Analysis of student's understanding about Newton's laws, in terms of perceptions to learning in senior high school

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Abstract. The results of student’s analysis of physics mastery of class X in several high schools in the city of Padang, showed the lowest value found in Newton's laws of motion. This shows that students experience various obstacles in mastering this material. One of them is the factor of the perception of students towards learning physics. This study aims to reveal the tendency of students' perceptions of learning physics in Newton's law material, student mastery, their relationship and the factors of difficulty in learning Newton’s laws of motion, in terms of student perception. This study included descriptive correlational study in high school in Padang city in semester from January to June 2019. With stratified random sampling technique obtained by 60 students as samples to represent a clever student, medium and less, which is derived from 4 SMA and one private school. The instrument used to obtain data, in the form of 60 items of perception questionnaires and 24 items of mastery of material compiled based on a grid combination of 4 dimensions of knowledge and 6 levels of cognitive processes refers to Bloom's revised taxonomy. The instrument used has fulfilled its validity and reliability. The results showed that a) the perception of students towards learning the laws of Newton at the high category, b) mastery of physics students are on the low category, c) There are positive correlation between the perceptions of teaching physics with students mastery to the material laws Newton's motion, with 36.2% contribution. b) The proportion of understanding dimensions of students' knowledge: factual, conceptual, procedural, and metacognitive respectively, are 51.42 %, 36.88 %, 13.96 %, and 4.54 %. c) the proportion of mastery of cognitive process levels for the ability to remember, understand, apply, analyse, evaluate and create are: 54.44 %, 33.56 %, 38.75 %, 14.44 %, 13.19 % and 5.81 %. d) study difficulties were found in learning Newton’s law materials according to the perceptions of students, in terms of factors: students individual; properties inherent in physical matter; and student learning conditions created by the teacher.

1. Introduction

The main objective to be achieved through learning in school, is that students master various dimensions of knowledge contained in each subject [1]. The mastery in question is marked by an increase in knowledge, in line with an increase in the ability to think and change attitudes towards a better fit with values that can be accepted in life in society [2]. Physics as one of the subjects of specialization in science in high school is very dominant role for technological development. Technological progress is one indicator of the progress of the nation. Therefore, the mastery of physics becomes very important to individuals who are technology literate. In learning in schools, mastery of physics is marked by the achievement of high learning outcomes.
A review of the physics students' mastery X class at several high schools in Padang city at the end of the semester from July to December 2018, based on the data documentation teachers show sub summative score to Newton's law materials of motion, occupies the lowest average among topics other physics, which is 52.5 in the average range of 52.5 - 89.5. This suggests that the activity of learning on this topic has not learning climate that is conducive for students to be able to master the subject matter well, than the right to subject another.

A conducive climate in learning can only be achieved if the teacher is able to build students' positive perceptions of learning, concerning goals, content, processes, and assessment of learning outcomes [3]. Learning objectives should be able to accommodate the needs of students, learning content is expected to contain useful knowledge and can be experienced by students, the learning process should be able to make a sense of joy for students in learning, so that motivation and student learning outcomes increase, and learning evaluation should be able to run objectively, open and acceptable to students. If all of this can be realized by the teacher, of course students can accept the learning done by the teacher and students' positive perceptions of learning can be awakened properly.

Perceptions of learning can also be influenced by students' interests and talents in subject matter. Especially in concerning the nature inherent in the subject matter. Subject matter that is of interest to students, generally can provide positive perceptions for students, and on the contrary if it is not desirable it will lead to negative perceptions [4]. When reviewed the inherent nature of Newton's law material, the discussion uses the concept of vectors, force diagrams, mathematical analysis, and the problem model is very diverse. All these inherent characteristics might be able to cause negative perceptions for students if students have difficulty in learning and discussing related questions.

Based on these arguments, learning is felt to be problematic if students find difficulties in learning. For this reason, it is necessary to do research on students how the students' perception of learning Newton's law material, what are the dominant factors that cause negative perceptions, and in what ways learning must be done so that students' perceptions become positive, so students can follow the learning well. The problems to be disclosed through the research conducted, it is to determine: a) the tendency of students' perceptions of learning physics in materials Newton's laws of motion, b) mastery of average students in terms of complexity dimensions of knowledge on the matter of Newton's laws, c) relating perceptions of learning by mastery of Newton's legal material about motion, and d) the main factors causing mastery of Newton's law material low in terms of perception.

2. Literature Review

2.1. Characteristics of knowledge dimensions on Newton's law material

A review of the Newton's law material of motion, there are three laws that underlie it, which was developed by Newton (1687) as the basis of classic mechanics. All of these law with respect to; inertia properties of objects are known as the first law, the relationship of acceleration with force and mass of the object as the second law, and the relation of action and reaction as the third law. The third law involves a wide range of knowledge about quantities, unit and physics concepts. Some of physics quantities on this topic, namely; mass (m) as a scalar quantity with units of kilograms (kg) in International Systems (SI), and grams (g) in cgs. Concerning quantity vector is the speed (v) with units in meters/second (m/s) in the SI and centimetres/second (cm/s) in cgs, displacement (s) with the units meters (m) in the SI and centimetres (cm) in cgs, acceleration (a) with units meter/second² (m/s²) in SI and centimetre/second² (cm/s²) in cgs. and force (F) with units of newtons (N) in SI and dyne (dn) in cgs. Various applications that vary from the third laws involve various concepts such as; style, vector, diagram style, the nature of inertia, touch style, style, touch, friction, coefficient of friction, normal force, and tension straps [5] [6]. With appropriate approach learning, students are expected to master the various dimensions of the knowledge contained on the topic, followed by practice at every level cognitive process are increasing.

Referring to Bloom Taxonomy revision, essential materials to the discussion of the Newton’s laws topic, distinguished four dimensions of knowledge that are factual, conceptual, procedural, and
metacognitive knowledge. In physics learning, factual knowledge can be a statement of facts relating to the development of conceptual knowledge and procedural. Conceptual knowledge regarding concepts, principles, theories, laws, and rules of nature. Procedural knowledge regarding procedures and work steps, in developing and realizing something in physics. Metacognitive knowledge with respect to the knowledge that formed as a result of self-evaluation of each individual student on the mastery of factual, conceptual and procedural knowledges, in efforts to solve problems encountered [7]. In physics learning, the factual knowledge being studied should be chosen in relation to the formation of conceptual knowledge or procedural knowledge. As an argument, this reasoning can be examined through the following examples [8].

**Factual Knowledge**, example:

- Bullet when fired vertically into the air will fall back to earth.
- The more people pushing a down car, the acceleration of the car will be faster. If the number of people pushing a stop car, greater mass of the car being pushed, and smaller acceleration of the car.

**Conceptual Knowledge**, example:

- Force is a form of interaction between two or more objects, in the form of pull or push can cause changes to the objects affected including vector quantities.
- The acceleration of an object is directly proportional to the force is given and inversely proportional the mass of object.

**Procedural Knowledge**, example:

- The procedure of using free body diagrams in solving problems is related to the influence of forces on objects.
- Experimental procedure to find the acceleration relationship with the force and mass of an object.

**Figure 1.** The sequence of experiments to find out Relationship of mass m with acceleration a

**Figure 2.** The order of experiments to find out Relationship of force F with acceleration a

The sequence of activities in Figures 1 and 2 found the concept to the 2nd Newton's law, is an example of **procedural knowledge** that can be used to acquire conceptual knowledge about the relationship between the acceleration (a) with force (F) and mass (m) [9].

**Metacognitive knowledge** is knowledge as thinking about thinking [10]. It is the formation of students themselves in order to deal with problems and questions that require analysis. Such knowledge can be
formed from factual, conceptual and procedural knowledge that students already have. For example, for free fall and vertical upward motion when air friction is ignored, students have understood the equation: 

\[ h = V_0 t \pm \frac{1}{2} gt^2 \]. Suppose students are faced with the problem as follows:

When ball A is thrown vertically up with an initial speed of 50 m/s, identical ball B is dropped from 125 m height directly above ball A. If g = 10 m/s², a) after how long do the two balls meet?, b) At what height do the two balls meet?

To solve this problem, students who have never applied various strategies to build metacognitive knowledge tend to implement the formula: 

\[ h = V_0 t \pm \frac{1}{2} gt^2 \]

with a long enough solution to find the right answer. Whereas students who have used to implement various strategies in solving various problems that are analytical, will try to create metacognitive knowledge which is dealt with more briefly and effectively to get the right results. Suppose the strategy adopted is to try to describe the state of the ball as shown in Figure 3.

**Figure 3.** combination of two opposite moves

In physics learning, metacognitive knowledge will increase on student’s self if they understand conceptual and procedural knowledge, and many exercises are given that require the ability to analyse and evaluate concepts through problem-solving activities. The fourth dimension of the knowledge that by Anderson and Krathwohl (2002) combined with 6 levels of cognitive processes ability that are starting from the lowest level, namely the ability to remember (C-1), understanding (C-2), applying (C-3), analyze (C-2) evaluate (C-5) and create (C-6). The complexity of content in physics learning is defined as the fulfilment of the 4 dimensions of knowledge through student learning. The process of constructing these 4 dimensions of knowledge in learning is presented in Figure 4.

\[
H = h_A + h_B = 125 \text{ m} \\
H = V_0 t - \frac{1}{2} gt^2 + \frac{1}{2} gt^2 = V_0 t \\
\text{obtained metacognitive knowledge that is } H = V_0 t \\
\text{So that the solution} \\
a) \ t = 2.5 \text{ s} \\
b) \ h_A = 93.75 \text{ m} \]
Figure 4. The Process of Building 4 Dimensions of Knowledge

All these dimensions of knowledge are hierarchically an algorithm of the process of forming a holistic concept understanding that involves the ability to think at a high level (C-1 to C-6). The combination of the 4 dimensions of knowledge and the 6 levels of cognitive processes in question can be seen as the complexity of the content and cognitive processes as learning outcomes on each topic discussed in learning.

The ability to remember (C-1) is the ability to recognize and recall subject matter that has been learned and is able to retain the subject matter just as taught. With this ability students can write back, said back, or describe the back material that has been submitted by teacher’s ability to understand (C-2) is the ability to construct meaning of the subject matter that has been written, spoken and illustrated teacher. With this ability students can interpret, model, classify, summarize, compare, or explain the knowledge gained through learning. The ability to apply (C-3), is the ability to apply or use procedures that have been learned in certain circumstances. With this ability students can carry out or use a procedure that is appropriate to the problem at hand. The ability to analyze (C-4), is in the form of the ability to decipher the material being studied, into its parts according to the appropriate category. With this ability students can distinguish, know the similarities, and integrate between the appropriate parts of the material. The ability to evaluate (C-5), is the ability to make decisions based on certain criteria or references. With this ability students are expected to be able to test or assess a product or process. The ability to be creative (C-6), is the ability to integrate parts for making something new and coherent, or a product that is original. Verbs Operations (Marines) to accommodate this capability is the ability to formulate, plan, and construct something so that making new product [11].

If related to Newton's law material, the order of the level of cognitive processes from the ability to remember (C-1) to the ability to create (C-6), hierarchically describes the level of literacy (openness of insight) about the object’s students learn. As an example, regarding the concept of style can be illustrated as follows:

a) The ability to remember (C-1), for example to reiterate the notion of force, the force (F) is a vector quantity as a result of the interaction between 2 objects in the form of pull and push, which can give rise to the object that is being held

b) The ability to understand (C-2), for example understanding that in discussing the concept of force must implement the vector concept which is graphically expressed in the form of a straight-line
direction with an arrow at the end, where the length of the line indicates the magnitude of the force, and the direction of the arrow indicates the direction of the force.

c) Ability to apply (C-3), for example students can apply the concept of vectors in discussing the concept of force, using force diagrams (free body diagrams). A question reads: A block of mass \( m \) is located at the foot of the inclined plane with slope angle \( \alpha \) and coefficient of kinetic friction \( \mu_k \).

If the acceleration gravity \( g \), and the block is pulled with force \( F \) so that the beam accelerating is \( a \). Determine the magnitude of the force \( F \) (in symbols \( m, \alpha, \mu_k, \) and \( g \)). To solve these problems, students must be able to apply the concept of force as a vector quantity.

d) Ability to analyze (C-4), for example, students can analyze whether the force can cause movement or not on a case are discussed. to get this capability, for example, students are asked to analyze a case on the matter, in order to obtain the right solution. Example of an analytical problem: A block of mass \( m = 1 \) kg is located on the inclined plane whose tilt angle \( \alpha = 37^\circ \) and its kinetic friction coefficient \( \mu_k = 0.2 \). If the acceleration of gravity is \( g = 10 \) m/s\(^2\), and the block is pulled with a force \( F = 10 \) N. Will the block move or not? a) if it moves, how fast will it accelerate? b) If the beam doesn't move why? To answer this question needs to be analyzed whether large tensile force \( F \) larger, smaller compare to maximum number of static friction force and style hold objects under the influence of the gravity force

e) The ability to evaluate (C-5), for example students are asked to prove or test the truth of an equation. An example of a question reads: Prove with simple experiments that the acceleration (a) caused by a force (F) is proportional to the magnitude of that force (F), and inversely proportional to the mass of the object (m) with equation \( a = \frac{F}{m} \)

f) The ability to create (C-6), for example students are asked to construct a simple formula to find out the minimum force (F \( \text{min} \)), which is needed to move a beam whose mass m is located on the plane with a slope angle \( \alpha \), if the acceleration of gravity is \( g \) and the coefficient of friction maximum static field and beam \( \mu_s \cdot \text{max} \).

2.2. Perception towards learning Newton's laws

Everyone has their eyes on situation they experienced, as well as in live learning activities of students. This view, opinion or interpretation is often known as perception [12]. Perception is done through sensing, namely vision (eyes), hearing (ears), smell (nose), taste (skin), taste (tongue). Perceptions of the learning process of the main ones are the outcomes sensing through the eyes and ears that are stored in the form of information. Referring to the opinion of experts, the perception can be defined as the process by individuals to selection, organize, and interpret information coming through senses. This information is analyzed, interpreted and evaluated by the brain so that get an overview of the whole form of meaning to the stimulus received from the object perceived. The meaning is formed through learning, memory, hope and attention of each individual. The results of perception arise sympathy, or antipathy from individuals, as a form of positive or negative perception of the object being perceived.

Perception of an object is composed by 3 components, namely perceptual, emotional, and behaviour, in the form of cognition, affection, and conation. Cognition is based on the knowledge and information absorbed by someone [13]. Affection is evaluative about pleasure and displeasure, and conation about one's readiness to act and behave towards the object of perception. The perception of learning Newton’s law material concerns how views opinion or the results of interpretations of learning Newton's law material in terms of aspects of cognition, affection of the students. From the cognition aspects, it can be seen how close to the truth of knowledge and information to understand the students from learning in accordance with the scientific concept. From the aspect of affection, it can be seen how close the attitudes of students to implement the subject matter in the daily activities in accordance with the attitude of the scientific developed from the subject matter. It can be seen how fitting students skill to implement its concepts content of the subject matter are applied correctly.
2.3. The prediction model for mastery of subject matter is based on teacher and student perceptions of learning

The learning approach, which is applied by the teacher in learning according to the teacher's conception and perception of the learning. Likewise with the learning approach of students, also in accordance with their conceptions and perceptions about learning [14] [15]. Conception can be interpreted as a meaning or understanding that is understood about an object being studied, and the conception will shape one's perception of something, as a driver to determine the approach taken in dealing with a situation [16]. If the teacher's conceptions and perceptions of learning are understood as activities that convey concepts, concepts in the syllabus or transfer teacher knowledge to students, then in learning the teacher will tend to implement a teaching approach that is focused on delivering information. If the teachers' conceptions and perceptions about learning believed as activities to help students to acquire the concepts and knowledge, then teachers will tend to apply the study approach focuses on teacher-student interaction that the students get the concept and the right knowledge. If the conceptions and perceptions of students about learning is seen as an activity to get and refine the concept of students, the learning approach taken by the teacher tends to be centred on student activities that can build and improve the wrong student concept [17].

Students' perceptions and perceptions about learning are also determined by the learning approach applied by the teacher. As well as the conceptions and perceptions of teachers about learning. This means that students' conceptions and perceptions about learning are in line with the teacher's conceptions and perceptions about learning. If students' conceptions and perceptions about learning are to memorize or memorize knowledge, students will take a surface approach to their learning, and are not oriented to the meaning contained in the subject matter. But if conceptions and perceptions of students about learning is seen a as an abstraction of meaning and as the process of interpreting the subject matter that the air in order to understand the reality, then the student will take the deep approach in learning. It can be concluded that student satisfaction on subject matter is determined by the approach taken by students in learning. The approach to student learning is also determined by students' conceptions and perceptions about learning, and the teacher's approach to teaching. The teacher's approach to teaching is determined by the teacher's conception and perception of learning [18]. This conclusion is summarized in the form of a prediction model of student mastery of learning presented in Figure 5.

![Figure 5](image-url)

**Figure 5.** Model prediction mastery of subject matter in terms of conception and teacher and student perceptions of learning and learning.
3. Research Method and Finding

3.1. Research Methods
The research method applied is Ex post facto in the form of correlational descriptive research which aims to track the factors that cause the mastery of Newton's law material in low students in terms of aspects of student perception. The data obtained are described using tables and graphs, and the relationship between the perception variable (X) to the material empowerment (Y) of students is processed and analyzed by correlational techniques.

As the population in this study were high school grade X students in Padang city in the semester of July December 2018 consisting of 16 public high schools and 4 private high schools, all of which had an accreditation rank A. The sampling technique used was Stratified Random Sampling, obtained 4 public high schools and 1 Private high school as a sample group. From each school were randomly assigned 12 students who have been classified as a clever student, medium and less to represent the same two teachers per school, obtained a total sample 60 students.

This research involves 2 variables, namely Perception of learning physics in Newton's law material as an independent variable (X), and Mastery of Newton's law material as a dependent variable (Y). Research data in the form of primary and secondary data. Premier data is perception towards learning Newton’s laws, obtained using instruments such as questionnaire in the form of Likert scale, and mastery data of the material obtained by using Newton's law instrument in the form of tests. Secondary data in the form of daily test results (UH) class X semesters 1 and 2 as a material to identify research problems

The instrument of perception of learning physics in Newton's law material (IPTF), was developed based on 3 components as indicators of perception objects, concerning aspects of cognition, affection and conation, as many as 50 items , and Perceptions of the difficulty factors in studying physics in Newton's law material, as many as 10 the items. Instrument of mastery of Newton's law material about motion (IPHN), developed for sub-material: 1, 2, and 3 Newton's law by using 24 indicators as many as 24 items using a 4x6 table that refers to the Bloom Taxonomy revised developed by Anderson and Krathwohl (2002) . All instruments used have fulfilled their validity and reliability through trials.

To find out the level of perception and the level of mastery of students' knowledge about learning physics in Newton's law material about motion, and the factors that cause Newton's law material about motion difficult to master students used percentage techniques (%). To determine the relationship between Perception (X) with the Mastery of Physics Material (Y) students, as well as the% contribution of perception to the mastery of Physics material. Use correlation and index determination techniques. Data is processed and analyzed after meeting normality and linearity requirements.

3.2. Results Obtained

3.2.1. The tendency of students' perceptions of physics learning in Newton's law material
Data on students' perception of learning towards Newton's first law material is presented in Table 1.

| A Perception of Learning Material Inertness Objects | average | % maximum score | Perception Level |
|-----------------------------------------------------|---------|-----------------|------------------|
| 1 The mass of an object is a measure of inert object | 2.75    | 68.75           | high             |
| 2 There is no force on a marble that moves with a constant speed | 2.94    | 73.50           | high             |
| 3 Use seat belts in 4-wheeled vehicles to overcome the nature of inertia | 2.54    | 63.50           | High             |
| 4 Removing tomato sauce from a bottle is an example of the practice of inertia | 1.12    | 28.00           | low              |
| 5 Pass through the flames quickly, without burning as the application of the nature of inertia | 1.16    | 29.00           | low              |
| average                                           | 2.10    | 52.55           | high             |

Data on Table 1 shows that the average score of students' perceptions of learning materials Newton's law of average scores ranged from 1.12 to 2.94 with an average of 2.1 (52.55%) at the high category. Low perception lies in the material sample application of Newton's laws are issued ketchup out of the
bottle, and practice passing the blaze quickly without burning. Students are indicated to not know many of these two examples well.

Data on the tendency of students' perceptions of learning Newton's second law material is presented in Table 2

Table 2. Data on perception of learning Newton's second law material

| B | The relationship of acceleration with the force and mass of an object | average | maximum score | Perception Level |
|---|---|---|---|---|
| 1 | The force can be in the form of pull or push | 3.94 | 98.50 | very high |
| 2 | Operational of force using the concept of vectors | 2.85 | 71.25 | high |
| 3 | The impact of force is not always when the force is in contact with an object | 2.24 | 56.00 | high |
| 4 | Normal and friction force are components of the touch force | 1.45 | 36.25 | low |
| 5 | Resultant of force does not always cause changes in speed | 2.44 | 61.00 | high |
| 6 | The unit of force is Newton (N) = kg m s, dan dyne = gr cm s | 3.45 | 86.25 | very high |
| 7 | In order for objects to move, push force > friction force | 3.36 | 84.00 | high |
| 8 | In order for objects to move, push force > friction | 3.54 | 88.50 | very high |
| 9 | The amount of acceleration due to a force is inversely proportional to the mass of the object | 3.68 | 92.00 | very high |
| 10 | The acceleration of an object expresses changes in the velocity of objects every time unit | 2.94 | 73.50 | high |

Data on Table 2 shows that the average score of students' perceptions of learning materials second Newton's law of average scores ranged from 1.45 to 3.94 with an average of 2.99 (74.73%) at the high category. Low perception lies in the material normal force and friction force as the touch force, indicated students have not mastered this material well.

Data on students' perception of learning towards Newton's third law material is presented in Table 3

Table 3. Data on perception of learning Newton's third law material

| C | Relationship between action force and reaction force | average | maximum score | Perception Level |
|---|---|---|---|---|
| 1 | The action force A with respect to B, causes the reaction force B will with respect to A | 3.86 | 96.50 | very high |
| 2 | The action force A on B and the reaction force B on A are always the same | 3.75 | 93.75 | very high |
| 3 | Gaya aksi dan gaya reaksi antara benda A dan B terjadi bersamaan | 1.95 | 48.75 | low |
| 4 | The action force and the reaction force between objects A and B occur simultaneously | 2.25 | 56.25 | high |
| 5 | The gravity force and the Normal force are not examples of action force and reaction force pairs | 1.25 | 31.25 | low |
| 6 | Force diagram is the projection of all forces on an object, over components X and Y | 1.15 | 28.75 | low |
| 7 | The force diagram uses the principle of vectors | 1.95 | 48.75 | low |
| 8 | The force diagram, is a way to express vectors graphically | 1.55 | 38.75 | low |
| 9 | In the diagram, if long style 2 N = 3 cm, then force 5 N length 15 cm | 3.05 | 76.25 | very high |
| 10 | State the force on the diagram is expressed in the form of a straight-line direction | 2.95 | 73.75 | high |

The data in Table 3 shows that the average score of students' perceptions of learning Newton's third law material the average score ranges from 1.25 to 3.86 with an average of 2.37 (59.28%) in the high category. Low perceptions lie in the concepts of: a) force diagrams, b) relations of gravity and normal forces, c) use of the principle of vectors in force magnitudes, and d) relationships between action forces and reaction forces. For these 4 concepts, students are indicated to have not mastered well.

Data on the total tendency of students' perceptions of learning Newton's law material is presented in Table 4

Table 4. Data on total perception of learning Newton's law material

| NEWTON'S LAW MATERIALS ARE PERCEPTED | average | maximum score | Perception Level |
|---|---|---|---|
| A Perception of learning objects of Inertia | 2.10 | 52.55 | high |
| B Relationship between force and acceleration and mass of Inertia | 2.99 | 74.73 | high |
| C The relationship between action force and reaction force | 2.37 | 59.28 | high |
| D Difficulty factors in learning Newton's law of motion | 3.48 | 87.05 | very high |
| average | 2.74 | 68.40 | high |
The data in Table 4 shows that the average score of students' perceptions of learning materials Newton's laws overall average scores ranged from 2.10 to 3, 47 with an average of 2.78 (68.40 %) at the high category. There is no perception in the low category. The perception in the very high category lies the students' perception of the factors of difficulty studying Newton's laws. For this aspect of perception, students are indicated to have experienced many difficulties in learning Newton's laws.

3.2.2. The average mastery of students in Newton's law material
Results of the evaluation on a student's mastery of Newton's laws of matter, refer to the table 4X6 revision Bloom's taxonomy by Anderson and Krathwohl (2002), presented at the Table 5

| DIMENSION OF KNOWLEDGE | LEVEL OF COGNITIVE PROCESS | AVERAGE | POWER OF LEVEL |
|-------------------------|-----------------------------|---------|----------------|
| FACTUAL                | C-1  | 76.00  | 56.25  | 74.00  | 55.25  | 25.50  | 21.50  | 51.42  | LOW   |
|                        | C-2  | 89.00  | 50.75  | 53.50  | 1.00   | 26.25  | 0.75   | 36.88  | VERY LOW |
|                        | C-3  | 31.00  | 25.25  | 26.00  | 0.75   | 0.25   | 0.50   | 13.96  | VERY LOW |
|                        | C-4  | 21.75  | 2.00   | 1.50   | 0.75   | 0.75   | 0.50   | 4.54   | VERY LOW |
|                        | C-5  | 54.44  | 33.56  | 38.75  | 14.44  | 13.19  | 5.81   | 26.70  | POWER LEVEL |
|                        | C-6  | LOW    | VERY LOW | VERY LOW | VERY LOW | VERY LOW | VERY LOW |

Data on Table 5 shows that the level of student mastery scores was in the range between 0.50 to 89.00, with an average of 26.70 with a low category. Mastery of the very low dimension of knowledge is in procedural knowledge and metacognitive knowledge. Average mastery of the dimensions of factual and conceptual knowledge is in the medium and low categories. The mastery of cognitive process levels for levels C-1 to C3 are in the medium and low categories, while for levels C-4 to C-6 all are in the very low category.

3.2.3. Relationship of perception of learning with mastery of Newton's law material
Data relating to variable X (perception of physics learning on Newton's law material) and Y variable (mastery of Newton's law material), after fulfilling the normality and linearity requirements, an analysis of the relationship with the product moment correlation technique at 95% significance level obtained correlation value of $r_{xy} = 0.645$ with high category. By using the equation of determination index $D = (r_{xy})^2$ obtained $D = 0.416$. This means that the contribution of perception of learning to the mastery of Newton's law material students amounted to 41.6%, the rest is due to other factors.

3.2.4. Factors of student's difficulty in learning Newton's law
Data on the factors of difficulty in learning Newton's law material according to students' perceptions is presented in Table 6. Data on Table 6 shows that from 9 of the 10 items proposed difficulty factor expressed in the instrument is within the range of scores between 3.05 to 3.95 or with a percentage of 76.25 to 98.75% in the very high category. Only 1 item regarding difficulty because of low learning motivation showed a score of 2.85 (71.25%) with a high category.
Table 6  Data on students' perceptions of factors of difficulty in learning Newton's law

| D   | Difficulty factors in learning Newton's law of motion                                                                 | average | % maximum score | Perception Level |
|-----|----------------------------------------------------------------------------------------------------------------------|---------|-----------------|------------------|
| 11  | Changing narrative questions in the form known, asked and answered                                                   | 3.12    | 78.00           | very high        |
| 12  | Change the narrative problem into a simple drawing                                                                    | 3.45    | 86.25           | very high        |
| 13  | Change the problem to a simple drawing and describe it in the form of a style diagram                                | 3.75    | 93.75           | very high        |
| 14  | Describes many forces acting on objects in the form of force diagrams                                               | 3.90    | 97.50           | very high        |
| 15  | Expressing force graphically                                                                                         | 3.55    | 88.75           | very high        |
| 16  | The questions given are generally different from the examples given by the teacher                                | 3.95    | 98.75           | very high        |
| 17  | Building a formula based on differences in the diversity of problems in the problem                                 | 3.85    | 96.25           | very high        |
| 18  | Lack of practice working on varied questions                                                                       | 3.35    | 83.75           | very high        |
| 19  | Low math mastery                                                                                                     | 3.05    | 76.25           | very high        |
| 20  | Low learning motivation                                                                                            | 2.85    | 71.25           | high             |
|     | Average                                                                                                             | 3.48    | 87.05           | very high        |

4. Discussion
In general, students' perceptions of learning physics in Newton's law material are high. In some aspects that cause low student perception lies in the material that students find difficulty in learning. The difficulties mentioned can occur if the teacher has not provided a conducive climate so that students can learn optimally, so the perception is low [19]. From the results of the evaluation of students' mastery of material on Newton's law, in general are in the low and very low categories. especially on the combination of procedural and metacognitive knowledge for levels C-4 to C-6. This shows the practice of students to think analytical, critical and creative thinking has not been done well. Besides the material aspects that cause low student mastery are subject matter that students perceive in the low category, which is related to the application of the concept of force as a vector quantity, the application of inertia properties of objects of gravity and normal forces, and the relationship of action and reaction forces, so that the self-students occur misconceptions that indicate learning done by teachers is still not quite right [20]. Correlational analysis results between the perception score with the student's material mastery score showed a positive and meaningful relationship with a contribution of 41.6 percent, this is consistent with the theory put forward by experts that the mastery of student material would be good if the perception of learning is good, and vice versa. From the research results it can also be revealed a number of students' difficulties in learning Newton's law material originating from factors: individual students; properties inherent in physical matter; and student learning conditions created by the teacher. These difficulty factors can be used as input for teachers to improve the next learning process.

5. Conclusions
The results of the study concluded that: a) the tendency of students' perceptions of physics learning on Newton's law material about motion with an average score of 2.74 (68.40%) in the high category, b) the average mastery of students in terms of the complexity of the dimensions of knowledge on the material Newton's law, with an average percentage of students mastery of 26.7 in the low category c) There is a positive and meaningful relationship between the scores of perceptions of learning with Newton's law mastery score about motion with a value of rxy of 0.654 and the contribution of perception of mastery of the material of 41.6%, and d) indicated 10 main factors causing the mastery of Newton's law material low in terms of perception, namely:

1) Changing narrative questions in the form of being known, asked and answered
2) Change the narrative problem into a simple drawing
3) Changing questions in the form of simple drawings into urain in the form of style diagrams
4) Describe many forces acting on objects in the form of force diagrams
5) Expressing style graphically
6) The questions given are generally different from the examples given by the teacher
7) Building a formula based on differences in the diversity of problems in the problem
8) Lack of practice working on various problems
9) Low mathematical mastery
10) Low learning motivation

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