Diagnosis of physics learning difficulties of X MIA grade students of SMA Negeri 3 Pinrang

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Abstract. This research is a descriptive quantitative research which aims to determine the level of physics learning difficulties of students and factor causing of physics learning difficulties of X MIA grade students of SMA Negeri 3 Pinrang. Subject in this research is X MIA grade students of SMA Negeri 3 Pinrang of Academic Year 2017/2018 which amounted to 204 students. The level data of physics learning difficulty of students is obtained from diagnostic test result of students. The factors data that causing students have learning difficulty of physics, obtained from semi-open questionnaire sheet filled by students and it’s continued by semi-structured interview. Based on the results of data analysis, level of physics learning difficulties on material of Newton’s law was in the very high category with an average score of diagnostic test of students in the amount of 9.59. The difficulties experienced by students in solving diagnostic tests consist of: linguistic knowledge with percentage of difficulty level is 52.81% at the high category, schematic knowledge with percentage of difficulty level of 87.59% at the very high category, and algorithmic knowledge with percentage of difficulty level of 93.09% at the very high category. Difficulties experienced of students are caused by factor of health, intelligence, community environment, study habits, and study time.

1. Introduction
One of the educational challenges faced by the Indonesian people today is the low quality of education at every level and education unit. Various efforts have been made by the government to improve it through efforts to enhance the quality of education, increase knowledge of teachers, and adjust the curriculum. Government efforts are directed at achieving maximum learning goals oriented to improving students learning outcomes that indicate improving of the education quality.

The quality of education depends on the learning and teaching process. Learning refers to subjects who receive lessons, while teaching refers to subjects who deliver lessons. In implementing the learning and teaching process, a teacher often encounters students who have learning difficulties. Learning difficulties is a significant gap between real accomplishment and expected accomplishment on the basis of intelligence tests estimation individually [1].

Difficulties experienced by students vary. This is due to various factors that cause learners to have learning difficulties. Such as cognitive abilities of students who are lacking, but family background also influences students in learning [2]. Parental involvement in preventing learning difficulties of students is very necessary, parents can encourage students to learn independently [3,4]. Moreover, factors that cause learning difficulties for students is teacher [5].

Based on the results of interviews conducted with several students in SMA Negeri 3 Pinrang, the results showed that most students tended to consider physics subjects to be the most difficult subject to learn because many formulas in physics should be memorized. The result of observation in class X
MIA and XI MIA of SMA Negeri 3 Pinrang showed that the learning process of physics was taking place, apparently there was still many students having difficulty for answering the practice questions eventhough the practice questions had already explained. This is condition that causes students physics learning outcomes to be low. On the other hand, some students do activities that are not fair when the learning process takes place, such as going out of class. If this is left unchecked, the learning objectives will not be well achieved. Here is the role of the teacher as an educator and facilitator who not only analyzes the subject matter delivered, but also can analyze the difficulties experienced by students in receiving the lessons presented and overcome them.

From several facts that have been stated above, it is necessary to do a diagnosis of the difficulties faced by students in studying physics. This is important because the difficulties faced by students are very influential on students learning achievements and can be used a reference by teacher in improving the quality of students learning outcomes. Procedure of diagnosis of learning difficulties students in three steps: (a) identifying cases of learning difficulties, (b) identify the factors that cause learning difficulties, and (c) draw conclusions and make recommendations on the solution [6].

Based on the description, the author intends to examine these in the form of research about diagnosis of physics learning difficulties of X MIA grade students of SMA Negeri 3 Pinrang. The aims of this study are to determine the level of physics learning difficulties of students and find out the factors that cause of physics learning difficulties of X MIA grade students of SMA Negeri 3 Pinrang.

2. Methods
This research is descriptive quantitative research. The implementation of this research was carried out on students of X MIA grade in SMA Negeri 3 Pinrang which amounted to 204 students. The variable in this study is physics learning difficulty of students. Physics learning difficulties of students referred in this study is a situation that occurs in students whose result of learning physics are low (below the average score achieved by the group of students when working on a diagnostic test) and the result achieved are not balanced with effort which done because of several factors. In this case, the factors causing physics learning difficulties of students consist of two factors are internal factors and external factors.

Information or data in this study were obtained through diagnostic tests, questionnaire, and interview guidelines. Diagnostic tests are used to find out students who have physics learning difficulty, seen through mistakes made by students in solving the givens questions [7]. Form of diagnostic test questions in the essays form. While the questionnaire in this study, contains a statement to collect data from students about the factors causing physics learning difficulties experienced by students using a likert scale. The questionnaire which was used is a semi-open questionnaire. The statement on the questionnaire are favorable and unfavorable statements with score of 4, 3, 2, 1 for favorable statements and 1, 2, 3, 4 for unfavorable statements. To find the reasons and views of students about the causes of physics learning difficulties experienced by students that is not revealed in the questionnaire, then proceed with interviews. The type of interview used in this study is semi-structured interviews.

The instrument used in this study, carried out by expert testing or called content validity test. The assessment results from the two experts were analyzed using the Gregory equation. Instrument of diagnostic test and questionnaires were empirically validated for students of XI MIA grade in SMA Negeri 3 Pinrang. Then analyzed item of diagnostic test of quantitative consists of calculating the level of difficulty and discrimination power of each diagnostic test item. Then calculated the validity of each diagnostic test item and questionnaire statement using the product moment correlation coefficient. Followed by the calculation of reliability by using the cronbach alpha equation. So that obtained 10 items of diagnostic test used in this study and 56 statements of questionnaire used in this study. Diagnostic test for physics problem solving skill regarding newton’s law [8]. Examples of problems and assessment diagnostic test rubrics as follows.
Data from diagnostic tests and questionnaires were analyzed using descriptive analysis techniques that were calculated using Microsoft Excel programs. Then the score category guideline were made. For the diagnostic test results are divided into 4 categories: very low, low, high, and very high. Categorization of level of physics learning difficulties opposite with categorization of diagnostic test result of students. Next localize the difficulty of the students based on the difficulty in completing the diagnostic test question, namely difficulty of linguistic knowledge, schematic knowledge, and algorithmic knowledge by calculating the percentage of each difficulty in the settlement steps taken by students. And the dividing into 4 categories of the percentage of each difficulty in completing steps is very low, low, high, and very high. While the difficulty category of each aspect of the factors causing physics learning difficulties of students by dividing 4 categories is very complicate, complicate, not complicate, and very not complicate. The result of the interviews was described to support the result of questionnaire.

3. Result and Discussion
The description of the results of the diagnostic test of X MIA grade students of SMA Negeri 3 Pinrang of Academic Year 2017/2018 on material of newton’s law is illustrated in the following table.

Table 1. Descriptive statistic of diagnostic test result of students on material of Newton’s law

| Statistics          | Statistics Score |
|---------------------|------------------|
| Subjects            | 204              |
| Maximum ideal score | 55,00            |
| Minimum ideal score | 0                |
| Median              | 8,71             |
| Mode                | 0                |
| Maximum score       | 37,75            |
| Minimum score       | 0                |
| Average score       | 9,59             |
| Standard deviation  | 7,14             |
| Variance            | 50,99            |
The following is the data of students based on the results of diagnostics test on material of Newton’s law.

**Table 2.** Percentage of total students based on diagnostic test result on material of Newton’s law

| Diagnostic Test Score | Category   | Number of Students | Percentage (%) |
|-----------------------|------------|--------------------|----------------|
| 0 – 13                | Very low   | 165                | 80.88          |
| 14 – 27               | Low        | 31                 | 15.20          |
| 28 – 41               | High       | 8                  | 3.92           |
| 42 – 55               | Very high  | 0                  | 0              |

Based on table 1 and 2 above, it can be observed that the results of the diagnostic tests of students on material of Newton’s law is very low category. This is showed by the average score obtained from the results of diagnostic tests of X MIA grade students of SMA Negeri 3 Pinrang amounting to 9.59. So the level of physics learning difficulties of students on material of Newton’s law is in the very high category. The results of the percentage of each difficulty experienced by students of X MIA grade of SMA Negeri 3 Pinrang in completing the diagnostic test questions on material of Newton’s law, as follows.

**Table 3.** Percentage of students’ difficulties in completing diagnostic test questions on material of Newton’s law

| Solution Steps   | Percentage (%) | Category   |
|------------------|----------------|------------|
| Linguistic knowledge | 52.81         | High       |
| Schematic knowledge      | 87.58         | Very high  |
| Algorithmic knowledge     | 93.09         | Very high  |

Difficulties of students in completing diagnostic tests on material of Newton’s law because there are errors in the completion of diagnostic test questions, including translation errors, misconceptions, strategy errors, and calculation errors made by students. The translation errors is done by students because there is still a lack of ability to understand physics symbols so that there are difficulties experienced by students in writing the purpose of the problem into the symbol of physics. This cause students to experience difficulties in linguistic knowledge, can be seen in table 3 pointed out that the difficulties experienced by students in linguistic knowledge is the high category. While the difficulties experienced by students in schematic knowledge are caused by misconceptions made by students due to errors in using equations and errors in converting units. Based on table 3, it can be observed that the difficulties experienced by students in schematic knowledge is the very high category. This causes students to also experience difficulties in the algorithmic knowledge is the very high category. Whereas the level of difficulty of the diagnostic test item is medium, topics of diagnostic test is limited and specific [9]. Although students apply basic strategies well, students use a trial and error approach so they give-up when faced with difficulties [10].

Difficulties experienced by students in learning physics are due to various factors. The following are the questionnaire data on the factors causing the physics learning difficulties of X MIA grade students of SMA Negeri 3 Pinrang in terms of the students’ internal factors, the following results are obtained.

**Table 4.** Descriptive statistics of results of questionnaires factors causing physics learning difficulties of students in terms internal factors

| Statistics | Statistics Score |
|------------|------------------|
| Health     | 12.00            |
| Disability | 8.00             |
| Intelligence| 16.00           |
| Interest   | 44.00            |
| Motivation | 40.00            |
Grouping categories of internal factors that cause students to have physics learning difficulties, obtained as follows.

**Table 5. Distribution of category of factors causes physics learning difficulties in term internal factors**

| Score Range | Health | Disability | Intelligence | Interest | Motivation | Category         |
|-------------|--------|------------|--------------|----------|------------|------------------|
| 2 – 4       | 2 – 4  | 4 – 6      | 10 – 18      | 9 – 16   |            | Very not complicate |
| 5 – 7       | 3 – 4  | 7 – 9      | 19 – 27      | 17 – 24  |            | Not complicate    |
| 8 – 13      | 5 – 6  | 10 – 12    | 28 – 36      | 25 – 33  |            | Complicate        |
| 11 – 13     | 7 – 8  | 13 – 16    | 37 – 45      | 33 – 40  |            | Very complicate   |

Based on table 4 and 5, it can be observed that health factors make it complicate for students to learn physics. This is showed by the average score obtained from the questionnaire in terms of health factors, which is the complicate category. Questionnaire results revealed that health conditions will affect concentration when receiving lessons. This is consistent with Shaw, Gomes, Polotskaia and Jankowska statement that the learning process will be disrupted if one’s health is also disrupted, besides that it will also be tired, less excited and easily sleepy [11].

Intelligence of students also makes it complicate to learn physics. This is revealed in a questionnaire that students had difficulty in answering the questions if the questions were not the same as the examples of questions that had been explained by the teacher while learning students. The lack of ability of students in answering question can be seen in the results of diagnostic tests, where students have difficulty of linguistic knowledge, schematic knowledge, and algorithmic knowledge which is very high category. While the factors that cause students’ learning difficulties in terms of disability, interest, and motivation, do not make it complicate for students to learn physics. Some students revealed in a questionnaire that if there is material that difficult to understand, then always ask friends or physics lesson teachers to explain of the material that difficult to understand. Questionnaire data of the factor causing physics learning difficulties of X MIA grade students of SMA Negeri 3 Pinrang in terms of external factors of students, obtained the following results.

**Table 6. Descriptive statistics of results of questionnaires factors causing physics learning difficulties of students in terms external factors**

| Statistics | Facilites and Infrastructure | School Environment | Family Environment | Community Environment |
|------------|-----------------------------|--------------------|--------------------|-----------------------|
| Maximum ideal score | 32,00 | 32,00 | 28,00 | 12,00 |
| Minimum ideal score  | 8,00  | 8,00  | 7,00  | 3,00  |
| Median       | 18,00 | 16,00 | 15,00 | 8,00  |
| Mode         | 18,00 | 16,00 | 15,00 | 8,00  |
| Maximum score | 30,00 | 27,00 | 23,00 | 12,00 |
| Minimum score | 8,00  | 8,00  | 7,00  | 3,00  |
| Average score | 17,93 | 16,37 | 14,61 | 8,01  |
| Standard deviation | 3,86  | 3,86  | 3,07  | 1,65  |
| Variance     | 14,89 | 14,93 | 9,40  | 2,71  |
Grouping categories of external factors that cause students to have physics learning difficulties, obtained as follows.

**Table 7. Distribution of category of factors causes physics learning difficulties in term external factors**

| Score Range | Facilites and Infrastructure | School Environment | Family Environment | Community Environment | Category        |
|-------------|------------------------------|-------------------|--------------------|-----------------------|-----------------|
| 8 – 13      | 8 – 13                       | 6 – 11            | 2 – 4              | Very not complicate   |
| 14 – 19     | 14 – 19                      | 12 – 17           | 5 – 7              | Not complicate        |
| 20 – 25     | 20 – 25                      | 18 – 23           | 8 – 10             | Complicate            |
| 26 – 32     | 26 – 32                      | 24 – 29           | 11 – 13            | Very complicate       |

Based on table 6 and 7, it can be observed that community environment factors make it complicate for students to learn physics. It is showed by average score obtained from the questionnaire in terms of community environment factors is the complicate category. Based on the reason students in the questionnaire, revealed that the environment crowded disrupt the learning process at home. There were also students who revealed that they were more active in participating in activities around the environment than learning at home. The environment of the community and neighbors or alsp playmates around the house greatly influences the learning activities of students [12]. While the factors causing students’ learning difficulties in term of facilities and infrastructure, school environment, and family environment, do not make it complicate for students to learn physics. But there are some students experiencing learning difficulties caused by family environment factors due to lack of costs to meet learning needs. This is in accordance with the result of Misbah, Mohamad, Yunus and Ya’cob research that family factors prevent students from learning because of the socio-economic status of the family [13].

Based on interviews with students, there are other factors that cause students to experience learning difficulties. This factor is study time. As revealed by some students in the questionnaire that ordinary students lack concentration in learning physics due to the time to study physics at the school in the afternoon at 1.45 – 4.00 p.m. This makes students’ learning concentration disrupted due to the hot room conditions. It corresponds to Suryabrata which reveals that study time is also a factor that causes students to experience difficulties in learning and study time including non social environmental factors [14]. In addition, there are other factors that causes students to experience difficulties in learning physics. This factor is study habit. Study habits also cause students to have physics learning difficulties. This was revealed by some students that they would study if there was an exam. When the physics subject teacher was unable to enter, many students were reluctant to study independently in class. In addition, students also prefer to play handphone while at home. As revealed by B65 students, the activity that is most often done at home is playing handphone.

**4. Conclusion**

The level of physics learning difficulty of X MIA grade students of SMA Negeri 3 Pinrang on material of newton’s law is very high with an average score of diagnostic test of students in the amount of 9,59. The difficulties experienced by students in solving diagnostic test consist of linguistic knowledge with percentage of difficulty level is 52,81% at the high category, schematic knowledge with percentage of difficulty level of 87,59% at the very high category, and algorithmic knowledge with percentage of difficulty level of 93,09% at the very high category. Difficulties experienced of students are caused by factor of health, intelligence, community environment, study habits, and study time.

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