

REACTION RATE MATERIALS LEARNING WITH NESTED CURRICULAR ARRANGEMENT ASSISTED BY WEB ENHANCED COURSE TO IMPROVE CRITICAL THINKING SKILLS AND STUDENT'S LEARNING OUTCOME

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Abstract

This study aimed to evaluate the learning of reaction rate materials with nested curricular arrangement which designed and implemented using inquiry models. The research subjects were 36 students of 10th grade of MIA 4 in Senior High School 1 Manyar, Gresik. Learning evaluation was based on two variables which were the skill improvement and student learning outcome. This study followed a quasi-experimental research design with one group pretest and posttest design. Analysis of skill improvement and student learning outcomes using the t-test. The research instruments were learning implementation sheets, observation of student activities, critical thinking skills test and learning outcomes test. The learning implementation in the first and second meetings obtained 4 rates, categorized as good according to the lesson plan. The students relevant activities during the learning process in the first meeting amounted to 94.63% and in the second meeting was 95.23%. Most students had learned well because of the high percentage implementation level. Critical thinking skills which were trained included focusing questions, considering the information source credibility, inducing and considering the results of the induction, observing and considering the results of observations. Critical thinking skill and student learning outcomes had significant improvement that is proved by T-test with the aid of SPSS, this shows that the value of t arithmetic more than t statistics table. According to the result, it is known that nested curricular arrangement assisted web enhanced course could develop the critical thinking skill and the student learning outcomes.

Keywords: Nested, Web Enhanced Course, Critical Thinking Skills, Inquiry.

INTRODUCTION

The range of education is inseparable from the learning process. The learning process can be done individually or in groups both formally and informally. One formal learning process is learning at school. One of the subjects is chemistry. Chemistry subjects in senior high school/vocational high school is about anything that related to substances including composition, structure, properties, changes, dynamics and energetics of substances that involve skills and reasoning. The discussion of chemistry includes a fairly complex system, ranging from atoms, molecules, compounds and equation reactions involving all three [1].

One of the basic competencies in chemistry learning basic competence 3.6 in eleventh grade, the basic competence about understanding the collision theory in chemical reactions based on the effect of temperature on the average rate of particle substances and the effect of concentration on the frequency of collisions. The reaction rate itself is one of the materials that describes how quickly or slowly a reactant runs out or a product is formed [2]. Unfortunately, student understanding of the reaction

rate materials is low. Based on the interviews with one of the chemistry teachers of Senior High School 1 Manyar, Gresik on September 12, 2018 not all students achieve the minimum completeness criteria in reaction rate materials. The students having difficulty in the reaction rate material. One of the obstacles is that not all of the students are interested in the materials, moreover reaction rates material are classified as difficult materials. In addition, based on the percentage of mastery of the chemistry question materials for the 2016/2017 national examination, Senior High School 1 Manyar, Gresik received a score of 70,16 that is under of minimum completeness criteria [3].

The reaction rate materials is not only taught by lecturing method but also by other methods. Learning media are needed to help explaining these concepts so as to facilitate students in constructing the concepts. The construction of a new concept is strongly influenced by the learning process. The learning process in educational units are held in an interactive, inspirational, fun, challenging, motivating way so that the students actively participate, and provide sufficient space for

initiatives, creativity, and independence in accordance with the talents, interests and physical and psychological development of students. This statement is accordance with the nature of the 2013 curriculum that the learning of chemistry includes knowledge, skills, and attitudes and thinking abilities through direct interaction of learning resources [4].

The ability of thinking skills is trained in various ways to get the best way of thinking that can be done by students. One of them is critical thinking skills. The learning process should be well organized in order to train the critical thinking skills. One of the learning models that can be applied to achieve this goal is to apply the inquiry model. The inquiry model is learning that focuses the students to understand the content of a discipline materials actively involved in the learning process through personal discovery [5]. The inquiry model phase which is applied includes attracting interest, explaining, investigating, elaborating, and evaluating [6]. The use of inquiry model is expected to improve students critical thinking skills.

Critical thinking is reasoned and reflective thinking by emphasize making decisions about what to believe or do. Ennis argues that critical thinking is rational thinking about what is done or what is believed [7]. Critical thinking skills according to Ennis are focusing questions, considering the information source credibility, inducing and considering the results of the induction and observing and considering the results of observations. Critical thinking skills are also expected in line with student learning outcomes as an indicator of the success of the learning process. Critical thinking skills are process to improve learning outcomes.

Student learning outcomes is actually a change in behavior that have occurred through the learning process. The change in behavior is the form of learners abilities after learning activities that are the result of learning goal[8]. Learning outcomes is cognitive learning which is products of the learning process. The learning model to improve critical thinking skills and learning outcomes, one of them is the application of nested curricular structuring [9].

Nested is the learning that specifically integrates curriculum in one scientific discipline and to put the focus of integration on a number of learning skills. Learning skills include thinking skills, social skills, and organizing skills [8]. The development of nested must be adapted to the students daily activities so that the learning process is more attractive for students.

It is inevitable for students to live without technology, either mobile phones, web or even social media. The using of technology should support the learning process directly and indirectly. One way to package learning that are supported by technological developments is by applying the web enhanced course in learning.

Web enhanced course is using internet to support the learning quality which is carried out by combining face-to-face and long-distance learning. Web enhanced course explores the links that are already available on the web then adopted and analyzed to help students completing the given worksheet [8]. In this study, the students could explore the link that is suggested by the teacher, namely Kentchemistry and GCSE Science Chemistry. Both of the websites help the students in obtaining information in the explaining phase to practice considering the information source credibility skills. Kenchemistry website contains learning animations that can elaborate the concepts to students in 3 dimensions. Kenchemistry website can be accessed for free and is presented in English. While the GCSE Science Chemistry website contains learning videos that are presented in English. GCSE Science Chemistry teaches concepts systematically. In addition, web enhanced course learning is also used in posttest, namely by using the Edmodo application online. Edmodo is an application that contains student learning outcome that connect teachers with students. The Edmodo application helps teachers to conduct test remotely. Students will get two forms of questions, namely essays to critical thinking skills test and multiple choice questions for learning outcomes test. Both can be done on the same day as the 24 hour exercise. The students who done the test cannot change their answers because their score is automatically sent to their teachers.

Based on previous researches by Aprianoro (2017) and Kuntasari (2016), the studies show that the nested model is able to improve critical thinking skills and student learning outcomes. Based on the statement apply the implementation of nested curricular arrangement assisted by a web enhanced course in order to improve students' critical thinking skills and learning outcomes in the reaction rate material by utilizing technological developments.

The purpose of the research is to improve the critical thinking skill and student learning outcomes by applying reaction rate material learning with nested curricular arrangement assisted by web enhanced course.

METHOD

The method that is used in this research is quasi-experimental with one group pretest and posttest design. This study did not use a comparison class method, but it used the initial test (pretest) to determine the extent of the students ability. After doing the learning, the final test (posttest) was to find out the students final ability, so that the difference was obtained. The subjects of this study were students in class of 10th MIA 4 in Senior High School 1 Manyar, by giving prerequisite materials before collectting the data. The number of subjects was 36 students. The study was conducted on January 30, 2018 to February 6, 2019 in two meetings. Learning tools that were used syllabus, lesson plan, and worksheet. The instruments that were used in this study were observation implementation learning sheets, student activity sheets, critical thinking skills test and learning outcomes test.

The research procedure that was used were the preparation phase, the review/validation phase, the implementation phase and the data analysis phase. In the review phase, the results of the worksheet obtained criticism and suggestions from the reviewers, i.e. a chemistry lecturer and a chemistry teacher in Senior High School 1 Manyar, Gresik. Then the criticism and suggestions were followed up to improve the worksheet. The next phase was worksheet validation in terms of content validity and construct validity given to 3 validators, i.e 2 chemistry lecturers and a chemistry teacher by giving assessment scores in the range 1-4 to the worksheet in accordance with the validation sheet. The validation can be counted by the formula :

$$\text{Validation (\%)} = \frac{\sum \text{overall score}}{\sum \text{criteria score}} \times 100\%$$

The next phase is the data collection after the worksheet developed are declared valid. The method of collecting data used two forms, which were observation and test. Data on the learning and activity of students were obtained through observation, while data on critical thinking skills and learning outcomes were obtained by test.

Likert scale technique was applied to analyze the data. To get the validation equalize from three observers, a percentage of agreement was used. The value of the percentage of agreement according to Borich (1994) can be calculated using formula percentage of agreement.

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

The implementation of the learning model is considered good if the percentage of agreement from different observers reaches a percentage of $\geq 75\%$.

Data on student activities during learning activities are obtained by counting the number of activities that arise during learning activities.

$$\text{Percentage (\%)} = \frac{\text{frequency of activity that appears}}{\text{overall activity frequency}} \times 100\%$$

The students activity is well accomplished and support the effectiveness of the nested learning model in improving critical thinking skills if the percentage of relevant student activities is higher than the activities of irrelevant learners. Data on the results of critical thinking skills test are analyzed based on the results of the pretest and posttest. Differences in the scores of students critical thinking skills in the pretest and posttest are analyzed using the t-test by calculating the pretest and posttest value difference with the hypothesis:

H₀ : there is no significant difference between the value of the pretest and posttest.

H₁: there is a significant difference between the value of the pretest and posttest.

If the value of t arithmetic more than t statistics table, so H₀ is rejected and H₁ is accepted which means that the application of a nested model assisted by a web enhanced course can improve students critical thinking skills on the concept of reaction rates materials.

Data from the results of the learning outcomes are analyzed based on the results of the pretest and posttest. The value of student learning outcomes can be calculated by the formula:

$$\text{value} = \frac{\text{score obtained}}{\text{overall score}} \times 100\%$$

Differences in the value of student learning outcomes pretest and posttest are analyzed using the t-test by calculating the pretest and posttest value difference with the hypothesis:

H₀: there is no significant difference between the value of the pretest and posttest

H₁: there is a significant difference between the value of the pretest and posttest

If the value of t arithmetic more than t statistics table, so H₀ is rejected and H₁ is accepted which means that the application of a nested model assisted by a web enhanced course can improve student learning outcomes on understanding the concept of the reaction rate.

RESULTS AND DISCUSSION

Implementation of Learning

The implementation of learning is the conformity between teacher activities when teaching with the learning model syntax. The model used in this learning consists of 5 phase which are attracting attention, investigating, explaining, elaborating, and evaluating. The feasibility of learning is measured by the observation sheet of learning implementation instruments on curricular arrangement nested assisted by a web enhanced course.

The implementation of the learning model was observed by 3 observers who were a chemistry teacher and two chemistry lectures. In conducting the assessment, three observers had a high level of understanding. It is proved by low level of percentage of agreement over 75%, which means the prove of the understanding. Understanding of observer in all aspects that observed and assessed both at the first meeting which presented the first material and second material, as well as the second meeting which also presented the third material and fourth. The use of the mode for evaluation of every aspect of learning implementation was strengthened.

During the learning activities from the preliminary to concluding phase, the teacher role in the learning process continuously changed. The teacher acted as a motivator, mentor, and facilitator. However, overall the teacher acts as a manager of learning. In a well-maintained classroom, the teacher could manage the classroom to stay conducive in order to the transfer information to all of the students. The ability of learning management could be seen from the implementation of learning in both meetings.

In most assessed aspects, the teacher obtained four mode assesment 4 that is categorized as good in both of the first and second meetings. Based on the results, it could be concluded that the material learning model of the reaction rate materials with nested curricular arrangement assisted by the web enhanced course had been well accomplished and appropriated to the lesson plan.

Student Activity

The observation of student activities aims to acknowledge the all of the students activity during the reaction rate materials learning process with curricular arrangement nested with the help of a web enhanced course. Observation of student activities is conducted by two observers with each observer, observed three groups where each group consists of six students. The frequency of activities that appeared was observed every five minutes during the learning activities. The following is an analysis of

the students activities in the first and second meetings showed in Table 1.

Table 1. Data Percentage of Student Activity

No	Activity	Day - 1	Day- 2
1	Identifying problems	5.42 %	5.51 %
2	Formulating questions	6.27 %	5.94 %
3	The ability to write relevant concepts	5.87 %	5.51 %
4	Using technology (web enhanced course)	10.36 %	10.60 %
5	Expressing the hypothesis	5.42 %	5.94 %
6	Identifying variables	6.31 %	5.51 %
7	Doing experiments	16.73 %	16.96 %
8	Arranging observations (organizational skills)	6.27 %	5.51 %
9	Analyzing experimental data	5.42 %	5.96 %
10	Drawing conclusions	9.91 %	11.02 %
11	Reflection	5.42 %	5.51 %
12	Presenting experimental results (social skills)	11.25 %	11.02 %
13	Doing irrelevant activities (disturbing friends, making noise, etc.)	5.37 %	4.99 %

Based on Table 1, it shows that the student activity in the first and second meetings were different. The percentage of student activity was obtained from the average value of each activity from six groups that is observed by the observer. At the first meeting the teacher discussed the effect of concentration and surface area on the reaction rate. At the second meeting the teacher discussed the effect of temperature and catalyst on the reaction rate. The information of the relevan and irrelevant acticity showed in Figure 1.

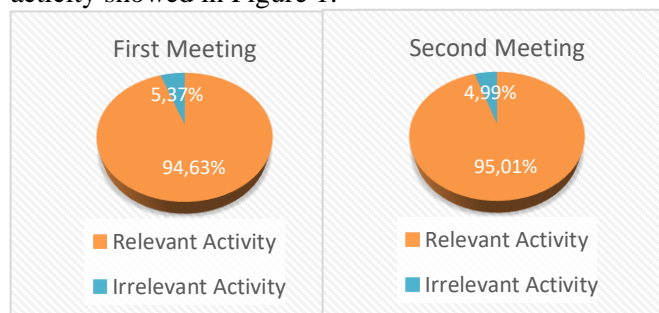


Figure 1. The Graph of Pie Relevan and Irrelevant Activity

The dominant activity at the first meeting was conducting experiments, as well as in the second meeting. Meanwhile, the irrelevant activities obtained the smallest percentage among other activities. This activity is an activity that was rarely carried out by the students at the first meeting and second. This is in accordance with the principle of chemical learning based on the 2013 curriculum which mentions chemical learning is expected to encourage students to become active learners where students become the center of learning [4]. Most students had well carried out reaction rate material learning with curricular arrangement nested with web enhanced courses.

Critical Thinking Skills

Critical thinking skills is reasoning and reflective thinking that is emphasized in making decisions about what to believe or do [8]. In this study there were four criteria that were trained, which were focusing questions, considering the information source credibility, observing and considering observations, and inducing and considering the results of induction.

Critical thinking skills were measured using test sheet instruments. Data of critical thinking skills was obtained from the test that were obtained before and after applying reaction rate materials learning with curricular arrangement nested with the help of a web enhanced course. Data of critical thinking skills were obtained from the test that were obtained before and after applying reaction rate material learning with curricular arrangement nested with the help of a web enhanced course. The following is the value of the pretest and posttest of critical thinking skills then tested with normality test as a prerequisite of t test. The tabel of normal test and t test that are showed in Table 2 and Figure 2.

Table 2. The Normality Test Score of Critical Thinking Skills

One-Sample Kolmogorov-Smirnov Test			
		pretest	posttest
N		36	36
Normal	Mean	29.1556	78.8222
Parameters ^{a,b}	Std. Deviation	10.62774	3.25375
Most Extreme Differences	Absolute	.123	.114
	Positive	.114	.109
	Negative	-.123	-.114
Test Statistic		.123	.114
Asymp. Sig. (2-tailed)		.183 ^c	.200 ^{c,d}

a. Test distribution is Normal.

Based on the data in Table 2 and Figure 2, it shows that statistical analysis was used because it was necessary to do an initial test to determine what statistical method to use. After it was known that the data were normally distributed, T test were conducted with the aid of SPSS.

Paired Samples Test							
Paired Differences				95% Confidence Interval of the Difference		t	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	Mean	Lower	Upper		
-49.66667	11.16300	1.86050	-53.44368	-45.88965	-26.695	35	.000

Figure 2. The T Test Score of Critical Thinking Skills

Based on the T-test, it was obtained that the value of t arithmetic = 26.695 with $\alpha = 0.05$ and $n = 36$ and t table = 2.042. By comparing the value of t arithmetics and t statistics table, it was known that t arithmetics more than t table. Therefore, it could be concluded that H_0 is rejected and H_1 is accepted, which means that there was an increase in learning outcomes after learning with nested curricular structuring assisted by a web enhanced course if it was observed classically. When it was analyzed further, it is known that there were students who attained a posttest score of critical thinking skills with a predicate in a good sufficient range, but there were students who attained low scores and needed guidance because they got a posttest score that is not in the expected value area.

The average value of the critical thinking skills pretest got the value of 29.16 which received less predicate, while the average result of the posttest score was 78.82 which received a good predicate. To have more understanding, the following is presented a graph of the average students' score at pretest and posttest that showed in Figure 3.

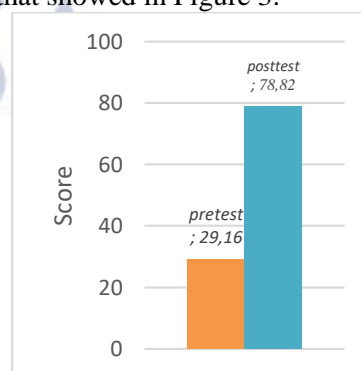


Figure 3. The Average Score of Critical Thinking Skills

Based on the Figure 3, it can be shown that after learning the reaction rate material with curricular arrangement nested with web enhanced course, the students average score of critical thinking

skill had increased from 29.16 to 78.82. This shows that reaction rate learning topic with curricular nested and web enhanced course is successfully implemented because it can increase the final score.

Statistical test will also be carried out on each of the four criteria of critical thinking skills that are trained, which are focusing questions, considering the information source credibility, observing and considering the results of observations, and inducing and considering the results of induction. In summary, the students' average score of each criterion in critical thinking skills in the pre-test and post-test is shown in Table 3.

Table 3. The Average Score of Each Criteria Critical Thinking Skills

No	Critical Thinking Skills	Score	
		Pretest	Posttest
1	Focusing questions	35.22	79.11
2	Considering the credibility of the information source	29.22	80.56
3	Inducing and considering the results of induction 1	18.89	80.11
4	Observing and considering observations	25.33	80.11
5	Inducing and considering the results of induction 2	31.11	74.22

In short, in Figure 4, it is presented a graph of the students' average score in pretest and posttest for each criteria of critical thinking skills.

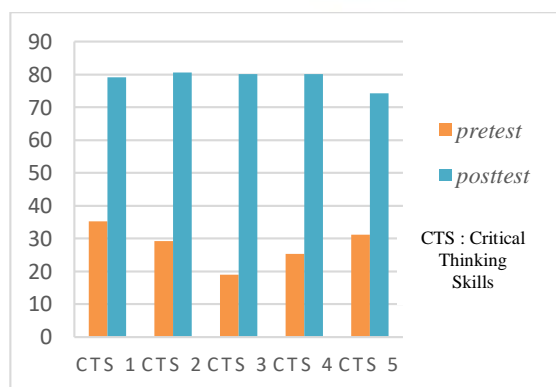


Figure 4. Graph of the The Average Score for Each Criteria Critical Thinking Skills

Based on the Figure 4, it can be seen that after learning the reaction rate materials with nested curricular arrangement assisted by a web enhanced

course, the average score had increased on all criteria of critical thinking skills.

The trained critical thinking skills have several benefits that help students building a concept by finding it themselves. Student is directed to study discovery, so that the concepts obtained are more mastered and developed with their own perspective. In addition, the student also gets various alternative answers from friends and teachers. Student is also directed to be a good work partner in a study group and work together in solving a problem [9].

Student Learning Outcomes

Learning outcomes are an illustration of the student mastery level or student completeness towards the learning objectives set. The learning outcomes that is observed in this study were cognitive learning outcomes in the form of values obtained during posttest [9]. Student learning outcomes are measured using the learning outcome test instrument. The learning outcome test sheet contains ten multiple choice questions that refer to the cognitive domain.

This learning outcome assessment is used to determine the achievement of student knowledge competency. In analysing the learning outcomes, it is applied t test. Learning outcomes are declared complete if the student get the above 75 (more than the minimum of completeness criteria of Chemistry at Senior High School 1 Manyar, Gresik). Whereas, the classical completeness that must be fulfilled is that students who complete individually are higher than/or equal to 75%. The results and analysis of student learning outcomes scores on sub-material factors that influence the reaction rate are tested with normality test as a prerequisite of t test. The tabel of normal test and t test that are showed in Table 4 and Figure 5.

Table 4. The Normality Test Score of Learning Outcomes

One-Sample Kolmogorov-Smirnov Test		pretest	posttest
Normal	N	36	36
	Mean	44.4444	83.0556
Parameters ^{a,b}	Std. Deviation	10.54093	8.21825
	Absolute	.191	.284
	Positive	.191	.284
Most Extreme Differences	Negative	-.173	-.216
	Test Statistic	.191	.284
Asymp. Sig. (2-tailed)		.002 ^c	.006 ^c

a. Test distribution is Normal.

Based on the data in Table 4 and Figure 5, it can be seen that the statistical analysis is done

because it is necessary to do an initial test to determine what statistical method to use. After it was known that the data were normally distributed, T test were conducted with the aid of SPSS.

Paired Samples Test						
	Mean	Std. Deviation	Paired Differences		t	Sig. (2-tailed)
			Std. Error Mean	95% Confidence Interval of the Difference		
			Lower	Upper		
pretest_hasil_belajar - posttest_hasil_belajar	-35.83333	12.50714	2.08452	-40.06514 -31.60153	-17.190	.000

Figure 5. The T Test Score of Learning Outcomes

Based on the T-test, it was obtained the value of $t_{\text{arithmetic}} = 17.190$ with $\alpha = 0.05$ and $n = 36$ and $t_{\text{table}} = 2.042$. By comparing the value of the t count and t table, it is known that t counts is more than t table. So it can be concluded that H_0 is rejected and H_1 is accepted, which means that there is a significant increase in learning outcomes after learning with nested curricular structuring assisted by a web enhanced course.

When it was analyzed further, it is known that there were students who attained the score that is below the minimum standard. There were five students who had not yet reached the the minimum of completeness criteria score but had experienced an increase from the previous pretest score. The lack of score in these five students was caused by the lack of understanding in several concepts especially in the elaboration of analyzing data. On the other hand, the scores of 31 students had increased and reached the minimum of completeness criteria scores. More clearly, the following is presented a graph of the average score of students at pretest and posttest that showed in Figure 6.

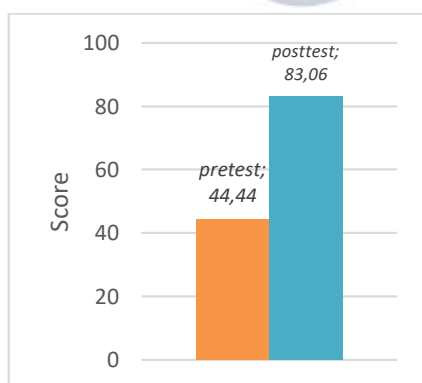


Figure 6. Graph of the Students learning Outcomes Average Score

According to the Figure 6, it is known that after implementing the learning reaction rate materials with nested curricular arrangement assisted by web enhanced course in the teaching the reaction rate material, the students' average score had increased

from 44.44 to 83.06. It exposes that the learning reaction rate materials with nested curricular arrangement assisted by web enhanced course succeeded because it is able to increase the student cognitive learning outcomes in reaction rate materials.

The learning outcomes that had been analyzed is beneficial for acknowledging the cognitive ability (product) on reaction rate material. The five students who did not pass the minimum criteria completeness could have remedial test to improve their competence. On the other hand, the 31 students who passed the minimum criteria completeness could proceed the learning by doing the enrichment test to optimize their understanding of the reaction rate material. Moreover, the learning outcomes that was obtained can be used as the teacher performance report on implementing the learning model in the teaching process and to measure the students accomplishment.

CLOSURE

Conclusion

After analyzing and discussing data, it is obtained for the study entitled "Reaction Rate Materials Learning With Nested Curricular Arrangement Assisted By Web Enhanced Course To Improve Critical Thinking Skills And Student's Learning Outcome" as follows:

1. The accomplishment of learning reaction rate materials with nested curricular arrangement assisted by web enhanced course in the first and second meetings, the teacher obtains a rating of mode 4 in good category. Based on the results obtained, it can be concluded that the material learning model of the reaction rate with nested curricular arrangement assisted by the web enhanced course has been well implemented because it is in accordance with the lesson plan.
2. The relevant activities of students in the learning process of the reaction rate with structured curricular nested assisted by the web enhanced course at the first meeting is 94.63% and at the second meeting is 95.33%. Most of the students have conducted reaction rate material learning with curricular nested with web enhanced course. This is also evident from the lack of irrelevant activities in the first and second meetings. Irrelevant activities get the smallest percentage compared to other activities which are 5.37% at the first meeting and 4.77% at the second meeting.
3. Critical thinking skills that are trained to students are measured using a test sheet at the pretest and posttest. Critical thinking skills that are trained are focusing questions, considering

the information source credibility, inducing and considering the results of the induction, observing and considering the results of observations. T-test values respectively for the trained criteria are 9.950; 15,149; 15,587; 12,728; 10,183. Based on the value of the t test on each criterion it is known that after learning the rate of reaction materials with nested curricular arrangement assisted by a web enhanced course, the average value of students has increased on all criteria because t arithmetics is more than the t statistics table. This shows that reaction rate materials learning with curricular nested that assisted by web enhanced course succeeds because it can improve critical thinking skills in the reaction rate materials.

4. The student learning outcomes after getting the learning treatment the rate of reaction materials with curricular arrangement nested assisted by a web enhanced course has increased. Based on the t-test it is known that the value of t arithmetic is 20,1409 which is higher than t statistics table. This shows that the learning reaction rate materials with nested curricular arrangement assisted by a web enhanced course succeeds because it can improve student learning outcomes.

Suggestion

1. In critical thinking skills, researcher only limits to 4 criteria, in the future, it is expected to be able to apply the other critical thinking skills or develop critical thinking skills that have been applied by researcher.
2. The use of technology in the learning process (web enhanced course) is only limited to considering the information source credibility and posttest, for the next researcher, it is expected to be able to maximize the use of technology in the learning process.
3. The use of the Edmodo application is limited to posttest only, for future it is expected to be able to develop Edmodo to organize learning better.

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