Scientific reasoning profile of junior secondary school students on the concept of static fluid

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Abstract. Scientific reasoning is one of the most important ability. This study aims to determine the profile of scientific reasoning of junior high school students about the concept of static fluid. This research uses a descriptive method with a quantitative approach to get an idea about the scientific reasoning of One Roof Junior Secondary School Student Kotabaru Reteh in Riau. The technique of collecting data is done by test of scientific reasoning. Scientific reasoning capability refers to Furtak's EBR (Evidence Based Reasoning) scientific reasoning indicator that contains the components of claims, data, evidence, and rules. The result obtained on each element of scientific reasoning is 35% claim, 23% data, 21% evidence and 17% rule. The conclusions of this research that scientific reasoning of Satu Atap Junior Secondary School student Kotabaru Reteh, Riau Province still in the low category.

1. Introduction
In science learning, scientific reasoning is one of the most important ability, because reasoning is involved in the process of analyzing/problem solving, integrating/synthesizing parts, planning experiments, drawing conclusions, generalizing, evaluating and proving, and generating these capacities in unusual problems [1]. Scientific reasoning is an anaytical using scientific logic as ewll as its own logic that contributes among others in critical thingking, ability to solve problems and it conducting scientific investigations.

Some understanding of scientific reasoning criminal terms which is expressed by experts such as: Scientific reasoning is the ability to infer based on the available evidence. The reasoning is the process of describing evidence [2]. Reasoning is the process of drawing conclusions from the principles and evidence to create a new conclusions or evaluating conclusions proposed [3]. Scientific reasoning as the ability to define science questions, ways to answer questions, analyze data, and interpret results [4]. Scientific reasoning is the cognitive skill required to understand and absorb scientific information that involves understanding, theoretical evaluation, statistics, and causal hypotheses [5]. Scientific reasoning includes the ability of thinking involved in an investigation, experimentation, evaluation of evidence, inference, and argumentation [6].

In a school-based process that is observed, the teacher simply explains, notes the formula and gives examples of questions. Students only take notes without any demonstration or experiment given by the teacher. So that students' scientific reasoning in learning is not trained at all. Many science teachers assume that they will bring the teaching of scientific reasoning by itself without the personal participation of students in the scientific process [7]. Scientific reasoning relates to abilities used in scientific practice and is related to the collection and analysis of evidence [8].
The ability of scientific reasoning is expected to increase if students are able to construct or construct their own knowledge through in-depth understanding. An investigation during the learning process can produce scientific knowledge through reasoning based on the evidence obtained [9].

2. Methods
This research was conducted on 20 students of class VIII in one of One Roof Junior Secondary School in Riau academic year 2017/2018. This research uses descriptive research to know students' scientific reasoning on static fluid material. The research instrument is an essay to measure scientific reasoning. The assessment of scientific reasoning refers to the Evidence Based-Reasoning (EBR) Pattern that contains the components of claims, data, evidence and rules [10].

Before this instrument is used in the research, first tested the validation of experts to correct the problem that has not been in accordance with the measured indicator.

Data has been collected and then performed an assessment for each question that has a score of one. After printing, the next step is to perform a percentage of each indicator of scientific reasoning ability, the percentage of the process is done by using the following formula:

\[
\% = \frac{\text{score each indicator}}{\text{total score each indicator}} \times 100\%
\]  

After that is done categorization for each indicator, that is grouping score obtained by student in very high category, high, low and very low. This categorization is adapted to the categorization ability according to Arikunto. Guidelines for scientific reasoning categorization of students as in Table 1 below.

| Percentage score (%) | Category       |
|-----------------------|---------------|
| 81-100                | Very high     |
| 61 – 80               | High          |
| 41 – 60               | Medium        |
| 21 – 40               | Low           |
| 0 – 20                | Very low      |

Student data and percentage will be used by the researcher to perform descriptive analysis. Descriptive analysis is performed to provide an overview and obtain complete information related to the scientific reasoning capability profile.

3. Results and Discussion
Scientific reasoning measured in this study refers to Evidence Based-Reasoning (EBR). The elements of reasoning are premise, claim, data, evidence, and rule. Claim is about a specific premise. This includes either what something will do in the future (prediction/presumption), or is happening in the present or past (conclusion or outcome). A claim could be expressed as a relationship among datapoints (evidence), statements about single datapoints (data), and statements of generalized relationships (rules); however, it is an isolated statement that is not used as backing.

Data is a supporting statement describing the outcome of a single specific experiment or a single observation in a personal anecdote or prior knowledge/books/tests in support of a claim. Evidence is a supporting statement summarizing a related set of data in support of a claim. Evidence is specific to the context in which the data were collected. It describes a contextualized relationship between two properties, a property and a consequence of that property, or a finding, rather than a general principle or law. Rule is a supporting statement describing a generalized relationship, principle, or law in support of a claim. This relationship is general in the sense that it is expected to hold even in contexts and circumstances not previously observed. The result of the research is the percentage of students'
scientific reasoning about the components of claims, data, evidence, and rules. The result of students’ scientific reasoning assessment on the concept of static fluid is presented as follows:

![Figure 1. Profile Scientific Reasoning Ability students to class XI of Static Fluid](image)

Figure 1 shows that students' scientific reasoning is low. It is known that the scientific component reasoning claim is 35%, 23% data, evidence is 21%, and the rule is 17%.

Scientific reasoning of students in claims is still not appropriate to answer the problem or phenomenon. Then in analyzing the data to support the claim is also not right. Then the data presented there is no analysis that supports the claim, so the data only write to answer questions only. In submitting evidence by giving examples in everyday phenomena, it is still not appropriate. Then to propose rules in the form of concepts related to the phenomenon is still very less. Therefore students' scientific reasoning has not been correct, so it is still low. This is in accordance with the results of students' scientific reasoning assessment by Daryanti [11] shows the students' reasoning ability is still low. The conclusion of the research by Rimadani [12] is students still in low level of category of scientific reasoning skills.

To follow up this scientific reasoning profile it is expected that teachers can improve the quality of better learning in schools by applying appropriate learning models and approaches. Duschl and Gitomer [13] said that very important to design instruction that students involve to build thinking patterns, reasoning and problem solving skills, this is it useful for preparing students to play a role in explaining science and designing an experiment.

4. Conclusion
Based on the results of research, it has been found that students' scientific reasoning is still low. It is proven to claim a 35% score, 23% data, 21% evidence, and 17% rules. This finding will be the basis for further research on innovative learning models and strategies that can improve student’s scientific reasoning ability.

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