

SCIENCE WRITING TEST DEVELOPMENT FOR JUNIOR HIGH SCHOOL STUDENTS

Abdul Haris Odja

State University of Gorontalo
abdul.haris.odja@gmail.com

Abstract

The study was aimed to develop a writing test in science based on the concepts of science in Junior High School. The research was a part of learning development to improve writing skills in science. Test adapted and adjusted from written expression in science developed by Wang, *et al* (2011). The components of this written test in science consisted understanding science vocabulary, identifying a problem to be investigated, providing evidence in responding to the question, drawing evidence-based explanations. Assessment of the test was carried out through expert validation and test the sensitivity of the test. The results of the expert assessment showed decent test used with some revisions. While the overall sensitivity of the tests included in the sensitive category with average numerical value sensitivity is 0, 57. If the terms of each indicator successive test values numerical sensitivity were 0.40, 0.66, 0.47 and 0,75.

Key Words: *writing in science test, Concept Heat, and Junior High School*

I. Introduction

One of the competencies associated with literacy, science, and problem solving is the ability to write mainly associated with science. It's like being dictated by the Hand, Prain, & Wallace, (2002); Dlugokienski, Amy, & Sampson (2008) that writing is one of the important aspects of scientific literacy. Science Writing is seen as science aspects of teaching science that closely related, for example after an observation activity, learners are required to communicate the results of observations both orally and in writing. Verbal communication has better chance for learners to communicate than in writing.

Writing skills practice of schools charged to one of the subject that both are Indonesian or another foreign languages subject. Meanwhile, on other subjects show that writing isn't a concern. Through giving more attention to communication skills of learners to communicate knowledge through writing, teachers can make the writing skills that relate to a topic of science in evaluating how much understanding and problem solving skills of learners related to specific science concepts.

The enthusiasm and the learners' ability to write scientific in Gorontalo area are low. Based on the data, it was found that (1) at the time of writing

competition scientific organized by APKASI (Association of District Government in Indonesia) for senior high school in Gorontalo only one that meets the requirements of scientific writing (APKASI , 2013); (2) For the activities of scientific writing competition teenager in 2015 by LIPI, followed by junior_ and senior high school, the views of the participants, none representative of learners was from Gorontalo (LIPI, 2005) .The low interest of scientific writing skills was not only due to the inability of learners in writing in Indonesian language but also the inability of students to communicate phenomena or issues around it.

To measure the writing skills for students of junior high school especially those related to science writing test is required. Writing tests are used as a selection on the activities of scientific writing competition usually is raw scientific writing. Meanwhile, the writing skills of learners, especially in elementary and junior high school does not include all of scientific writing skills. Some of the writing test that has been developed among others such as writing a refutation of an event, a scientific explanation and scientific expression.

In this study, the writers developed a test measuring the ability to write science by adapting and adjusting the expression of science writing test developed by Wang, *et al* (2011). For that reason, the selection of expression science tests include: (1) test was developed in accordance writing skills of students in elementary and junior high school; (2) test relates to the concept of science.

Writing in Science

The learners must be given a lot of opportunities to practice writing at the time of elementary and junior high school. When the language skills increased their cognitive, usually writing skills also improved. For example, a better understanding of the syntax and grammar will help strengthen writing skills. The students write recount, describe and writing a short poem in elementary level. At the junior high, the students are able to make book combines narrative reports on observations, reflections, and analysis. In high school, they were able to give an explanation that does not depend on the structure of the narrative only (Santrock, 2011).

Writing is also an important aspect of scientific literacy (Hand, Prain, & Wallace, 2002; Dlugokienski, Amy, & Sampson, 2008). Writing for learning is an

activity in which the students produce and clarify understanding of scientific concepts to themselves not only for the evaluation of teachers but also to communicate. Learners can communicate their understanding of a particular concept in the form of some kind of writing. It's something complex cognitive processes. The ability to write follows the sequence of the development of learners (Slavin, 2006). In junior high school, students are engaged in the concrete operational stage to write something never done (concrete). In this study, learners were trained to write those relating to observations made in the laboratory or in the classroom.

Writing science is important for learners because it enables them to clarify the scientific phenomenon observed and to help build scientific knowledge and experience of the investigation. Writing strategies to learn science is seen by many teachers to help students build a deeper understanding of science concepts being studied. The investigation is expected to make learners demonstrate writing skills to explain something like: communicating the event, explained the procedure, to communicate, to explain the observations based on evidence. Science Writing Heuristic is one instill literacy practice in scientific investigation, has helped promote and metacognitive explicit explanation of the conceptual understanding. (Fazio & Gallagher, 2009).

Writing Assessment

Several researches related to writing skills in science were developed by Dlugokienski, Amy, & Sampson (2008); McNeill & Krajcik (2008/2009) and Wang, *et al* (2011). Dlugokienski, Amy, & Sampson developed writing refute. McNeill & Krajcik developed writing scientific explanations since 2006. Then, Wang, *et al*. developed written expression in science in 2011. All three strategies of science writing focused on elementary school students, junior high and senior high schools.

Strategy development and assessment are all three forms of writing have some differences and similarities. The equation of the three writing in science is the three discuss or focus learners in communicating scientific phenomena which exist

in science concepts. There are differences in strategy and assessment of each type of writing.

Assessment of write a refutation, rebuttal is being focused on mistake or error about science concepts. Denial or rebuttal evidence is based on investigations, laboratory experiments for the topic under discussion while it is accompanied by convincing examples. It is also about regulating aspects of literary sentences, paragraphs, and a conclusion. In addition, it discusses the use of the right language, punctuation, spelling errors. Learning and assessment strategies are divided into three main parts: first write an outline or major things; The second and third write a rough draft write the final draft.

Assessment of writing scientific explanations by McNeill and Krajcik consists of three aspects of the assessment that claim, evidence and reasoning. Claims relate to the initial answers on questions or problems. Evidence is scientific data to support claim, the data must be appropriate and sufficient to support the claim. And also the data can be sourced from the lab or the other. Reasoning components is a justification that connects between the claim and the evidence using the scientific principle of adequate and appropriate.

The components of this written expression in science consists of understanding science vocabulary, identifying a problem are to be investigated, providing evidence in responding to the question, drawing evidence-based explanations. Understand the vocabulary of science is to provide a full written explanation with examples and events, the description of what is observed that demonstrate an understanding of the vocabulary of science. The second component is identifying problems i.e., investigating writing scientific-oriented questions, including questions descriptive and rational. The third component provides evidence that in response to questions by identifying, distinguishing and comparing the facts and evidence. The last component is ratings writing expressions that portray the evidence-based explanations which the participants are asked to observe the patterns and relationships; logical descriptive and provide evidence-based explanations. It appears that both instruments show the same thing that convey initial answer according to the problems, provide evidence and give an explanation.

II. Method

The study is part of research learning model development which in some extent resembled to the method of research and development (R & D) using Borg and Gall model (2003). This study employed three main steps: (1) a preliminary study, which consisted of a literature study and survey of spaciousness; preparation of preliminary tests; (2) the development of models, including trial tests on a limited basis; (3) test models, covering widely the test trials. This paper discusses limited test models.

The product developed should fulfill the standard of a good test. A test instrument is said to be good if it meets several criteria such as validity, and sensitivity, reliability. In this study, science writing test was examined in terms of validity testing expression and reliability tests earlier by Wang, *et al* (2011). The test was conducted by the author, namely the validity of the expert and the sensitivity of the items. It was related to the content of material science and the impact of learning developed.

The test is claimed to have a high sensitivity when the test scores after learning greater than the test scores prior learning. An otherwise sensitive items when the price of precious sensitivity positive for $S \geq 0.30$. The equation is used to calculate the sensitivity of the items adapted Mehrens & Lehman and Osuji (Suyono, 2014), namely:

$$S = \frac{U_2 - U_1}{N}$$

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Equation (1)

Where : U_2 = Average Post Test Score, U_1 = Average Free Test Score, N = Score maximum.

III. Result and Discussion

Test arrangement was based on a science test expression by Wang, *et al* (2011). Adaptations and adjustments were made based on the test necessity. Some adaptations were made included: the science of expression test using the image as a reference while writing the tests compiled using the results of observations discourse or text. Discourse (text) presents the results of observation laboratory activities, some things that concern learners in science writing test (1) Writing a sentence questions or issues that were investigated in the discourse, the prediction

of the question, as well as other questions that could be investigated in addition to the previous question; (2) write down the steps being taken to make observations along with the materials and equipment used during the observation; (3) organizing data, analyzing the data and concluded the results of observations by the existing discourse.

Expert assessment of tests was done by 6 (six) persons who had expertise on science education and evaluation. Expert assessment of the science writing test was conducted by giving valid and invalid statements. The assessment also provided the final conclusion decent ratings by giving a statement of judgment whether it should be revised or was feasible to use. The expert result of assessment science writing test indicated that the test was valid with a few notes for improvement. Some advices for revision by experts were given, including a revised assessment rubric on indicators of questions or issues that were investigated, discourse or text on the observation made more compact so that learners could develop the ability to write more science, sentences and language was improved by adapting to the learners development.

Sensitivity items were determined after the implementation of learning. At this stage, the experiment was limited to models developed. The items were sensitive when the numerical value of precious sensitivity was positive for $S \geq 0,30$.

Table 1. Numerical Value Sensitivity Test of Each Writing in Science

Indicator writing in science	Average score Pre-Test	Average score Post-Test	Numerical Value Sensitivity Test
Science Vocabulary	46.00	97.00	0.40
Identifying a problem	33.00	118.67	0.66
Responding to the question	54.50	114.50	0.47
Based Explanations	6.25	103.00	0.75
Average			0.57

The table showed that the overall sensitivity of the test writing in science included sensitive, where the numerical values was $S = 0,57$. Similarly in terms of each indicator on writing in science sensitivity the numerical value was above 0, 30. This indicated that the test writing science arranged could measure the impact of learning that has been implemented so that the items in the test writing science functioned well.

The sensitivity of the items was associated with learning activities that have been done before.. Learning was designed with a specific purpose such as to develop a high level thinking skills. Through exercises, the indicators of expected learning objectives could be achieved. The goal achievement of learning could be measured by the ability of learners complete a test.

As noted above, that the development of science writing test was part of the development of the learning model. Learning model was developed directly or indirectly indicator practice to the ability for write scientific phases of learning. The phase of learning was writing science practice indicators including the orientation phase problem, in which in this phase, the learners were trained to ask about matters related to natural phenomena presented teachers. Questions directed into a scientific question could be investigated. Observation phase was to drill to solve the problems based on questions of investigation. Learners were trained to plan in response to questions through observation well on lab activities or observations on a specific object. Explanation phase provided an explanation on the results of observations. Learners were provided with an explanation based on the observation. Observation data was analyzed and the range of interpretation so as to produce a scientific explanation for an observed phenomenon. The last phase was communication in which the learners reported all stages of observations which gave more emphasis on written communication. On the whole phase, the learners were guided to understand the concept that learned comprehensively.

IV. Conclusion

Based on the discussion, the conclusions of the study were drawn as follows:

1. Tests developed science writing was declared as valid by experts in the field of science education and education evaluation.

2. Sensitivity test writing in science was supposed to be sensitive based on the categories with average numerical value sensitivity which indicated 0,57.
3. Sensitivity test related to the learning was done in advance so that necessary attention to the learning objectives developed relationship with tests created.

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