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The Development of Physics Student Skills Test Using Basic Physics Measuring Instruments

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ABSTRACT

Learning about laboratory equipment is often done. However, at the end of the learning that is often carried out tests is knowledge. While the skills possessed by students are rarely carried out tests, even though skills are part of the competencies that must be achieved. This can be caused by the unavailability of test kits that can be used to measure skills. Therefore in this study researchers conducted research on the development of physics student skills tests using basic physics measuring instruments in the Fkip Unsyiah Physics Education laboratory. This study aims to obtain a skill test device using a valid basic physics measurement tool for physics education study program students. The products produced are in the form of assessment instruments in the form of rubrics on a scale of 1-3. This study uses the development model Rowntree which consists of three stages, namely: 1) Planning; 2) Development; and 3) Evaluation. The results showed that the instrument validation obtained a percentage of 80% with a very feasible category. While the results of the average percentage of practical performance using calipers is 90.3%, micrometer 92.1%, voltmeter 81.5%, and ampermeter 81.6%. That is, the average percentage of student performance is categorized as very feasible.

Keywords: skills test, student, basic physics measurement tool, assessment rubric

INTRODUCTION

The learning process is one of supporting the achievement of educational goals so that it will form good attitudes, skills and knowledge. According to Trianto in Wina Andriani (2017), "In a more complex meaning learning is essentially the conscious effort of a teacher to teach students (direct the interaction of students with other learning resources) in order to achieve the expected goals".

In accordance with government regulation No. 32 of 2013 concerning National Education Standards, it is stated in the explanation of article 22 paragraph 1 that assessment must include the competence of students related to the cognitive domain (knowledge), affective domain (attitude), and the psychomotor domain (skills). Therefore, the assessment in the Basic Physics practicum must cover all three domains.

The assessment is carried out to find out the developments that occur, the assessment carried out as a whole will help the lecturer or teaching staff in measuring the achievement of

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the competencies of the students in terms of all aspects, cognitive, affective, and psychomotor. The results of the assessment can help students find out and further improve which competencies they have not mastered. Assessment includes attitudes, knowledge and skills. Every student has the potential to think, skills and attitudes, but the level from one student to another can be different. There are students who have a bad attitude, but have high knowledge and skills. Conversely, there are students who have good attitudes, but have low knowledge and skills. Thus the lecturer or teaching staff needs to prepare a test to determine the level of ability possessed by each student or student.

Problem of Research

Lecturers or teaching staff in developing tests are generally still oriented to the material. The scope of the test is still based on the aspect of knowledge so that the measured results are only knowledge, while the skills possessed by students rarely do the test, even though the skills are part of the competencies that must be achieved.

In a simple test can be interpreted as a set of questions that must be answered or questions that must be selected or responded to, or tasks that must be performed by test participants with the aim of measuring the knowledge, skills, intelligence, or ability of a particular aspect of the test participant (Yusrizal 2016: 89). Of the three aspects of assessment, namely cognitive, psychomotor, and affective, the evaluation is rarely done is psychomotor. Psychomotor domains include physical movement and coordination, motor skills and physical abilities (Yusrizal, 2016). This skill can be honed if you do it often. The psychomotor domain is divided into three categories including motor skills, object manipulation, and neuromuscular coordination (Daryanto, 2010). The three categories above need to be followed up in order to find out the students' skills in doing basic physics practicum, namely the existence of assessment activities. Assessment comes from the word assessment which aims to see the process of achieving the competence of students towards learning outcomes in both theoretical and practical learning (Sofyan et al, 2006). Permendikbud no 23 (2016) explains that assessment is the activity of gathering and processing information to measure the process of achieving student learning outcomes. The 2013 revised 2017 curriculum assessment refers to three types of aspects namely affective, cognitive and psychomotor assessment. Practicum is categorized into psychomotor assessment (Skills).

Research Focus

Based on these problems, a study was carried out aimed at obtaining a skill test kit using a valid physics measurement tool for physics education study program students. With the hope that the results of this study can be useful for assessing student or student skills.

METHODOLOGY OF RESEARCH

General Background of Research

The approach used in this study is a qualitative approach. Called a qualitative approach because the data obtained and analysis obtained in qualitative form (Sugiyono, 2012).

Sample of Research

The objects in this study were all physics students of Fkip Unsyiah. The subjects in this study were the students of Fkip Physics at the Syiah Kuala University 2017 and 2018. Based on the research subjects, 15 students were required as research subjects.

Instrument and Procedures

The development model used is the Rowntree model. The Rowntree model is systematically structured. The Rowntree model consists of three stages namely, (1) planning, this stage consists of a needs analysis and formulation of learning objectives; (2) development, this stage consists of developing topics, developing concepts, and producing prototypes (products); and (3) evaluation, this stage consists of self evaluation, expert validation, carrying out trials of the product being developed.

RESULTS AND DISCUSSION

Research on "Development of Physics Student Skills Test Using Basic Physics Measuring Instruments" was conducted in November to December 2018. The development of this skills test was carried out using the Rowntree development model consisting of 3 stages, as follows.

1. **The planning stage**

The results of the interview with the supervisor showed information that aspects assessed in practical activities included knowledge, attitudes, and skills. But the more dominant assessment is the knowledge carried out in the form of responses before the practicum and the report of practicum results, while the aspects of skills assessment when practicum is still not done.

The lecturer also suggested that the developed instrument must be easily converted into grades. In addition, basic physics practicum is one of the subjects that is always practiced because practices are taught about basic physics theory so rubrics are needed to assess their performance.

2. **Topic Formulation**

After the interview is carried out, the topic formulation is carried out namely the indicator (lattice) skills assessment that must be achieved by students. The formulation of indicators in the form of skills that are often practiced with the aim that can be used to assess the performance of praktikan on basic physics material. The indicator formulation process is carried out with guidance from the supervisor in accordance with the psychomotor domain,

namely Neuromuscular Coordination and assessment is carried out using an ordinal scale consisting of a scale of 1-3.

3. Development Stage

Indicators (lattices) of the psychomotor domain assessment are developed in accordance with the appropriate skill indicators for measuring skills using basic physics measurement tools. Psychomotor domain which is still general in nature and must be re-formulated in the formulation of skills indicators specifically so that the resulting skill indicators can measure skills well.

4. Evaluation

Evaluation is the last step of a study. The evaluation aims to determine the appropriateness of the skills assessment instrument developed so that it helps the assessment process in practical activities. At this stage, the instrument developed will first be checked by the researcher. Furthermore, the product is submitted to the validator for validation to determine the level of eligibility. Product validation results show that overall the average percentage of skills assessment instruments for basic physics practicum is 80%. That is, the product developed is included in the very feasible category.

5. Implementation

The final product that has been validated is tested on a research sample to determine the effectiveness of the product being developed. The results of the skill test trials using calipers, micrometers, voltmeters, and ampermeters show the percentage with a very decent category. Graph of percentage of calipers, micrometer, voltmeter and ampermeter can be seen in Figure 1 below.

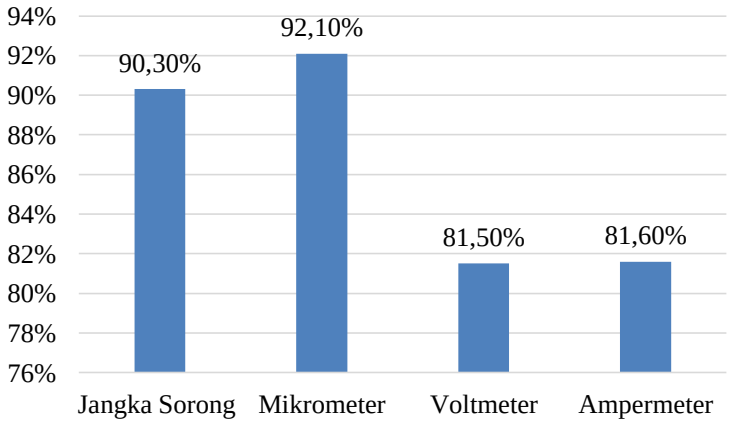

Figure 1. Percentage of Average Practice Performance

Based on Figure 1 above, the results of the trial of the calipers, micrometer, voltmeter, and ampermeter practical test results obtained the average percentage of the performance of the calipers practice is 90.30%, micrometer 92.10%, voltmeter 81.5%, ampermeter 81.60% .

That is, the average percentage of the four basic physics measuring instruments is categorized as very feasible.

The results of the skills test using the calipers from 15 people who do practicum on indicator 1 namely preparing the tool, with the assessment criteria is to be able to calibrate and check and know the accuracy of the calipers obtained by 13 people who are there and correct in preparing the calipers before measurement. Whereas 2 people were wrong in preparing calipers for not doing calibration.

The second indicator that is measuring with the assessment criteria is that it can shift the calipers of the calipers and place the object that is measured correctly and the object used is measuring the diameter of the ring. Of the 15 people who put the correct indicator into the second as many as 11 people. Inadequate practitioners in implementing the second indicator were 4 people. This is caused by an error in placing the object to be measured, when measuring the diameter of the ring praktikan placing the object in the lower jaw calipers, so that the measured diameter is the outer diameter of the ring, while the diameter you want to measure is the inner diameter of the ring.

The third indicator is to use the calipers with the evaluation criteria to use the sliding jaw properly before reading the results of the scale. Of the 15 people who did the right practice in implementing this indicator as many as 10 people. Inadequate practitioners in carrying out this indicator as many as 5 people. This is caused by errors of praktikan in using the calipers with the position of the object not yet right, praktikan using the calipers with the position of objects that are still loose so that the measured results are not accurate.

The fourth indicator is reading the main scale with the assessment criteria, namely reading the scale with a straight eye towards the measuring instrument and the main scale being read is the last line that is passed by the nonius scale. Of the 15 people who practiced it, 10 people were correct in doing this indicator. Inadequate practitioners did this indocator as many as 5 people. This is caused by the process of reading the scale done in an oblique position or not perpendicular, and the main scale that is read is not the last line through which the nonius scale is passed. Praktikan when reading the scale only pay attention to coincide lines, while the position of the last scale line that is passed nonius scale does not become the main benchmark in reading the scale.

The fifth indicator is reading the nonius scale with the assessment criteria that is able to read the nenoius scale correctly and can multiply the number sequence of the nonius line which coincides with the accuracy of the measuring instrument. Of the 15 people who practiced it, 10 people did it right. Inadequate practitioners in carrying out this indicator as many as 5 people. This is caused by errors of practice in reading the nonius scale which coincides with the main scale line, and errors in multiplying the sequence number of the nonius line which coincide with the accuracy of the measuring instrument.

The sixth indicator is to write down the measurement results with the assessment criteria can write the measurement results correctly. Of the 15 people who practice it correctly in doing it, up to 10 people, and those who do not do it correctly are 5 people. This is caused by errors of praktikan in multiplying the measurement results with the accuracy of the calipers used. Praktikan considers all calipers to have the same accuracy which is 0.1 mm. While the calipers are used with the accuracy of 0.05 mm.

The results of the skills test using the micrometer on indicator 1 that is preparing a measuring instrument with the assessment criteria can calibrate and check and know the accuracy of the micrometer correctly. Of the 15 people who put it right this indilator as many as 13 people, and the less appropriate do it as many as 2 people. This is caused by an error in calibrating the micrometer and there are praktikan who do not do the calibration.

The second indicator that is measuring with the assessment criteria can shift the sliding axis and place objects correctly. The truth in doing this indicator as many as 12 people from 15 people practice. Inappropriate practice do this for 3 people. This is caused by incorrect praktikan in shifting the sliding shaft incorrectly. When sliding the sliding shaft praktikan do not carefully so that when you want to clamp the object praktikan kesulitasn in sliding back the sliding shaft.

The third indicator is using the shear shaft with the assessment criteria can use the sliding shaft correctly before reading the measurement results. The truth in doing this infilator as many as 10 people from 15 people practice. Inadequate practitioners in carrying out this indicator as many as 5 people. This is because the praktikan menggunci the sliding shaft in a hurry while the object being measured has not really been squeezed properly.

The fourth indicator is reading the rotary scale with the assessment criteria, namely reading the scale perpendicularly and the scale being read is the last line through which the nonius scale is passed. The correct practitioner carries out this indilator as many as 11 people out of 15 practitioners. Inadequate practitioners in carrying out this indicator as many as 4 people. This is due to errors of praktikan in reading the scale with a position that is not perpendicular to the measuring instrument.

The five indicator is reading the nonius scale with the assessment criteria can read the nonius scale correctly and multiplying it with the accuracy of the measuring instrument. Of the 15 practitioners, there were 13 people who really did this indicator. Inadequate practitioners in carrying out this indicator as many as 2 people. This is due to errors of praktikan in reading the nonius scale obtained from the measurement results. Nonius scale that is read is not a scale line which is coincident with the main scale line.

The sixth indicator is to write down the measurement results with the assessment criteria can write the measurement results of the main scale and nonius scale correctly and multiply them with the accuracy of the measuring instrument. Of the 15 people who practiced this indicator correctly, 11 people. Inappropriate practitioners do this indicator as many as 4 people. This is because when multiplying the measurement results with the accuracy of the measuring instrument, praktikan wrong to use the accuracy of the measuring instrument used is 0.01 mm. While the accuracy or uncertainty of the micrometer is 1/2 x 0.01 mm = 0.005 mm or 0.0005 cm.

The results of the skills test using a voltmeter on indicator 1 are preparing a measuring instrument with assessment criteria to check and calibrate the voltmeter as well as checking and knowing the measuring limits correctly. The correct practice performs this indicator for 11 people out of the total number of practices for 15 people. Inappropriate practitioners do this indicator as many as 4 people. This is because the praktikan does not calibrate, check, and know the measurement limits correctly.

The second indicator that is measuring the assessment criteria to set up the measuring instrument correctly in accordance with the measurement limits. Proper practice in doing this indicator as many as 2 people from the total of all praktikan as many as 15 people. Inappropriate practitioners did this indicator as many as 13 people. This is because praktikan is wrong in putting together a series. Praktikan wrong in placing a positive negative pole position of the battery, and some praktikan incorrectly set a measurement limit according to the number of volts on the battery used. So the measurement results obtained are not accurate.

The third indicator is reading the measurement results with the appraisal criteria praktikan can read the needle pointer voltmeter scale correctly. On this indicator praktikan who did it right as many as 9 people. Inappropriate practice do as many as 6 people. This is because the practice is wrong in reading the scale needle in accordance with a predetermined scale when assembling the measuring instrument.

The fourth indicator is to write down the measurement results with the assessment criteria praktikan can write the measurement results correctly in accordance with the designated scale divided by the maximum scale multiplied by the measurement limit. The correct practice performs this indicator as many as 12 people out of all the practice as many as 15 people. Inappropriate practitioners do this indicator as many as 3 people. Practice is wrong in writing the measurement results because it is best to multiply or divide the designated scale with a maximum scale and measuring limit.

The results of the skill test using a voltmeter on indicator 1 are preparing a measuring instrument with the criteria of being able to check and calibrate the ampermeter and be able to know the measuring limit of the ampermeter used. The total number of praktikan as many as 15 people, and the right to do this indicator as many as 7 people. Inadequate practitioners in carrying out this indicator as many as 8 people. This is because the praktikan does not check the measuring limit and does not calibrate the measuring instrument.

The second indicator is assembling a series of measuring devices and taking measurements. The evaluation criteria are to be able to arrange the measuring instrument in accordance with the measurement limits and take measurements. The correct practitioners do this indicator as many as 8 people, and 7 people who are not quite right in doing this indicator. This is because praktikan is wrong in assembling the tool so that the measurement results obtained are not correct.

The third indicator is reading the measurement results, the assessment criteria can read the appointment of the ampermeter scale needle correctly. The right person to do this indicator as many as 8 people, and the less appropriate to do it as many as 7 people. This is because the praktikan in reading the needle scale does not match the specified measurement limits.

The fourth indicator is to write down the measurement results by means of the designated scale divided by the maximum scale multiplied by the measurement limit. Correct practice in doing this indicator as many as 9 people, and who are not right to do as many as 6 people. This is due to errors of praktikan in writing the measurement results because it is best to multiply or divide the designated scale with a maximum scale and measurement limits.

CONCLUSIONS

Based on the results of research on the development of skills tests, several conclusions can be drawn, namely that a skill test kit has been obtained using a basic physics measuring instrument for physics study program students Fkip Unsyiah, which has been validated by a team of experts. The percentage of validity of the skills test using a basic measuring instrument by a team of experts is 80% with the results of the student test trials using a basic measuring instrument is 90.3% for the calipers, 92.1% for micrometers, 81.5% for voltmeters and 81.6 % for ampermeter.

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References

Andriani W. (2017). Pengembangan Lkpd Praktikum Laboratorium Virtual Phet Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Gelombang Bunyi Di Smp Negeri 15 Banda Aceh. *Skripsi*. Banda Aceh: Universitas Syiah Kuala.

Daryanto. (2010). *Evaluasi Pendidikan.* Jakarta: Rineka Cipta.

Permendikbud. (2016). *Standar Penilaian Pendidikan.* Jakarta: Menteri Pendidikan dan Kebudayaan Republik Indonesia.

Purwanto, N.M. (2010). *Prinsip-Prinsip dan Teknik Evaluasi Pengajaran.* Bandung: Remaja Rosdakarya.

Pribadi, B.A. (2011). *Model Sistem Desain Pembelajaran.* Jakarta: Dian Rakyat.

Saputri. (2018). *Pengembangan Instrumen Penilaian Psikomotorik Untuk Praktikum Kimia Dasar*. *Skripsi*. Banda Aceh: Universitas Syiah Kuala.

Sugiyono. (2012). *Metode Penelitian Pendidikan, Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung : Alfabeta.

Yusrizal. (2016). *Pengukuran dan Evaluasi Hasil dan Proses Belajar.* Yogyakarta: Pale Media Prima