed. Because there was one data that was not normally distributed, the statistic method used was nonparametric statistics with the Wilcoxon test as an alternative because the requirements for conducting analysis with parametric statistics were not fulfilled. The Wilcoxon test results of the learning outcomes

data with the help of the SPSS program can be seen in Table 9.

Table 9. Wilcoxon Test Results of Learning Outcomes Test

Test Statistics ^a	
	Nilai <i>Posttest</i> Hasil Belajar - Nilai <i>Pretest</i> Hasil Belajar
Z	-5.275 ^b
Asymp. Sig. (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

Based on the Table 10, it was obtained a probability value (Asymp.Sig) <0.05 which was 0,000. Based on the data, it can be concluded that Ho was rejected and Ha was accepted, which means that there was a significant improve in learning outcomes after learning with curricular structuring nested assisted by schoology applications. When analyzed further, it was known that there were students who get the posttest score of learning outcomes with predicates in enough until good category, but there were students who get the predicate need guidance because they get the posttest value that was not reached passing grade.

Student Response

The learning of reaction rate materials with curricular structuring nested assisted by schoology application is learning that fairly new and rarely used by teachers in the learning process. Therefore, it was necessary to know how students' responses to learning that they have been received. Based on the responses of the students, it will be known whether learning with curricular structuring nested assisted by schoology applications was accepted by students well or not. Students were given a questionnaire response after the implementation of learning, where the response questionnaire consisted of eight items of questions both positive and negative questions. The positive questions were found in questions number 1, 4, 6, 7 and 8, while negative questions were found in questions number 2, 3 and 5. Each question of this questionnaire of student response can be seen in Table 10.

Table 10. Questionnaire of Student Response

Question	Key Word	Category
1	Interest in the learning	Positive
2	Difficult to understand material	Negative
3	Difficult to finish tasks	Negative

Question	Key Word	Category
4	Motivate solving the problem	Positive
5	Become passive in the learning	Negative
6	Critical thinking skills Learning	Positive
7	implementation on others subject	Positive
8	Meaningful experience of the learning	Positive

Percentage data on the results of the positive responses of students in each item on positive and negative questions are presented in Figure 5.

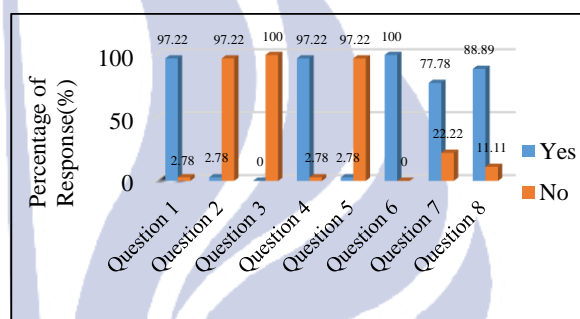


Figure 5. Diagram of Percentage Student Response Result on Each Item

Based on the Figure 5, it is known that in each item positive and negative questions students gave a positive response. From the data of the response results of these students, it can be seen that the percentage of positive responses of students was determined by certain equations which was 94,44%. The percentage of positive responses of students $\geq 61\%$, this means that learning with curricular structuring nested assisted by schoology applications can be said to be well received by students.

CLOSURE

Conclusion

Based on result and discussion of study, the conclusions obtained in this study were:

- 1) The learning of reaction rate with curricular structuring nested assisted by schoology application was carried out with the quality in the good to very good category in accordance with the lesson plan.
- 2) Students critical thinking skills after learning with curricular structuring nested assisted by schoology applications have improved significantly.

- 3) Student learning outcomes after learning with curricular structuring nested assisted by schoology applications have improved significantly, but there were students who get posttest scores that have not reached passing grade.
- 4) The learning of reaction rate materials with curricular structuring nested assisted by schoology applications can be well received by students based on the student responses.

Suggestion

Based on the results and discussion of the study, the suggestions given as input are:

1. The learning of reaction rate with curricular structuring nested assisted by schoology applications was proven to be able to significantly improve critical thinking skills and learning outcomes. Therefore, it can be recommended for use by teachers in learning.
2. Based on the results of the analysis, there were three students who obtained predicates need guidance on learning outcomes. Therefore, it is necessary to better manage the class so that learning takes place in a conducive and maximum manner and there are no students who get the posttest value that not reach passing grade.

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