The influence of quarted card and virtual laboratory media on students' critical thinking ability

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Abstract. Excretory System Material requires interesting and effective media in learning to obtain maximum cognitive abilities. The purpose of this research is to determine the effect of the quartet card and virtual laboratory media on students’ critical thinking ability. This research is quantitative research with an experimental method using a non-parametric analysis Sign test. The research design used was the Nonequivalent Control Group Design with a purposive sampling technique. The instrument used was 18 questions pretest and posttest. The results obtained from the average value of the pretest and posttest of the highest critical thinking ability were obtained by the class with the media using the quartet card 24.038, then the class using the virtual laboratory media was 21.043, and the lowest average score was the control class 18.05. Thus, it can be concluded that there is a positive effect of learning with the quartet card and virtual laboratory media on students' critical thinking ability in the excretory system material.

1. Introduction
The 21st century demands fundamental changes in education. This century demands quality human resources, having knowledge and expertise. Therefore, skills are needed in the 21st century including skills in problem solving, critical thinking, collaboration, and communication skills [1]. The skill to think critically is the ability to define problems, assess, process information as well as find solutions to problems. Therefore, the ability to think critically is needed in today’s digital era so that someone does not just believe in news or information that is not necessarily true [2]. In the current era of globalization, if you don’t have competence, you will be left out and unable to compete in competition. One way to achieve this is through education [3].

High school students' critical thinking skills are still low. The low critical thinking skills are due to a lack of innovation in learning. Teachers must innovate so that students become graduates who have competencies according to government standards. In addition, this is because learning in the classroom is still centered on teachers, even though the 2013 curriculum should apply student-centered learning [4]. Based on the results of a survey conducted by the government in the Program for International Student Assessment (PISA), the science ability of Indonesian students in 2015 obtained an average score of 403, this score is still relatively low [5].

A quartet card is a type of game card consisting of 4 cards in pairs or 4 cards with the same theme. The quartet card is a very interesting medium and can support and increase student interest in the
learning process. Students can play an active role through interaction between students with each other [6]. Meanwhile, a virtual laboratory is an interactive media-based learning media suitable for biology learning. This media imitates the activities in the laboratory as if the user feels he is in a real laboratory. The equipment contained in the virtual laboratory is designed according to real conditions [7].

Wakhyu Junita Wulansari [8] in the title of her thesis “The Use of Quartet Card Media in Learning Ecosystem Materials Towards Critical Thinking Ability and Learning Activities of Class X Students” in 2016, stated the results of her research that quartet card media improved students’ critical thinking ability seen from the significant difference between control class and experimental class.

From the description of the learning media above, it can be used as a reference for conducting a research “The Effect of Quartet and Virtual Laboratory Card Media on Critical Thinking Ability”.

2. Method
This research was conducted at Senior High School 1 Sitiung Dharmasraya Regency in March 2020. The research method used quasi-experimental with quantitative research type and the Nonequivalent Control Group Design design, namely the experimental design by looking at the difference in the average pretest and posttest between the experimental group and the control group which is not randomly selected [9].

The population of this research were all students of Senior High School 1 Sitiung with a total of 838 students. Samples were taken from affordable populations, namely class XI. The sampling technique used is purposive sampling (Non-Probability Sampling), which is a sampling technique based on a specific objective [10]. Data collection techniques using research instruments that have tested their validity and reliability. The instrument consists of 34 questions pretest and posttest which will be tested for validity and reliability then the results are taken to be analyzed.

The data collection instrument as an indicator for measuring critical thinking ability, namely in the form of 18 questions (pretest posttest) in the form of a description with a maximum score of 4. The test was carried out to obtain data on students’ critical thinking skills on the excretion system material using a quartet card media and virtual laboratory. Instrument calibration form validity test, reliability test, level of difficulty and discernment. Validity test research used content validity, because the instrument used is a test. So that the content validity test is done by comparing the contents of the instrument with the excretory material [11]. Reliability test is a good instrument is an instrument that still provides data in accordance with reality. The amount of provision indicates the high reliability of the instrument calculated by the formula [12]. Level of Difficulty is level of difficulty is the result of the comparison between students who answered correctly and those who answered the whole test [13]. Discernment is used to differentiate between upper and lower test takers. The distinguishing power is good if the results obtained are D> 0.3[14].

The data analysis technique used consists of the analysis prerequisite test and hypothesis testing. The analysis prerequisite test used was the normality test with Chi-Square and hypothesis testing using the non-parametric Sign test.

3. Results and Discussion
This research aims to explain the effect of quartet card media and virtual laboratory on critical thinking skills implemented at Senior High School 1 Sitiung. The data on the critical thinking ability of the excretion system material were obtained from the pre-test and post-test scores of the three different classes. The first experimental class and second experimental class used the media card quartet and virtual laboratory while the control class used power point media. The number of respondents was 69 students, namely class XI MIPA 1 totaling 20 students and class XI MIPA 2 there were 23 students, and XI MIPA 3 there were 26 students.
The learning process in the control class (XI MIPA 1) using power point media begins with learning activities that must be done by students by working on student worksheets. This is to spur students to think critically and find out independently the material to be studied. After the discussion is finished, the teacher confirms what the students have discussed with some explanations and draws conclusions. The teacher also tests their understanding at the end of the lesson by asking several questions related to the material for the day. It takes three meetings to complete the Excretion System material. The weakness of learning activities using power points is that the media is less attractive so that students are less enthusiastic and less active in the learning process.

The learning process of the experimental class (XI MIPA 2) using virtual laboratory media begins with the delivery of learning activities that must be carried out by students that day by working on student worksheets. This is done to encourage students to think critically, creatively and independently find out the material to be studied. Then, after the discussion is finished, the teacher confirms what the students have discussed. This makes students enthusiastic and active in carrying out discussions to compete with other groups in practicing virtually. They are also focused and happy when the teacher confirms the material with a presentation in the form of practicum virtually, then the teacher invites them to see the various processes of excreting each organ of the excretory system such as the mechanism of sweat formation, urine formation and others.

The learning process of the experimental class (XI MIPA 3) using quartet card media begins with the delivery of learning activities that must be carried out by students that day by working on student worksheets. This is done to spur students to think critically. Then, after the discussion is over the teacher explains the rules for playing the quartet cards. Students are very interested and enthusiastic when learning using the card media. This is because the quartet card is equipped with text, images and other combinations that activate the students' sense of sight. After the game, the students who received the card theme set presented the most in front of the class and the other students responded.
The ability to think critically is the ability to evaluate the gap between reality and truth, as well as the ability to analyze and make stages in solving a problem [15]. A person who has the ability to think critically, he will not believe directly what other people do before he looks for the truth with evidence and logical reasons [16]. According to Peter A. Facione (2015) in his book entitled "Critical Thinking: What It Is And Why Its Counts", there are 6 aspects of critical thinking skills including aspects of interpretation, analysis, evaluation, inference, explanation, and self-regulation [17].

In Figure (2), the pre-test control class, the indicator of critical thinking ability which has the lowest percentage of achievement is an indicator of self-regulation with the percentage of achievement is 35.42%, the highest indicator of achievement is the indicator of analysis with an achievement percentage of 47.08%. The average obtained from the overall score of the six indicators of critical thinking skills in the control class pre-test was 42.3%. Meanwhile, the indicator of critical thinking in the post-test which has the lowest percentage of achievement is the indicator of self-regulation with a percentage of achievement of 69.17% and the indicator that has the highest achievement is the indicator of interpretation with a percentage of 80.42%. The average score obtained from the six indicators of critical thinking skills post-test control class is 74.72%. This shows that there is an increase in the achievement of students' critical thinking skills from pre-test to post-test control class students.

The pre-test score for first experimental class with virtual laboratory media, the indicator with the lowest percentage of achievement was the self-regulation indicator with the percentage of achievement of 42.03% and the indicator with the highest achievement was the inference indicator with the percentage of the achievement of 51.81%. The average obtained from the six indicators of critical thinking skills in the first experimental class pre-test was 48.01%. Meanwhile, the indicator of critical thinking on the post-test which has the lowest achievement is the indicator of self-regulation with a percentage of achievement of 76.45% and the indicator which has the highest achievement is analysis with a percentage of achievement of 86.23%. The average overall score of the six indicators of critical thinking skills in the first post-test experimental class was 80.37%. This shows that there is an increase in the achievement of critical thinking skills from pre-test to post-test students of the first experimental class by 32.36%.

In the second pre-test of experimental class using quartet card media, the indicator that has the lowest percentage of achievement is the self-regulation indicator with the percentage of achievement of 38.46% and the indicator with the highest achievement is the interpretation indicator with the percentage of achievement of 42.95%. The average overall score of the six indicators of critical

| No | Indicator  | Control Class | Experiment class 1 | Experiment class 2 |
|----|------------|---------------|--------------------|--------------------|
|    |            | Pretest (%)   | Posttest (%)       | Pretest (%)       | Posttest (%)       |
| 1  | Interpretation | 44.17 | 80.42 | 48.91 | 82.61 | 42.95 | 82.37 |
| 2  | Analysis    | 47.08 | 75.42 | 45.65 | 86.23 | 42.63 | 76.6  |
| 3  | Evaluation  | 45    | 75.83 | 50.36 | 72.68 | 42.63 | 79.81 |
| 4  | Inference   | 41.67 | 74.58 | 51.81 | 78.62 | 40.38 | 78.21 |
| 5  | Explanation | 40.42 | 72.92 | 49.28 | 80.07 | 39.61 | 78.53 |
| 6  | Self Regulation | 35.42 | 69.17 | 42.03 | 76.45 | 38.46 | 73.73 |
|    | Mean        | 42.30 | 74.72 | 48.01 | 80.37 | 41.03 | 78.21 |

Figure 2. a. Table the results of the calculation of the average percentage of achievement of the critical thinking ability indicator.
thinking skills in the second experimental class pre-test was 41.03%. Meanwhile, the critical thinking indicator in the post-test which has the lowest percentage of achievement is the interpretation indicator with the achievement percentage of 82.37%. The average overall score of the six indicators of critical thinking skills in the second post-test experimental class was 78.21%. This shows that there is an increase in the achievement of critical thinking skills from pre-test to post-test in second experimental class students by 37.18%.

The prerequisite analysis test was carried out before testing the hypothesis, namely in the form of a normality test. The normality test aims to determine whether the data is normally distributed or not. Testing for normality uses the Microsoft Excel 2010 program count, namely the Chi Square method.

Hypothesis testing in this study is the results of students’ critical thinking skills using power point media, quartet card media, and virtual laboratory media and the influence of the media card quartet and virtual laboratory media on students’ critical thinking skills on excretion system material. The data is not normally distributed so that the hypothesis test used is the Sign Test.

Based on Fig. (3), the results of the control class pre-test post-test sign test are $X^2_{\text{count}} = 18.05$ greater than $X^2_{\text{table}}, \alpha 5% = 3.841$ ($X^2_{\text{count}} > X^2_{\text{table}}$), the pre-test post-test result for the first experimental class is $X^2_{\text{count}} = 21.043$ greater from $X^2_{\text{table}} = 3.841$ ($X^2_{\text{count}} > X^2_{\text{table}}$), and pre-test post-test result for the second experimental class, namely $X^2_{\text{count}} = 24.038$ is greater than $X^2_{\text{table}} = 3.841$ ($X^2_{\text{count}} > X^2_{\text{table}}$). Thus, it can be concluded that $H_0$ is rejected. All three have the same conclusion, but $X^2_{\text{count}}$ for second experimental class and first experiment is greater than $X^2_{\text{hitung}}$ for the control class, so it means that there is a difference in the average critical thinking ability of students in the control class, first experimental class, and second experimental class.

The next test is to find out how much influence the quartet card media and virtual laboratory cards have on students' critical thinking skills on the excretion system material by finding the difference in the average post-test scores for the control class and the experimental first class and second class. The difference in first post-test control class and Experiment is 5.58, and the second difference between the control class and the second experimental class is 3.61. So, the use of quartet card media and virtual laboratory have an effect on the critical thinking skills of students in the excretion system material for class XI MIPA at Senior High School 1 Sitiung.

4. Conclusion
Based on the research data and analysis, it can be concluded that there is a positive effect of learning with quartet card media and virtual laboratory compared to using power point media at Senior High School 1 Sitiung. This can be seen from the comparison of data analysis with the sign test for the critical thinking skills of the experimental class is higher than the control class. The contribution of research in the field of education can be used as a reference for improving the quality of learning and as an alternative to good learning media. This kind of research can be tested on more samples, so that the results can be more valid.
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