THE DEVELOPMENT OF SET ACTIVITY BASED ASSESSMENT (ABA) TO MEASURE STUDENT'S SCIENCE PROCESS SKILL IN BASIC PHYSICS PRACTICUM COURSES II

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ABSTRACT

Written Test-based assessment system can not assess the whole of students activity in the lab. The activity in the form of process skill is not measurable, causing practicum lectures goal to develop these skills have not been achieved. This development research, which aim to obtain the development Activity Based Assessment (ABA) set which are valid, reliable, practical and effective in order to measure students' science process skill in basic Physics II. Data processing research to test the validity and practicality done by calculated the average scores, reliability done by Alfa Cronbach reliability coefficient and agreement coefficient, while testing of the effectiveness done by *Intraclass correlation coefficient* (ICC) test and the average percentage. The set of ABA is valid by the validator since the average score of SAP validation is 3,71; guide practicum book is 3,23; content validation of ABA is 3,39; construct validation of ABA is 3,23 from maximum score is 4,0. The result experiment of ABA shows that the empirical validity of pre-lab instrument is 0.74 (valid), the realibility is 0.77 (quite high), the empirical validity of lab activity instrument is 0.97 (valid), the reliability is 0,83 (high), the empirical validity of lab report instrument is 0.92 (valid), the reliability 0.72 (quite high), the emperical validity of lab presentation instrument is 0.98 (valid), reliability is 0,7 (quite high). The result of learning set effectivity after experiment are as follow: (1) the assessment carried out by 8 observer to the ABA instrument have *Intraclass correlation coefficient* (ICC) value between 0,626 to 0,938 or exceed the consistency standards resulting in a very high consistent category; (2) students' science process skill is increase and place in level III; (3) the score average of student practicum using the ABA is over KKP (i.e.70). ABA set is stated practical based on the average of positive responses from lecturer and lab assistant that is 97,1% (very good) and student responses is 83% (very good). Based on the result of the analysis and discussion that ABA are valid, reliable, and effective for measuring the student's science process skills. In order to lecturers and lab assistants can use the ABA set as an alternative assessment.

Keywords: Set development, activity-based assessment, and science process skill.

1. Introduction

As an integral part in the learning process, the assessment should be one of the competencies required of an educator. Assessment should be done properly and appropriately and meet the principles of valid, objective, fair, integrated, open, inclusive and sustainable, systematic, beracuan criteria, accountable and educative..

According to Benjamin Bloom (Carin, 1993), there are three areas to focus assessment in educational purposes, namely (1) the cognitive aspect revolves around the knowledge (intellectual) that has a lot to do judgment, (2) the affective aspect that shows the attitude, and (3) aspect includes motor or psychomotor skills. It is clear that in addition to knowledge assessment, educators are also required to assess the skills of learners. Specialized in science learning, assessment can be defined as an activity that

brings the content, the process of science and scientific attitude (Rezba, 2007). Science learning assessment should being conducted to assess learners' progress in achieving the science process skills in addition to assessment context and scientific attitude.

Process skills are skills related to the physical and mental abilities are fundamental owned, controlled, and applied in a scientific activity, so the scientists managed to find something new (Semiawan, 1992). Specialized in physics learning process skills are the result of learning obtained in the form of the ability of learners owned, controlled, applied in a scientific activity like doing physics activities practicum.

Course practicum Physics II with a load of 1 SKS, providing considerable benefit in practice the skills that students need and provide skills development opportunities as much as possible and

the process of scientific attitude. According Woolnough and Allsop (Rustaman, 1995), there are at least four reasons stated by experts of science education on the importance of practical activities one of which, the lab can develop the skills base and the integration process of learners.

Thus, lecturers practicum courses Physics II are required to design a practicum with the assessment process that can provide information not only knowledge but also skills of learners as a whole. Based on in-depth interviews to lecturers and lab assistant Department of Physics FKIP UNTAN, assessment used in practical activities Basic Physics II is 10% attendance of students, 20% pre-test / post-test, 30% report the results of lab work, and 40% of the response at the end of the entire lab activities. In line with the research Banggali, et al. (2011) which states that the assessment is only seen practicum students from pre-assessment lab to giving assistance practical implementation, assessment of practical reports and votes after the final exam lab. It is seen that the assessment process is still based on paper and pencil tests only measure knowledge (pre-test / post-test and the response) and the results / products lab without involving the entire student activities. If the system is sustainable, then the student process skills can not be measured.

Based on the facts on the ground, it needs an instrument-based assessment activities (Activity-based Assessment / ABA) to measure the skills of the students in the lab Physics II, the formulation of the problem in this study, namely: (1) how the characteristics of the ABA in the course of Practicum Basic physics II to measure skills students process ?; (2) whether the ABA developed a valid and reliable ?; (3) whether the ABA tools to effectively measure the skills of students in a practicum course Physics II ?; and (4) whether the ABA developed practical tools to measure the skills of students in a practicum course Physics II?

The purposes of this study, namely: (1) to describe the characteristics of the ABA in the course practicum Physics II to measure the skills of the students, (2) determine the validity and reliability of the device ABA developed, (3) analyze the effectiveness of the ABA in measuring the skills of the students in practicum course Basic Physics II, and (4) analyzing the practicality of the ABA in the measuring process skills of students in a practicum course Physics II.

2. Research Methods

This study uses research and development is the development of devices Activity-based Assessment (ABA) to measure the skills of the students in the practicum courses Physics II which meet the criteria for a valid, practical, and effective. The study design was adapted from a research procedure Sugiyono (2013) which has been modified, namely: analysis of the problem, gathering information, pengemangan design, design validation, analysis and design revisions based validation experts, product testing, analysis and revision of products based on product trials , utility testing, and the final product. The research instruments used to collect the data consist of the validation sheet, preliminary tests, observation sheet activities and questionnaire sheet. Data collection techniques used in this study is the testing techniques, observation, interviews and questionnaires.

Data obtained from the validator analyzed descriptively by examining the results of an assessment of the ABA Device. Validator assessment results are used as inputs to revise / repair device developed by kriteria $1.00 < V_a \leq 1.75$ (not valid); $1.75 < V_a \leq 2.50$ (less valid); $2.50 < V_a \leq 3.25$ (quite valid); $3.25 < V_a \leq 4.00$ (valid). ABA device can be used at trial if the product has a minimum rating criteria is quite valid.

Before being used on a test user, test instruments ABA validity empirically by using the Pearson product moment.

$$r_{XY} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

With: r_{XY} = coefficient of correlation between variables X (score by each item / indicator skill process) and Y (the maximum score item / criteria), the two variables are correlated; N = the number of students.

ABA instrument reliability specialized in pre-lab instruments, used Cronbach Alpha reliability coefficient formula, while the instrument reliability lab activities, reports, and presentation of lab results calculated using the formula coefficient of agreement by Fernandes (Arikunto, 2010).

Analysis of the effectiveness of the test by analyzing the final data in the form of practical activity observation instrument values, instrument lab report, and the percentage of lab results. Test the consistency of views on the size of intra-class correlation coefficients (intraclass correlation coefficient, ICC) using SPSS version 21 with the criteria of the $ICC \leq 0.00 \leq 0.20$ (very low), $0.20 < ICC \leq 0.40$ (low), $0.40 < ICC \leq 0.60$ (enough), $0.60 < ICC \leq 0.80$ (moderate), $0.80 < ICC \leq 1.00$ (high).

$< \text{ICC} \leq 0.80$ (height), $0.80 < \text{ICC} \leq 1.00$ (very high) (Widhiarso, 2010). ABA device is said to be effective if the ICC minimal value in the high category. Determining the level of skills of the students by calculating the average score percentage implementation process skills of students. If the percentage implementation process skills $\geq 70\%$, then the device is effective in evaluating completeness ABA student activity (White, 2009).

Analysis of the data used is practicality questionnaire analysis and lab assistant lecturer response to the feedback and use of the ABA and analysis of student questionnaire responses to ABA analyzed by calculating the average score. Otherwise practical device if $\geq 80\%$ of respondents gave a positive response to the device developed (Hobri, 2009).

3. Results and Discussion

Results of interviews to several lecturers and lab assistant at the three universities, the assessment and assistant lecturer in Physics II lab activities not involving the overall activity of students. Assessment conducted drawn from 10% attendance, 20% pre-test / post-test, 30% yield after lab reports, and 40% response. Based on the results of this interview required a solution that the assessment may measure the skills of the students.

Based on the results of the analysis of the problem, the necessary analysis information gathering and then be followed by the development of product design. The development of products containing the design ABA design appropriate to the characteristics of the course assessment lab to measure the skills of the students in the practicum course Physics II. Software design begins with the development of the syllabus, SAP, lab manual, and components of the ABA. The device of the judgments made at this stage is called a draft I.

The device is in prototype form 1 or draft I validated by the validator 3, to obtain valid devices. The results of the overall assessment by the learning of validator against which developed devices are presented in Table 1, 2, and 3.

Table 1 Results of Validation Tool Contents APA

No	Aspect of Content validation	validator			Average	Criteria	Description
		1	2	3			
1	suitability of material content	3,25	3,5	3,75	3,5	very good	valid
2	truth concept	3	3	3	3	good	valid enough
3	truth evaluation tool basic physics lab activity II	3	4	3	3,33	very good	valid
4	suitability of process skills	3	4	4	3,66	very good	valid
5	truth tool evaluation process skill	3	4	3	3,33	very good	valid
Average of validation assessment (va)					3,36	very good	valid
conclusion of assesment validator		ABA device can be use without revision					

Table 2 Results of Construct Validation Tool ABA

No	Aspect of construct validation	Validator			Average	Criteria	Description
		1	2	3			
1	Completeness of component	3,25	3,25	3,75	3,4	Very Good	valid
2	The language used	3,25	3,25	3	3,2	Good	valid enough
3	graficity component	3	3	3	3	Good	valid enough
Rata-rata penilaian validator (va)					3,2	Good	valid enough
Conclusion The overall Validator assesment		ABA Device can be use with little revision					

Table 3 Results of Validation Tool Support

No	Device	validator			Average	Criteria	Description
		1	2	3			
1	SAP	3,80	3,67	3,67	3,71	Very Good	valid
2	Practical Handbook	3,20	3,35	3,15	3,23	Good	valid enough

Syllabus and SAP has the characteristics of the development of integrating the indicators to be achieved, namely in the event of a stationary wave lab, mirrors, glass planparallel, lenses, electrical measurements, Ohm's law and induced emf with indicators of process skills. Learning steps includes activity-based activities (lectures on) and also integrates with process skills approach. Practical guide was developed based on indicators of student process skills, equipped with a practicum student activity sheet (LKPM). LKPM contain assignments that directs students explore the skills of the process by critical thinking and analysis to seek and find their own answers to problems that arise in practical activities. The device is presented in five parts ABA holistic (whole), namely: there are guidelines for the use of assessment, assessment instruments activity-based science process skills, interpretation of the guidelines provides the answer key and process skills assessment rubric, and scoring guidelines for qualitative as well as quantitative. Instruments ABA developed included instruments pre lab, instrument activity lab, instrument practical reports, and instruments presentation of the results of the lab, so the assessment refers to the entire student activities both in the activity of pre-practicum, activity lab, activity reports, and activity presentation of the results of lab work to motivate students to be more active in the lab.

Product testing by the respondent 4 (2 physics professor and two assistant practicum) as assessors and 10 students of Physical Education B Clasa in semester 2 test instrument validity ABA uses product moment correlation formula, the validity of the items (for instrument pre-practicum) and validity criterion (for instrument lab activities, lab reports, and presentation of the results of the lab). Recapitulation ABA validity of the instrument are shown in Tables 4 and 5 (for instrument practicum activities, practicum reports, and presentation of the results of

practicum). Recapitulation ABA validity of the instrument are shown in Tables 4 and 5.

Table 4 Recapitulation Value Validity ABA Instruments (Instrument Pra practicum) Trial Products

Practicum content	Product Moment Correlation Coefficient Values ($r_{xy \text{ arithmetic}}$)				
	Item Problem				
	1	2	3	4	5
Stationary waves	0,72	0,73	0,65	0,66	0,88
mirror	0,86	0,83	0,69	0,83	0,81
Glass Parallel Plan	0,71	0,70	0,66	0,70	0,75
Lens	0,83	0,74	0,72	0,79	0,80
Electrical measurements	0,65	0,84	0,76	0,68	0,75
Ohm's law	0,68	0,67	0,73	0,75	0,71
Induced Emf	0,86	0,79	0,87	0,69	0,635
$r_{xy \text{ table}}$	0,63	0,63	0,63	0,63	0,63
Significant level	5%	5%	5%	5%	5%
Explanation	Valid	Valid	Valid	Valid	Valid

Table 5 Recapitulation Value Validity ABA Instruments Trial Products

Practicum Content	Product Moment correlation Coefficient Values ($r_{xy \text{ arithmetic}}$)		
	Instrument		
	Practicum Activity	Practicum Report	Presentation of the practicum results
Rater 1 & Researcher	0,96	0,91	0,99
Rater 2 & Researcher	0,98	0,94	0,96
Rater 3 & Researcher	0,97	0,94	0,98
Rater 4 & Researcher	0,96	0,88	0,98
$r_{xy \text{ table}}$	0,95	0,87	0,95
Significant level	5%	5%	5%
Explanation	Valid	Valid	Valid

From the analysis conducted, as many as seven events practicum, each consisting of five items matter and 32 indicators process skills, have a correlation coefficient value is bigger than the correlation coefficient table with a confidence level of 5%. According Arikunto (2012), coefficient arithmetic is smaller than the coefficient table, the correlation is not valid, and the other way.

Reliability test results of ABA instrument show a fairly high constancy ie > 0.6 , so the instrument can be used for measuring the activity of students, especially students of process skills. This is in accordance with the findings Kjellin, et al. (2008), found that the reliability assessment with Activity-based Assessment has a fairly high reliability in assessing a person's activity. The result of ABA reliability in product trials can be seen in Table 6 and 7.

Table 6 Reliability Pre-Practicum Instrument in Test Product

Practicum Content	Value	Level of confidence
	Reliability Problem (r_{II})	
Stationary waves	0,74	Enough
mirror	0,83	Hight
Glass Parallel Plan	0,73	Enough
Lens	0,81	Hight
Electrical measurements	0,73	Enough
Ohm's law	0,73	Enough
Induced Emf	0,80	Hight

Table 7 Reliability Inter Rater ABA Instrument Agreement in Product Trial

Instrumen	Average of Agreement Coefficient Value ($\overline{AC}$)		criteria
	D.1 & A.2	D.2 & A.1	
Practicum Activity	0,81	0,84	Hight
Practicum Report	0,71	0,73	Enough
Practicum Presentation	0,71	0,68	Enough

Explanation : D.1 is lecturers 1, D.2 is lecturers 2, A.1 is assistant 1, dan A.2 is assistant 2.

The stage of trial usage aims to determine the effectiveness and practicability of the ABA'S device was developed. Respondents of trial usage is 7 persons (3 physics Lecturers , 4 practicum Assistant) as assessors and 20 students of the physical education classes A in semester 2. The effectiveness of ABA device developed as seen from the results of testing with intraclass correlation coefficient (ICC) and the level of student's process skill on courses Basic Physics Practicum II.

Assessment consistenci test of inter 8 rater is done using Intraclass Correlation Coefficients (ICC) gained an average rating of r for the practicum activities instruments is 0,84, practicum reports are 0,88, presentations and practical results are 0,626. According to Norman and Streiner, 2000; Polgar and Thomas, 2000 (in Murti, 2011), the measuring instrument with the value of the ICC between metering $> 0,50$, indicating measuring instrument has adequate stability and high stability if the ICC between measurement $\geq 0,80$ Search ICC values with the SPSS program-21 shows that the activity of the teaching instruments and reports the results of the practicum work have high stability or in the sense of having a high consistency inter 8 rater, so that the instrument is effective.

The consistency that occurs inter 8 rater due assessment using to the set of ABA equipped with rating scale techniques on a1 - 4 interpretation of the guidelines. Instrument rubric developed with rating scale technique is used so that the assessment is more objective. Arikunto (2012) stated that, with the assessment rating scale intended to assessment more objective in assessing a person's appearance. The number of assessors also provide considerable contribution in defining the subjectivity of assessment in the technique rating scale. According to the Uno and Koni (2013) valuation technique rating scale should be done by more than one

evaluator so that minimize the subjectivity factors so that the results more accurate and consistent.

The results of the analysis of the overall student's process skills at each meeting that elaborated on the practicum activity instrument, practicum report instrument, and practicum results presentation instruments, is shown in detail in Figure 1.

Based on Figure 9, explained that the entire meeting process skills of the students were in either category or activity students tend skilled in doing practical work. It is shown from the 11 indicators of process skills are one indicator of the level IV, 9 indicators at level III, and one indicator of the level II. The average percentage of process skills of students is 75.7% or contained within the level III in Table benchmarking process skills. This percentage when compared with the standard of effectiveness by Rase & Papincak (in White, 2009) in the amount of $P \geq 70\%$ (located on level III and IV), then the criteria for the effectiveness of ABA instruments to measure skills students have effective processes. In line with Marithawati Research (2011), the ABA effective as skills assessment process IPA. This is demonstrated by the achievement of process skills of students during the learning process at the level III.

Based on the analysis of each indicator science process skills of students from all meetings that predicts skills are at level II; observing, measuring, calculating, controlling variables, formulate an operational definition, interpret, formulate hypotheses and communicate are at level III; and conducted experiments there at level IV. Pelevelan results show that the student has not sufficiently skilled in conducting predictions and are highly skilled in conducting experiments.

Predictions or expected results can be derived logically from hypotheses and design experiments (Wiyanto, 2008). Even so students still can not describe predictions as expected, it disebabkan because students have not been trained to make predictions before doing practical work. Unlike the Skills conduct experiments. In this study, students are highly skilled in conducting experiments. These results are consistent with research conducted by Chabalengula, V.M (2012) reported that student teachers have good experimental skills than other skills. This is because in the physics lab course students are accustomed to doing practical work such as stringing tool or lab experiments.

The results of the analysis of questionnaire responses of students to the ABA gained 83% the percentage of positive responses were entered in both

criteria, while for teachers to get the response percentage of 97.1%, which fulfill the criteria very well. Based on the overall results of the study can be summed meet practical criteria. This is in accordance with the opinion of Hobri (2009) which states that the device is said to be practical when 80% or more of respondents gave a positive response to the device developed. According to Van den Akker (1999), practicability refers to the level that users consider the intervention can be used and preferably in a state of 'normal'. Positive responses were given a lecturer and assistant practicum gives the sense that they are quite interested and agree with the assessment tools are developed, it is supported by the opinion of Basic Physics II lab assistant through interviews that the ABA with the characteristics and purpose of the assessment can facilitate the assessment process.

A positive response of students indicate that there is interest and the perceived motivation of students to the ABA developed. This is also reinforced by research Banggali, et al. (2011) states that students become more motivated and prepared to follow the activities of pre lab, lab activities, and report writing assistant practicum for student use activity-based ratings. Motivation can be interpreted as a willingness to issue a high level of effort to meet the needs of self something (Gibson in Uno and Koni, 2013). Motivation emerging cause behavioral changes in students' personality in activity practicum.

4. Conclusion

Characteristics of the APA developed, among other things: (1) syllabus and lesson plans lead to the lectures active approach process skills, (2) guide the lab is equipped with LKPM directing students explore the skills process by way of critical thinking and analysis to find their own answers of the problems arising in practical activities, (3) the ABA presented in the five components of a holistic (whole), namely: guidelines for the use, four instrument-based assessment activities science process skills, guidelines for interpretation, and the guidelines for scoring qualitative as well as quantitative, (4) assessment refers to the entire student activities both in the activity of pre-practicum, activity lab, activity reports, and activity presentation of the results of lab work to motivate students to be more active in the lab, (5) the observation sheet contains several indicators of science process skills base and integration developed as aspects of the assessment of activity of students in the lecture of basic Physics Practicum II.

Set of ABA are categorized valid after the process of content validity and construct validity by

a person skilled / expert in their field and revised. The validity of the ABA earned an average score of good and very good so categorized valid and can be used on course of Basic Physics practicum II. ABA device is said to be reliable if the reliability value > 60 . The average value of the reliability of the instrument is 0.755 ABA, ABA instrument developed thus said to be reliable and have a fairly high level of confidence as a measuring tool.

Assessment practicum activity with ABA declared effective because it meets three effective indicators, namely: (1) the consistency of assessment by the assessor to the instrument 8 ABA had ICC values of between 0.626 to 0.938 or exceed the

standards in the category consistency so consistently very high; (2) an increase in the skills of the students at each meeting, and the average percentage of skills at all meetings at the level III; (3) the average value of the final practicum of Basic Physics II with the ABA beyond the completeness practicum (NOA). The result of the development of practical devices are categorized based on the average of the positive responses and lab assistant lecturers in evaluating student activities and in response to the feasibility of developing an excellent ABA category and the average percentage of positive responses of students categorized either in the application of ABA.

Figure 1 Diagram of the Student's Process Skill Level Throughout the Meeting

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