Development of Two-Tier Multiple Choice Question Assessment Instruments for Measuring Science Process Skills Regarding Global Warming

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ABSTRACT

Psychomotor has many indicators, psychomotor indicators owned among students vary so that there needs to be improvements associated with psychomotor students. Psychomotor indicators have in common with the indicators contained in the ability of the science process skills, so that each student can improve psychomotor ability by improving the ability of the science process skills owned. In this study to measure the ability of science process skills that students have to use the instrument of evaluation of Two-Tier Multiple Choice Question, so the purpose of this research is to know the feasibility of Two-Tier Multiple Choice Question instrument to measure the ability of science process skills in junior high school students. This research uses research and development which is the learning evaluation instrument, by combining global warming science materials with the indicators in the ability of the existing science process skills. Implementation of this research was conducted by involving three schools is SMP N 1 Tasikmadu, SMP N 3 Karanganyar, MTs N Karangmojo. Based on the results of this study obtained the difficulty level about 44% easy and 56% medium category for first tier and 36% easy and 64% medium category for second tier. While for feasibility test of two tier multiple choice question evaluation instrument for first tier 40% enough and 50% good stated, while for second tier 44% enough and 56% good stated. From these two conclusions, it can be concluded that the Two Tier Multiple Choice Question evaluation instrument used is appropriate for use in learning.

Keywords: assessment instruments; science process skills; two-tier multiple choice questions; global warming

INTRODUCTION

In the education system, there are three interrelated things that are learning, development and education. The development is experienced and experienced by individual students, while education is an interaction activity. In the interactive activities, educators or teachers act to educate students. The act of educating is focused on the development of students become independent. To be independent, students are required to study [1].

Natural Science Learning (IPA) was invited to intersect directly with the natural surroundings. The aims are students can explore and understand the concept of science systematically through a deeper learning experience, so that science is not only the mastery of a collection of knowledge in the form of facts, concepts or principles but is also a process of discovery.

The result of a questionnaire of the need for science teachers of SMP / MTs in Karanganyar area between students' unresolvedness in science learning outcomes due to lack of practice about as part of the evaluation of learning. This resulted in the ability of students to be less honed and developed, in addition to the teacher for the assessment of haya techniques using the problem description and also a matter of ordinary double choice so as less able to know the progress and learning difficulties possessed by students. Assessment of the learning outcomes only measures the cognitive aspect does not pay attention to the science process skills possessed by students. This is because there is no instrument. The results of teacher needs analysis concluded that teachers need assessment instrument that can measure the skills of the science process.

The results of IPA study of SMP / MTs in Indonesia are still in the low category. It is seen from the data of Education Assessment Center (Puspendik) the average of National Exam results in junior high school / MTs in Indonesia from the last three years data obtained subjects average science with classification C.

From the last three years, data can be seen that science lessons in junior high schools / MTs in Indonesia is still low compared with other learning such as Indonesian and English.

This low learning outcomes of cognitive science may indicate a lack of students' science process skills. Harlen [2] explains that science process skills have a very important role in the development of knowledge (cognitive). Carrin and Sund [3] also explained that there is a relationship between process, attitude, and product. The result of cognitive learning is a product (knowledge) that is influenced by the process and attitude of students during the learning. Science lessons that less optimize aspects of process skills will ultimately have an impact on students' cognitive learning outcomes.

Scientific process skills are some skills to examine natural phenomena in certain ways to acquire science and science development [4]. Akinbobola & Afolabi [5] explain that science process skills are the cognitive and psychomotor skills used in solving problems. Scientific process skills are skills that scientists use in identifying problems, investigating, collecting data, transforming, interpreting and communicating. Integrated IPA learning should be packed with the base of learning Skills of Science Process so that learning can be effective with satisfactory results.

RESEARCH METHODS

This research is a research and development R & D that aims to develop a two-tier multiple choice question assessment instrument used to measure students' science process skills. The model used as the basis for the development of this assessment instrument refers to Borg and Gall [6].

Data collection techniques in this study by questionnaire, observation, and test. The type of data consists of qualitative and quantitative. The draft of the instrument is based on indicators that have been made before. Where the writing of questions is the translation of indicators into questions whose characteristics by the guidelines grid. Scoring model about two tier test using GRM. The scans on the two tier test will be presented *in table I*.

TABLE I. SCORING OF TWO TIER MULTIPLE CHOICE QUESTION

No	Aspect of Assesment	Score
1	No answer (TJ) or wrong answer-wrong reason (SS)	0
2	Wrong answer - right reason (SB)	1
3	The right answer-the wrong reason (BS)	2
4	The right answer-the right reason (BB)	3

RESULT AND DISCUSSION

The result of questionnaires needs from teachers of a science of SMP / MTs in Karanganyar area between students' unresolvedness in science learning outcomes due to lack of exercise questions as part of the evaluation of learning. This resulted in the ability of students less honed and developed, in addition to the teacher for assessment techniques only use the description and also the problem of ordinary double choice so less able to know the progress and learning difficulties owned by students. Assessment of the learning outcomes only measures the cognitive aspect does not pay attention to the science process skills possessed by students. This is because there is no instrument. The results of teacher needs analysis concluded that teachers need assessment instrument that can measure the skills of the science process. This development research is a TTMCQ assessment instrument to measure students' science process skills.

The initial design of the material is to create a concept map, combining science materials with the theme of global warming which regarding physics is the matter of heat transfer. It related to the way heat transfer by convection, conduction, and radiation on the process of heat transfer which is then exemplified in everyday life.

Chemical aspects of the substances that cause global warming, the gas triggers global warming such as carbon dioxide, methane, carbon monoxide and others that have something to do with the environment. The biological aspect relates to the impact that arises from global warming itself, such as the impact that may cause the immediate environment to have a direct and indirect impact. The initial design of the assessment is to make the cognitive test lattice, make two tier test questions as much as 25 questions, generate answer keys and assessment rubrics.

The draft of the instrument is based on indicators that have been made before. Where the writing of questions is the translation of indicators into questions whose characteristics by the guidelines grid. Scoring model about two tier test using GRM.

Validation results that have been implemented are used as the basis for the revision of assessment instruments. Validation is done Assessment (cognitive

aspect) using Aiken validation. Content validity is done by 12 experts in learning and evaluation. In this research, validation is done by 12 panelists, four experts from lecturers and eight experts from science teacher of SMP, from the validation result can be obtained conclusion of the instrument of valuation feasible to be used (good).

The product has been developed several times trial. The trials were conducted in three stages, i.e., limited-scale trials, medium-scale trials, and large-scale trials. The results of testing about cognitive problems in medium-scale trials are as follows. For reliability value for the first tier 0,731 and second tier 0,783 so it can be concluded that the instrument is reliable so that it has a good level of consistency or consistency. For the difficulty level the results obtained for the first tier 44% in the easy category, 56% medium category and for the second tier 36% easy category, 64% medium category. For the differentiating power the results obtained for first tier 40% enough and 60% good, while for second tier 44% enough and 56% good.

In the broad-scale trial stage, the Integrated TTMCQ IPA assess with the theme of Global Warming that has been through a limited-scale trial and medium-scale trials was applied to the experimental class in each school. Meanwhile, the control class did not use TTMCQ assessment.

The Integrated TTMCQ Assessment Tool for IPA with the theme of Global Warming developed serves as a guideline used in Integrated IPA learning. Also, TTMCQ assessment instruments developed can also be used to measure students' science process skills. The figure data on the increase of KPS in students is shown by the following 1, 2, and 3 figure.

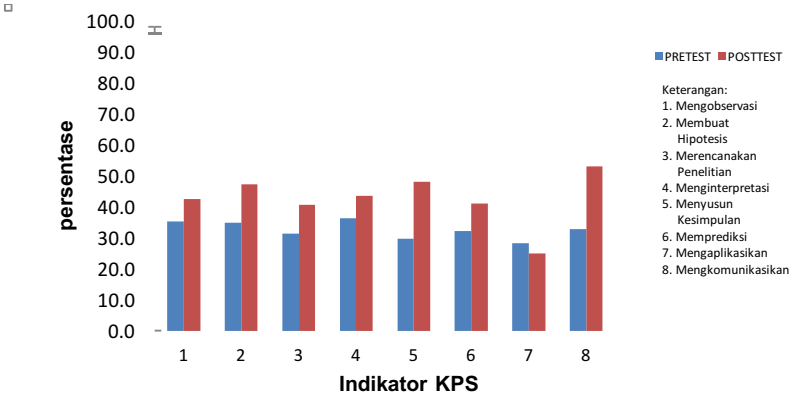

Figure 1. KPS SMP N 1 Tasikmadu

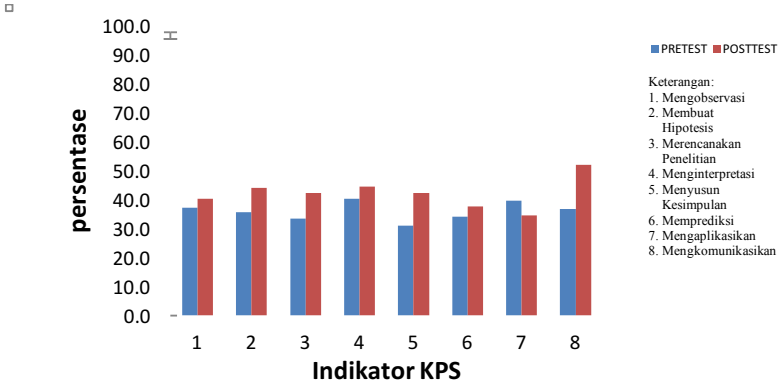

Figure 2. KPS SMP N 3 Karanganyar

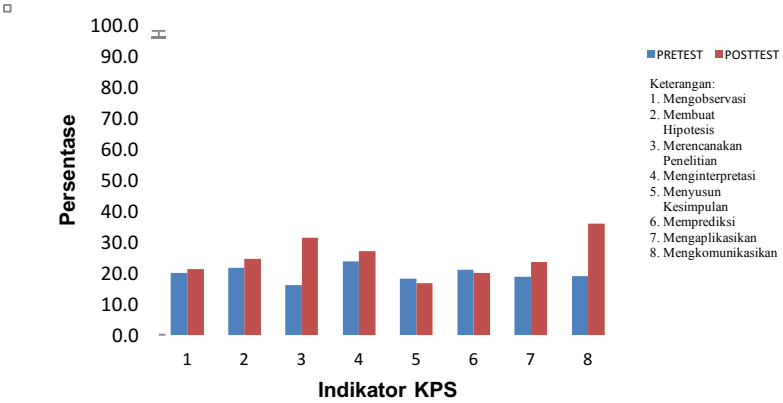

Figure 3. KPS MTs N Karangmojo

Based on the improvement of each KPS, it can be seen that the increase in KPS in SMP Negeri 1 Tasikmadu on indicators observes, hypothesizes, plans research, interpret, concludes, predicts, and communicates. Increasing PPP indicators in SMP Negeri 3 Karanganyar include observing, hypothesizing, planning research, interpreting, compiling, predicting and communicating. Increasing KPS indicators in MTs Negeri Karangmojo include observing, hypothesizing, planning research, interpreting, applying and communicating. As for the indicator that decreased from the three schools are not the same, for SMP Negeri 1 Tasikmadu and SMP 3 Karanganyar on indicators apply while for MTs Karangmojo on the indicators compile and predict.

In this study not only measure about cognitive but also psychomotor involving from students through practicum activity. The result of practicum activity is to make the students enthusiastic to have a significant influence on the KPS owned by each student because the students gain new experiences with practicum activities. It is not only the concepts and theories explained by the teacher but by the activities of the students can find the concepts and theories.

Explained by the teacher so that the concepts and theories can be understood by the students easily, the students not only imagine but the students can be directly involved in the discovery of the concept described in addition to the practice activities of students get new experiences related to practical activities

and can apply it directly. The results of this study are relevant to the research conducted by Feizioglu [7], which examined the effectiveness of laboratory-based learning on the students 'science process skills in chemistry learning, the results showed that the application of laboratory learning significantly influenced the students' science process skills. Similarly, a study conducted by Musasia [8], which compared experimental and control groups to physics learning, showed that experimental groups treated with practical learning had a higher mean value of higher science process skills than with the control group given the conventional learning treatment.

CONCLUSION

Based on the research that has been done, it can be concluded as follows: TTMCQ feasibility has been tested good validity by the expert, high reliability, has a difficulty level with the proportion 44% easy, 56% medium for the first tier, while for the second tier 36% easy and 64% medium. The percentage of 40% is enough, 60% is good for the first tier whereas for second tier 44% is enough and 56% good, besides the practicality level of matter which is appraised good meaning worthy to be used in learning.

SUGGESTION

The results of the research have led to the increase of Science Skills (KPS) score using the Two-Tier Multiple Choice Question assessment instruments; it is necessary to conduct study and assessment which refers to the improvement of KPS with different materials using guided inquiry approach and for assessment using the Two-Tier Multiple Choice Question.

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