THE DEVELOPMENT OF A SET OF INSTRUMENT FOR STUDENT PERFORMANCE ASSESSMENT IN THE PHYSICS LABORATORY WORK SUBJECT OF JUNIOR HIGH SCHOOL

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Abstract

This study aims to develop a set of instrument for the measurement of the laboratory work ability performance on physical subjects of junior high school students to measure the writing the report lab work' ability performance on physics subjects. This research was conducted through three stages, namely: the initial instrument development, the try out, and interpretation of the measurement result. The initial development stage included instrument writing, reviewing and validating of the blue print of the instrument, items, and assessment guidelines. The content validation was carried out by the measurement experts, physical education specialists, and teachers physics through forum group discussion (FGD).The instrument that had been validated was tried out to 54 students by involving three raters. Interpretation of the measurement results be described using the total score as the basis for the categorization of assessment. The results of the development a set of instrument for the measurement of the preparation of laboratory reports ability performance on physical subjects of junior high school students, aspects that measured include: statement of the problem, experimental design, data collection and display, data analysis, and conclusion. The reliability index of the instrument try out is at the exellent category of 0.858. The results of measurement showed that the preparation lab report ability performance on physics subjects scores are dominantly in the second and third categories out of the four categories. Thus, the writting of lab work reports ability performance of physical subjects of junior high school students are not satisfactory.

Keywords*: Performance Assessment, Lab Work Reports, Physics Subject.*

Introduction

Peraturan Menteri Pendidikan dan Kebudayaan RI Number 66 Year 2013 concerning assessment standards states that the assessment of learning outcomes by educators conducted on an ongoing basis is intended to monitor processes and progress of the students and to enhance learning effectiveness. Assessment in the field of education by educators is absolutely necessary to continuously monitor progress in students' ability. Therefore, assessment should be preceded by identifying indicators of learning outcomes and then continued with the application of an assessment technique that is relevant to the learning model that is used.

According to Sterling (2005: p. 33), effective assessment should be related to the ways the learning activities are carried out, and the results can be used to indicate the learning outcomes. The learning objectives one of them can be achieved through an assessment cycle that consists of diagnostic assessment, formative assessment, summative assessment, and

confirmatory assessment. The diagnostic assessment is made before a course begins. The goal is to find out what students already know about the concepts to be discussed in a course. Formative assessment is made throughout the course and this type of assessment should be done in each face to face meeting in the form of short items to monitor progress that students make. Summative assessment is done at the end of a course to assess whether students have learned about the concepts taught in the course. Confirmatory assessment is made a while after a course has ended to test knowledge retention.

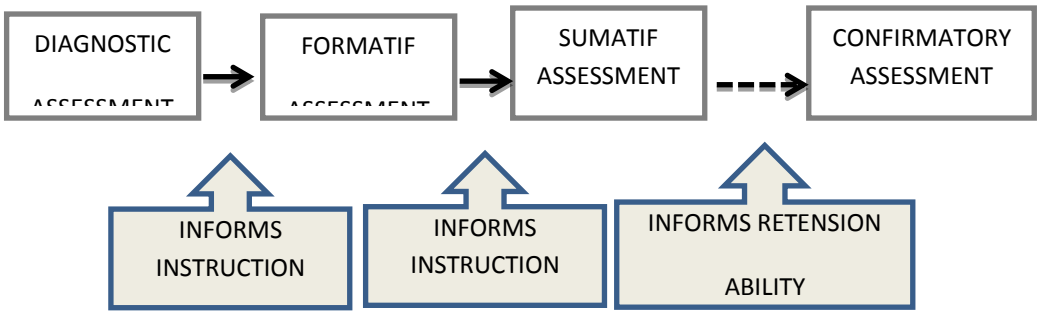

Figure 1. The Learning Assessment Cycle

Glencoe science (t.t.: p.3) split features of educational assessment into two, namely traditional assessment features and performance assessment features. The traditional assessment features include basic knowledge, knowledge processes, content of the knowledge, and problem solving. The performance assessment features include basic knowledge, group learning, self-assessment, application of skills, creative designs, authentic application, creative products, and application of all the skills that the students have mastered. Traditional assessment is a type of testing through the method of paper and pencil test, for examples, multiple choice, true-false, and matching. Another form of this paper and pencil test method is to ask testees to write down their own responses, such as in open-ended questions (essay), either short essays or free essays.

Quellmalz & Schank (1999: p. 2) state that performance assessment is generally intended to examine the knowledge and deep understanding of the students regarding the concepts and strategies of investigations, to make them actively think, and to measure their skills in communicating their understanding. This performance assessment method, according to Ruiz-Primo & Shavelson (1996: p. 1047) and Shavelson. et. al. (1992: p. 23), consists of: (1) direct observation, (2) notebooks, (3) computer simulation, and (4) paper and pencil test.

The 2013 Curriculum (Kurikulum 2013) puts an emphasis on performance assessment to determine students' achievement of competences which include knowledge, skills, and attitudes. The focus is on their successful learning outcomes which meet the specified

competence standards. The impacts that may arise are that teachers can enrich ideas to help make the most of students' ability to think. Based on the preliminary survey conducted in junior high schools (SMP) in DIY, it is revealed that physics practicum has not been assessed using this performance assessment. This is because of the unavailability of such an assessment instruments. Thus, research on the development of an assessment instrument which measures students' performance on the inquiry-based physics lab work which meets the validity and reliability as an alternative assessment format is necessary. Based on the foregoing, the objectives of the present study can be formulated as follows: (1) To develop a performance assessment instrument that meets the requirements of validity and reliability to measure Junior High School students' ability in writing the report of their lab work physics, and (2) To describe the ability of the students in the research site in writing the report of their physics lab work.

Research Method

This research employed a quantitative approach. The research subject consisted of Junior High School students and physics teachers as a rater. The research sample consisted of the students of SMP Negeri 15 Yogyakarta Class VII-B and VII-F with the physics teachers of Grades VII, VIII, and IX of the school as raters.

The stages to develop the performance assessment instrument to measure the ability to write the report of physics practicum referred to instrument development procedures proposed by Oriondo & Dallo-Antonio (1984: p. 34). Those stages of instrument development include: planning assessment, trying out the instrument, establishing instrument validity and reliability, and interpreting the assessment scores.

The stage of *planning assessment* began with arranging the learning continuum in the ability to write the report of physics practicum as the basis to develop the blueprint for the development of the assessment instrument. The blue print for the development of the performance assessment instrument for physics practicum reports covers a number of aspects of assessment, namely: identification of reports, statement of the problems, the experimental design, data collection and display, data analysis, as well as conclusions and suggestions. Preparation of the items to be assessed was based on the formulated blue print of the instrument development. The performance assessment instrument to measure junior high school students' ability to write the report of physics practicum consists of as many as 24 assessment items. The checklist model was used as the assessment format.

The content validity of this performance assessment instrument to measure the ability to write the report of physics lab work was obtained through *Focus Group Discussion (FGD)*

which involved measurement experts and physics teachers. Based on the results of the FGD, it is suggested that: (1) all the aspects of assessment, and assessment items developed by the researcher met the criteria of fit for use as an assessment instrument, (2) the performance assessment instrument try out was conducted at SMP Negeri 15 Yogyakarta with the students of Class VII-B and VII-F as the respondents, (3) the materials were about temperature and calor because these materials were discussed at the time of the research was conducted, and (4) raters that participated in this research consisted of one physics teacher of Grade VII, one physics teacher of Grade VIII, and one physics teacher of Grade IX as the representative of each grade.

The reliability of this performance assessment instrument to measure the ability to write the report of physics practicum was obtained using the following methods of estimating reliability: *interclass correlation coefficients* (ICC) and *Cronbach's alpha coefficient*. Criteria for the assessment instrument to have good reliability are if the ICC ≥ 0.60 and the Cronbach's alpha coefficient ≥ 0.70. The relationship between the ICC coefficient and the Cronbach's alpha coefficient (α) is formulated as follows.

$$ICC = \frac{MS_{people} - MS_{residual}}{MS_{people} + \left(df_{people}\ x\ MS_{residual}\right)}$$

$\alpha = \frac{k\ x\ \text{ICC}}{1+(k-1)x\ ICC}$ where k = the number of raters.

Interpretation of the score obtained from the performance assessment for the ability to write the report of physics practicum was made based on the attained criterion scores of the students in the research site. The scoring was done by trained raters consisting of three physics teachers and the results of the assessment by the researcher served as the benchmark. The scoring was done by putting a V sign in the column "Yes" when the sub-aspect being assessed is indicated in the physics lab work report notebook. The total score is obtained by summing all the (V) signs in the column "Yes". The criterion score was calculated using the following formula:

$$Score\ Criteria = \frac{Total\ Score}{Sum\ of\ Items} X\ 100\%$$

The criteria to obtain a score of 4, 3, 2, and 1 are that if ≥ 86%, (85-70)%, (69 -56)%, and ≤ 55% of the elements in the performance assessment can be done by the students, respectively. Qualitatively, the scores by 4, 3, 2, and 1 each have the following meaning: 4 = satisfactory, 3 = weak, 2 = inadequate, and 1 = unsatisfactory. The summary of the results for the assessment of the Junior High School students' ability to write the report of physics lab

work are presented in frequency distribution and percentage according to the scores of criteria of achievement.

Findings and Discussion

The results of the performance assessment instrument development for junior high school students' ability to write the report of physics practicum that had been validated by the experts through FGD are presented in Table 1 below.

Table 1.
Aspects and Sub-aspects of the Ability to Write the Physics lab work Report

No	Laboratory report Abilities Elements of Performance assessment	Assessment Point		
		Points Possible		Criteria Score
	Identification of report	Yes	No	
1.	The title clearly the independent and dependent variable	◯	◯	
2.	Name of experimenters is given	◯	◯	4 ◯
	Statement of the problem			
3.	The background for the problem is summarized	◯	◯	3 ◯
4.	Relevant literature is cited	◯	◯	2 ◯
5.	The hypothesis is stated clearly	◯	◯	
6.	It predicts the influence of the independent variable on the dependen variable.	◯	◯	1 ◯
	Experimental Design			
7.	The prosedur for controlling and measuring variables through repeated trials is easy to follow.	◯	◯	
8.	The experiment procedure is complete and clear enough that another person could carry it out	◯	◯	
9.	The experimental design tests the prediction	◯	◯	
10.	A compele list of required materials is provided	◯	◯	
	Data collection and display			
11.	Appropriate tools and materials are selected to collect the data	◯	◯	
12.	The data table included the appropriate data.	◯	◯	
	Data for the for the independent and dependent variables are clearly shown.			
13.	An appropriate type og graph is used. The independent variable is put on the x- axis and the dependent variable is put on the y-axis	◯	◯	

14.	The graph should reflect any uncertainty of measurement.	◯	◯	
	Data analysis			
15.	The analysis includes all the data.	◯	◯	
16.	The relationship between the dependent and the independen variables is clearly described.			
17.	The analysis includes appropriate mathematics prosedure			
18.	The analysis includes appropriate statistical procedures.	◯	◯	
19.	The analysis is accurate and thoughtful	◯	◯	
	Conclusion and suggestion			
20.	The hypothesis is evaluated clearly	◯	◯	
21.	Conclusions are reasonable given the observations made and the observer's prior knowledge.	◯	◯	
22.	Conclusions are explained and justified based on the observer's prior knowledge	◯	◯	
23.	Recommendations are made for further study.	◯	◯	
24.	References in the bibliography are make properly	◯	◯	
	TOTAL SCORE			

This performance assessment instrument for the ability to write the report physics practicum had been tried out to 54 Grade VII students of SMP Negeri 15 Yogyakarta. The trial involved three raters consisting of three physics teacher each from Grades VII, VIII, and IX. The materials in this assessment were *Temperature and Calor*. The assessment data gathered during the try-out were analyzed using the methods of estimating reliability, namely *interclass correlation coefficients* (ICC) and *Cronbach's alpha coefficients* with 95% confidence interval and the following results were obtained: ICC = 0.688 and Cronbach's Alpha (α) coefficient = 0.858, meaning that the resulting estimated reliability coefficient of the instrument belongs to a good category. This implies that this performance assessment instrument for the ability of junior high school students to write the report of physics practicum already has good inter-rater reliability.

Table 2.
Estimated Reliability of the Instrument

MS_p	MS_r	k	df	ICC	α-Cronbach
0.613	0.111	3	2	0.602	0.819

The results of the performance assessment for the ability to write the report of physics practicum of Grade VIII students of SMP Negeri 15 Yogyakarta with the scoring criteria

from 1 to 4 are presented in Table 3. Based on the frequency and percentage of the attained scores, it can be concluded that the ability to write the report of physics practicum of Grade VIII students of SMP Negeri 15 Yogyakarta belongs to the unsatisfactory category.

Table 3.
Results for the Measurement of the Ability to Write the Physics lab work Report

Criteria score	Frequency	Percent
1= unsatisfactory	1	1.9
2= inadequate	20	37.0
3=weak	33	61.1
4=satisfactory	0	0.0

Conclusions and Suggestions

Conclusions

Based on the research findings, the following conclusions can be made:

1. In relation to the performance assessment instrument for junior high school students' ability to write the report of physics practicum, the following can be concluded: (a) The aspects of assessment covered the ability to: identify the report, express the problems, employ the experimental design, collect and display the data, analyze the data, as well as draw conclusions and suggestions. (b) The format of assessment employed the checklist model consisting with 24 items of assessment. (c) The content validity of the instrument was obtained through Focus Group Discussion. (d) Qualitative estimation of the reliability of the instrument is considered good.
2. The ability of the students of SMP Negeri 15 Yogyakarta in writing their physics lab work report is considered unsatisfactory.

Suggestions

Based on the concluded findings of the research, the following suggestions can be made:

1. It is important to conduct training in how to develop a performance assessment instrument for the ability to write the report of physics practicum intended for physics teachers that are not members of the FGD.
2. Physics teachers in Junior High Schools can employ this performance assessment instrument for the ability to write the report of physics practicum which results can be used as learning assessment.

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