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Scientific Reasoning Abilities Profil of Junior High School Students in Jambi

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ABSTRACT

This study aims to determine the profile of scientific reasoning ability of junior high school students in Jambi. The type of this research is descriptive quantitati while the research design using survey type cross-sectional design. The population in this study were junior high school students in Jambi City with a total of 25,789 students. The sampling technique used is cluster sampling. The sample used in this study is 1146 students from 15 schools with different accreditat n levels. Techniques of data collection of this study are using the problem of reasoning abilities from lawson's classroom test of scientific reasoning (CTSR) in 2000. The results showed that 100% of the sample is concrete. With the ability of Conservation of matter and volume as the most ability owned by students with the percentage of 16.1% and the lowest ability is the ability of Proportional reasoning with a percentage of 3.0%. This shows that students have not been able to use their reasoning for abstract things. In general, no reasoning ability that has a percentage of 50% indicates that students' reasoning ability in junior high school is still very low and fundamental.

Keywords: Profile, scientific reasoning, junior high school, Jambi city

INTRODUCTION

Physics is a branch of Science a scientific study of matter and energy and how they interact with each other. Through the study of physics, students are expected to develop rea ning abilities (reasoning) in the thought of inductive and deductive analysis using physics concepts and principles to explain natural events and problem-solvi both qualitatively and quantitatively. Scientific reasoning is one of the 21st-century science that is expected to be taught in science classes in an effort to prepare students for their success in facing the challenges of globalization (shofiyah et al., 2013)

The change of educational paradigm in the 21st century requires a student-centered learning design so that teachers must know how the nature of the students, and know the right way or approach in tying the ability that is the goal in education today. By knowing how the characteristics of learners then a teacher will be able to design an effective and interesting learning. The more teachers know about their students the more responsive the teaching will be.

One of the characteristics needed in the design of learning is the stage of development of learners. This developmental stage of the learner can be explained through the ability of scientific reasoning. By knowing the profile of this scientific reasoning ability, the teacher will be easy to determine the right approach and teaching method (Nehru and Syarkowi, 2017).

The low scientific reasoning of students can also be seen from the results of the PISA test in 2009. Indonesia in e PISA test, especially on the IPA scale, ranked 60 out of 65 countries and scored an average of 383 which is relatively low when compared with the average score set by OECD of 501

(OECD, 2009). For that reason, scientific reasoning ability should be trained and included in the process of physics learning. In addition, scientific reasoning is important because it represents the collection of skills and abilities needed to accomplish tasks in the process of scientific inquiry. This is demonstrated in a study conducted by Shayer and Adey for three years, one of which concluded that scientific reasoning ability has a correlation to science content learning outcomes (Shayer and Adey, 2006).

Although such scientific reasoning capability is necessary, the data on junior high school scientific reasoning is unknown. This is known from interviews to several physics teachers at SMP N 18 in Jambi, SMP N 19 in Jambi, SMP N 16 in Jambi, SMP N 17 in Jambi, and SMP N 22 in Jambi, that there is no data on scientific reasoning, other than that based on search results in the internet data for the ability to reason junior high school students in the city of Jambi is unknown (has never been studied or published). Whereas the data of scientific reasoning ability is very important in the learning activities and to determine the standard of laboratory activities or experiments and determine the extent to which the ability of students in inquiry. This test is done in junior high school because based on the age of child development, junior high school students have started to be in formal operation stage. Where at this stage, a child has mastered complex mental operations and concerns concrete and abstract concepts. So at this stage, a child is able to develop a hypothesis. Based on the above description it is necessary knowledge of the "scientific reasoning abilities profil of junior high school students in Jambi".

RESEARCH METHODS

The research design used is survey research design. Survey research is a procedure in quantitative research in which research administers attitudes, opinions, behaviors, or special characteristics of the population. This research collects data only at one particular time point not periodically, so the research design used is survey design type cross-sectional design (Creswell, 2015). The population of this study is all junior high school students in Jambi. Due to many populations then this research uses sample technique. The sampling technique used in this research is cluster sampling technique (area sampling). Cluster sampling is used to determine the sample when the object to be researched or the source of data is very broad, eg residents of a country, province or district (Sugiyono, 2016).

This research was conducted in several junior high schools in Jambi City. The population in this study is junior high school students in the city of Jambi with a total of 25,789 students. The sample used in this study is 1146 students from 15 schools with different accreditation levels. How to get random data with consideration of accreditation of the school. Based on the website of BAN-SM In Jambi, there are 44 schools that are accredited. With a sample size of at least ¼ of the total school total. A school accredited A of 32 schools, from the population taken 8. School accredited B as many as 9 schools, from the population is taken 4. Accredited schools C as many as 3 schools, and taken the three schools. So the number of schools to be studied there are 15 junior high schools, for each school taken sample 1 class each group study. As for the minimum number of used follow the formula Isaac and Michael. Where for the population of 25,789 students, the total sample size is as much as 334 students.

Quantitative data collection techniques using tests. The test is a data collection technique that is done by giving a set of written questions. Operationally the test can be defined a number of tasks to be performed by the test (Joni, 1984). The test is a method of psychological research to obtain information about various aspects of the behavior and inner life of a person, using measurements that produce a quantitative description of the aspects studied. This study aims to measure the ability of scientific reasoning, then the

instrument used to obtain data in this study is a matter of reasoning ability test from lawson's classroom test of scientific reasoning (CTSR) year (2000). The instrument used has been translated by Nurul Kamisani from Tadalako University and validated by A.Rusli from Parahiyangan University, Bandung in 2014.

Each reasoning problem is developed from six reasoning patterns. The pattern of distribution reasoning skills tested is listed as follows.

Table 1. Scientific Reasoning Abilities in Distribution of Reasoning Instruments

Scientific reasoning skills	Number test	The number of test
Conservational of matter and volume	1-4	4
Proportional reasoning	5-8	4
Control of variable	9-14	6
Probabilistic reasoning	15-18	4
Correlational reasoning	19-20	2
Hypothetical-deductive reasoning	21-24	4

(Source: Han, 2013)

Analysis of data used is descriptive statistics, statistics used to analyze data by describing or describing the data collected. Students' answers are assessed by the researcher, the students will be given a score of 1 is able to answer correctly on the questions and reasons asked. If the students only answer correctly on one of them (the question is correct while the reason is wrong or the question is wrong while the reason is right) or both are not right, then the score is 0. The first and subsequent numbers are so related that the maximum score is 12 and the minimum score is 0. Each student's score will be categorized into three categories of scientific reasoning ability (Deming and O'Donnell, 2011). Criteria for the category of scientific reasoning ability can be seen as follows.

Table 2. Scale categories of scientific reasoning ability

The ability of reasoning	Score
Formal	9-12
Transition	5-8
Concrete	1-4

(source: Han, 2013)

In addition, the scores obtained by students will be calculated average then converted into percentage form. Analysis of student answers in every reasoning pattern is also done. The total score of all students in each reasoning will be calculated and changed into percentages so that it can be seen which pattern of reasoning has the highest percentage and the lowest percentage.

RESULTS AND DISCUSSION

The research was conducted in several public and private junior high schools in Jambi namely SMPN A, SMPN B, SMPN C, SMPN D, SMPN E, SMPN F, SMPS G, SMPS H, SMPS I, SMPS J, SMPS K, SMPS L, SMPS M, SMPS N, SMPS O. The population in this study is junior high school students in Jambi city with the total number is 25.789 students. The number of samples used in this study was 1146 students from 15 schools with different accreditation levels. Each school consists of class VII 1 class, class VIII 1 class, class IX 1 class.

Profile of Scientific Reasoning of Junior High School Students in Jambi

The overall result scientific reasoning profile of Jambi Junior High School students' is as follows.

Table 3. The result overall of the scientific reasoning profile of junior high school students in Jambi

Categori	the number of students	percentage
Formal	0	0
Transition	0	0
concrete	730	100
numbers	730	100

The average result of scientific reasoning ability of junior high school students in Jambi City can be seen as follows.

Table 4. Average Scientific reasoning ability of junior high school students in Jambi City

Scientific reasoning skills	the average value
Conservational of matter and volume	16,1
Proportional reasoning	3,0

Control of variable	8,7
Probabilistic reasoning	5,1
Correlational reasoning	13,7
Hypothetical-deductive reasoning	6,1

Based on table 4, the highest scientific reasoning ability of junior high students is the conservation of matter and volume that is only owned by 16.1% of all students, it states that this capability only has 16 out of every 100 samples, and the most scientific reasoning ability of low is proportional reasoning that is owned only 3.0% of all students, which means that the scientific reasoning ability of junior high school students in Jambi is still low.

In this study 100% of samples are concrete. This indicates that the junior high school students of Jambi are only able to think logically through concrete objects, and it is difficult to understand things that are only represented verbally. From 15 0% schools with transition profiles, and 0% with formal profiles. This means junior high school Jambi reasoning is still low because each school only reached concrete reasoning. Thus scientific reasoning is very important in the learning process as well as to determine the standards of laboratory activities.

The ability of reasoning can bring about important educational implications. Very high reasoning skills are needed not only in making decisions and solving problems (Ding, 2011 & Lawson, 2004). Previous research has shown that there is a positive correlation between students on scientific reasoning ability and action of learning outcomes in science content (Lawson, 2000). The increased scientific reasoning ability significantly positively impacts the practice of learning. Instructions are not just enough to lead students to develop/improve abilities (Lawson, 2004). Instruction should be able to influence students to grow to the highest level. Therefore, teachers should be able to teach science as a critical inquiry process.

The highest scientific reasoning ability is Conservation of matter and volume. In this study, the highest scientific reasoning ability is the ability of Conservation of matter and volume that is only owned by 16.1% of all samples. From table 4.4 the ability of Conservation of matter and the highest volume at SMPS O is 29.6% and SMPS F is 28.0%. Percentages to higher Conservation of matter and volume capabilities indicate that some students have been able to use reasoning when it comes to field shapes or wake-ups, and can already log a volume-related issue.

The lowest scientific reasoning ability is the proportional reasoning. In this study, the lowest scientific reasoning ability is the average proportional reasoning ability that is only owned by 3.0% of all samples. From table 4.4 the lowest proportional reasoning ability in SMPS K, and SMPN N is 0,0%. Proportional reasoning ability is the reasoning ability of the two-variable system that has a linear function relationship that leads to conclusions about the simulation or phenomenon that can be marked about the constant ratio (Shofiyah et al, 2013). This lack of proportional reasoning ability makes it difficult for students to give proper conclusions in a learning process, besides that students will have difficulty in doing scientific activities such as high-level inquiry or problem-based learning.

CONCLUSION

Based on the above results and discussion it can be concluded that 100% of junior high school students in Jambi city have a concrete profile. This indicates that the junior high school students of Jambi are only able to think logically through concrete objects, and it is difficult to understand things that are only represented verbally. From 15 0% schools with transition profiles, and 0% with formal profiles. This means junior high school jambi reasoning is still low and fundamental, because each school only reached concrete reasoning. The highest scientific reasoning ability is the conservation of matter and volume that is only owned by 16.1% of all samples. This indicates that the scientific reasoning ability

possessed by junior high school students is still very basic. The lowest reasoning ability is proportional reasoning, which only has 3.0% of all samples.

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