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Menguji Konsep Serta Menemukan Konfusi
(Materi Torsi dan Rotasi pada SMA Negeri 1 Kota Serang)

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Abstract. *This study aims to analyze the misconceptions in students in SMAN 1 Kota Serang on the material of Torque and Rotation. The research tested was a two-tier based question, consisting of 13 multiple choice questions with five answer options and one supporting reason for each answer. Data collection was carried out through Google Form media and distributed to 36 students of class XI IPA 9. The data obtained were students understood 13.9%, partially understood 11.1%, misunderstanding 22.2%, specific misunderstanding 33.3%, and did not understand 19.5%. This test is based on the result was tested there were students' misconceptions, namely the moment of force 5.55%, the relationship between force and moment of force 25%, the position of force to the axis 75%, the equation of rotation and GLBB 41.66%, Linear kinetic energy from frequency and radius 69.44%, The relationship between centripetal acceleration and radius 80.55%, and the kinetic energy of rolling objects 63.88%. The results of this test are analyzed into which parts of the students experience misconceptions, with these findings expected to be used as a basis for designing targeted learning interventions.*

Keywords: *Misconceptions, two levels, Torsion and Rotation*

1. INTRODUCTION

Physics is one of the branches science has a crucial role the development of science and tecnhnology. Physics is seen as a product, process, and attitude .Therefore, physics teaching needs to prouce must produce students who has knowledge ability, positive mindset, and a deep proficiency in concepts. However, several studies show the student is question experience lots obstacles in understand the concept of physics. For example, conceptual difficulties occurs because when students asked to decide relationship between magnitude of the force (N) and the moment of force (N·m). Mathematically, the relationship between the magnitude of the force and moment of ability is directly equivalent if length of force arm is kept constant. However, in practice, when asked to interpret the graph of the large relationship of force to the ratio of moment to force (N·m/N), some students gave answers that showed misconceptions. They state that the graph will be a straight line passing through the point of origin, without taking into account that the ratio of moment to force actually results in a fixed value if the arm of force is constant. Therefore, a legtimate and reliable detection tool is needed identify level of understanding of students' conceptions on torque and rotation materials.

Instrument testing of Torsion and Rotation material diagnostic questions with the aim of identifying misconceptions in grade XI students at SMA Negeri 1 Serang City. This test is important because the material is a fundamental part of physics learning, especially understanding the concepts of force, force moments, rigid body balance, rotational dynamics,

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and even in everyday life. However, in reality, students often experience confusion when distinguishing between linear and rotational concepts.

The diagnostic instrument tested was a two-tier-based question, consisting of 13 multiple-choice questions with five answer options and one supporting reason for each answer. Data collection was carried out through Google Form media and distributed to 36 grade XI students. The results of this test are an analysis of which parts of the student experience misconceptions, with these findings expected to be used as a basis for designing targeted learning interventions.

2. KAJIAN THEORITIS

In the education system in Indonesia, there are various levels, and one of them is the Senior High School level .High School is a stage of education that must be comleted before continuing to a highher level of education. In Senior High School teaching, studying various sciences, one of sciences studied is physics. Physics is one of the developing fields of knowledge from the observation of the phenomenon that exist in the relationship that occurs in it(Aslih,2017). Physics lessons are often considered as lessons are often considered as lessons that are not liked by students. Many studets think physics is a difficult lesson in the school and furthermore difficult when they reach college (Guido, 2013). In addition, physics is a field of study that combines the actions and signs of natural events linked to ongoing or present phenomena(Giancoli,2014). The goal of learning physics will be achieved if the learning process goes well. In reality, what happens in the field is still not in accordance with the expected functions and goals. Students still have difficulty in solving problems related to physical and mathematical concepts, this can happen possibly because students only know physics formulas without a good understanding of concepts (Syuhendri, 2015).

Misconception is a conception of a person that is not in accordance with the scientific concept recognized by experts (Suparno, 2013). Misconceptions can take the form of initial concepts, incorrect connections between concepts, intuitive ideas or wrong views. In detail, misconceptions can be (a) Inaccurate understanding of concepts, (b) Incorrect use of concepts, (c) Classification of incorrect examples of the application of concepts, (d) Interpretation of different concepts, (e) Chaos of different concepts, (f) Hierarchical relationships of incorrect concepts (Wafiyah, 2012).

Students can experience misconceptions that come from the formation of false initial knowledge through their life experiences (preconceptions). This wrong student preconception can be formed because students receive incomplete information. For this reason, the teacher

needs to complete the information obtained so that it becomes correct and complete.5 If the student does not succeed in making the correct relationship between the preconception they have and the new information provided by the teacher, a misunderstanding (misconception) will form. 6 The result is that the student will again retain his or her initial understanding of the concept and place his or her new concept in its cognitive structure separately. 7 Thus, students' understanding of a concept can be formed but accompanied by misconceptions (Kurniasih, 2010).

One of diagnoses test is to apply Two-Tier Multiple Choice (TTMC). TTMC is a multiple-choise a two diagnostic test David F. Treagust was the initial developer in1988. At the first tier contains questions regarding concepts being tested while the second level contains the reasons for each response to the question in the first level as a form of diagnostic test. By using this instrument, the student's probability of guessing the correct answer can be reduced to 4%. In addition, teachers can also find out the conceptions possessed by students and the category of student understanding (Septiana, 2014).

3. METHODS

This study uses a quantitative method with *two-tie questions,* for the test tool consists of two stages, the first is in the form of multiole options questions and the second tier is in the form of response reasons from thr first tier. The instrument utilized first stage was in multiple choice question format and in the second tier was in the form of open-ended reasons. This research will be carried out on May 5, 2025. Data collection was carried out through *Google Form* media and distributed to 36 students of grade XI Science 9.

4. RESULTS AND DISCUSSION

The research was conducted on May 5, 2025 at SMA Negeri 1 Serang City, Based on the findings of the analysis of students' understanding of torque and rotation materialsusing two tier testing, the following information were get:

Table 1. Percentage of Students' Comprehension of Torque and Rotation Material

Category	Presentase
Understand	13,9
Partially Understanding	11,1%
Misunderstanding	22,2%
Specific Misconceptions	33,3%
Don't understand	19,5%

Based on data in table 1. 1, students' understanding of concept torsion and rotation material with specific misconceptions (misconceptions), which is 33.3%,moment the low percentage is students who understand the concept, which is 13.9%. According to the results of the analysis, there are still manny studentswho face misunderstanding, especially specific understandings, and they do nut fully understand the concept torque and rotation materials. Misconception is a major problem faced by almost half of students. Teachers must immediately know about misconceptions in order to reconfirm the torque and rotation material, and in the learning process it is corrected so that the material is easy to understand by students.

Table 2. Ratio Student know of every clue

Idea material	**Presentase**
Moments at Style	5,55%
The Relationship of Style and Style Moments	25%
Position of Forces to Shaft	75%
Rotation and GLBB Equation	41,66%
Linear kinetic energy of frequencies and radius	69,44%
Centripetal acceleration relationship and radius	80,55%
Kinetic energy of rolling objects	63,88%

Based on the data in table 2. of evaluation results, adapt some students who have no understood every clue on torque and rotation bahan. Highest student understanding was obtained when determining the relationship between centripetal acceleration and radius with a sum of 80.55%. The indicators have a percentage below 10%.The student gave the correct answee although it was not completely accurate, then the student is included in the group that has half understanding

Table 3. learners Perception Torsion and Rotation material

Material Concept	**Miskonsepsi**
Moments of Style	Gaya yang sejajar
The Relationship of Style and Style Moments	Garis lurus miring ke atas yang melalui titik asal (semakin besar gaya, momen bertambah linier)
Position of Forces to Shaft	Reduced style
Rotation and GLBB Equation	Acceleration that changes speed (both linear speed or angle)
Linear kinetic energy of frequencies and radius	Because the mass of each point is considered equal, then the greatest linear kinetic energy will be generated by the machine
Centripetal acceleration relationship and the fingers	Centripetal acceleration increases then the angular speed is reduced
Kinetic energy of rolling objects	Total kinetic energy is not affected by velocity, as rotation keeps Balance

Based on Rasche's analysis, it states that;

Person: REAL SEP.: 1.45 REL.: .68 ... Item: REAL SEP.: 2.59 REL.: .87

Person STATISTICS: MEASURE ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	JMLE MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEASUR-AL CORR.	PTMEASUR-AL EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Person
31	13	13	4.71	1.88	MAXIMUM MEASURE				.00	.00	100.0	100.0	31P
20	12	13	3.34	1.11	1.07	.35	.48	.01	.29	.28	92.3	92.2	20P
26	12	13	3.34	1.11	1.07	.35	.48	.01	.29	.28	92.3	92.2	26P
28	12	13	3.34	1.11	1.07	.35	.48	.01	.29	.28	92.3	92.2	38P
36	12	13	3.34	1.11	1.07	.35	.48	.01	.29	.28	92.3	92.2	36P
5	11	13	2.41	.85	.60	-.77	.32	-.20	.56	.37	92.3	85.8	05P
11	11	13	2.41	.85	.60	-.77	.32	-.20	.56	.37	92.3	85.8	11P
13	11	13	2.41	.85	1.32	.74	1.13	.56	.23	.37	76.9	85.8	13P
27	11	13	2.41	.85	1.27	.66	.90	.40	.27	.37	76.9	85.8	27P
16	10	13	1.77	.75	.80	-.43	.58	.12	.53	.43	84.6	80.3	16L
17	10	13	1.77	.75	1.06	.28	.83	.35	.41	.43	84.6	80.3	17L
19	10	13	1.77	.75	1.75	1.69	1.59	.83	.08	.43	69.2	80.3	29L
34	10	13	1.77	.75	.49	-1.48	.32	-.20	.66	.43	84.6	80.3	34P
2	9	13	1.24	.70	.80	-.54	.59	-.06	.57	.47	76.9	77.4	02P
7	9	13	1.24	.70	.97	.03	.75	.13	.49	.47	76.9	77.4	07P
8	9	13	1.24	.70	.97	.03	.75	.13	.49	.47	76.9	77.4	08L
14	9	13	1.24	.70	.62	-1.25	.47	-.23	.65	.47	92.3	77.4	14L
15	9	13	1.24	.70	.87	-.31	.67	.04	.54	.47	76.9	77.4	15P
18	9	13	1.24	.70	1.71	1.91	1.45	.73	.15	.47	46.2	77.4	18L
25	9	13	1.24	.70	.62	-1.25	.47	-.23	.65	.47	92.3	77.4	25L
29	9	13	1.24	.70	.87	-.31	.67	.04	.54	.47	76.9	77.4	39P
35	9	13	1.24	.70	.62	-1.25	.47	-.23	.65	.47	92.3	77.4	35P
3	8	13	.78	.67	1.23	.84	1.07	.37	.40	.50	61.5	74.4	03P
12	8	13	.78	.67	.96	-.04	.86	.13	.52	.50	76.9	74.4	12L
23	8	13	.78	.67	.75	-.88	.58	-.26	.63	.50	76.9	74.4	23L
30	8	13	.78	.67	1.05	.26	.94	.22	.48	.50	76.9	74.4	30L
10	7	13	.34	.66	1.04	.25	.92	.14	.51	.52	84.6	72.3	10L
22	7	13	.34	.66	.99	.03	.80	-.05	.55	.52	69.2	72.3	22L
32	7	13	.34	.66	1.34	1.28	1.20	.50	.37	.52	53.8	72.3	32P
33	7	13	.34	.66	.89	-.37	.72	-.18	.59	.52	69.2	72.3	33P
4	6	13	-.10	.67	1.02	.15	.77	-.16	.56	.55	61.5	73.3	04P
21	5	13	-.56	.70	1.09	.39	1.23	.55	.50	.57	76.9	76.1	21L
24	5	13	-.56	.70	1.33	1.04	1.85	1.25	.36	.57	76.9	76.1	24P
6	3	13	-1.69	.84	1.40	.83	.99	.33	.47	.59	76.9	86.5	06P
9	3	13	-1.69	.84	1.84	1.42	1.85	1.00	.24	.59	76.9	86.5	09P
1	1	13	-3.67	1.22	.48	-.66	.12	-.60	.64	.46	100.0	92.3	01L
MEAN	8.6	13.0	1.17	.81	1.02	.08	.80	.15			79.3	80.2	
P.SD	2.7	.0	1.58	.24	.33	.83	.41	.39			11.7	6.5	

Figure 1. A table of person statistics from the analysis of the Rasch model based on logit as well as the values of INFIT and OUTFIT

Based on the analysis data using the Rasch model, the students' conceptual ability on torsion and rotation materials showed logit from -3.67 to +4.71, with an average of 1.17 and a standard deviation of 1.58. The data shows that students vary, ranging from low to high.

The instrument is quite capable of distinguishing the level of ability of students with a person reliability value of 0.68. The instrument supports in grouping students into two different ability groups with a person separation value of 1.45.

The mismatch between the model's predictions and the actual responses in some students reinforces the finding that some students not only do not understand, but retain incorrect alternative understandings. These findings are in line with the research of Rimoldini and Singh (2005) who stated that misconceptions in physics are often stable and cannot be easily changed through direct instruction alone.

5. CONCLUSIONS AND SUGGESTIONS

Students experience misconceptions in the basic concepts of torque and rotation, especially in the relationship between force magnitude, force arm length, and force moment. Angular functions to determine the magnitude of force moments, analogize linear motion and rotational motion, and interpret a graph in rotational dynamics. Students tend to easily answer questions that relate material to real life opposition. So that teachers use a visual-based approach or experiment with students that makes it easier to understand the experiment directly, hold exams for each chapter so that when UTS and UAS are easier to answer questions and are directed to the main concept, teachers use identification test questions at the beginning or end of the chapter regularly so that they can detect student understanding.

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