



Reverse Tullip Education

# **DETERMINATION OF MISCONCEPTIONS ABOUT MASS AND WEIGHT OF 7TH GRADE STUDENTS OF MIDDLE SCHOOL**

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## **Abstract**

The aim of this study is to determine misconceptions about the mass and weight of 7th grade students. The study was conducted in the fall semester of 2019-2020 in a public school in Kastamonu. The universe of the study consists of all seventh grade students in Kastamonu province. The research sample of the study consists of seventh grade students consisting of 20 people in a public school determined by random sampling. The research method, which is one of the quantitative research methods, was used. In the study, a 3-stage achievement test consisting of 10 questions developed by the researcher was used as data collection tool. The findings obtained in the study were subjected to descriptive statistics. As a result of the research, misconceptions of the students were determined and suggestions were made.

**Keywords:** Science, misconception, mass and weight.

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### **Citation:**

Doğanay, K., (2020).DETERMINATION OF MISCONCEPTIONS ABOUT MASS AND WEIGHT OF 7TH GRADE STUDENTS OF MIDDLE SCHOOL. Social Scientific Centered Issues, 2(1), 3-7.

## 1. INTRODUCTION

In science education, students often have difficulty in learning the concepts because the subjects are mostly abstract. When the researches in the field of science education are examined, it is seen that the most misconceptions, conceptual changes and learning difficulties are studied. It is thought to be among the units that have many misconceptions and confusion due to the fact that it is difficult to observe the mass and energy issue concretely (Karakuş, 2019). When the relevant literature on mass and weight is examined;

Karakuş (2019), the effect of using concept cartoons in science class on misconceptions of 7th grade students on mass-weight,

Cerrah Özsevgeç, Yurtbakan and Uludüz (2019), the effect of the concept cartoon in eliminating the misconceptions of the fourth grade students of primary school towards the concepts of “mass and weight”,

• Balbağ (2018), determining the cognitive structures of science teacher candidates regarding mass and weight concepts by using word association test (KIT),

• Ecevit and Özdemir Şimşek (2017), Science education of teachers, evaluation of misconception and elimination studies,

• Kirtak Ad and Kocakulah (2013), Can physics and science teacher candidates notice the difference? Mass and center of gravity concepts example,

• Koray, Özdemir and Tatar (2005), elementary school students' misconceptions about “Units”: It is observed that they study mass and weight example.

Within the context of the related literature, the problem status of this study is stated as determining the misconceptions about mass and weight. of 7th grade students

## 2. METHOD

In this study, which aims to determine the misconceptions about mass and weight of 7th grade students, the screening method, which is one of the quantitative research methods, was used. The screening method is a method that provides researchers with very easy information and quality information when in-depth information is required (McMillan & Schumacher, 2009; Yılmaz & Aydın, 2019).

### 2.1. Sample of the Research

The sample of this study consists of 20 7th grade students studying in a randomly determined public school in Kastamonu. While determining the research sample, suitable sampling method was used. The appropriate sampling method is a very useful sampling method for providing the researcher with time, effort and cost convenience (Fraenkel & Wallen, 2003; Yılmaz & Yanarateş, 2020).

### 2.2. Data collection tool

In the research, a 3-step multiple choice success test consisting of 10 questions was used as a data collection tool. At the stage of development of the achievement test, first item pool of 20 questions was created and expert opinion was taken. Then, the success test was applied to a group of 70 people and pilot applications were carried out. As a result of the pilot application, item difficulty index and item discrimination coefficients were determined. Then, in this framework, the necessary screenings were made and the reliability coefficients of the success test were determined. The reliability coefficient of the success test was found to be .868. This value is considered valid if it is .70 and above in social sciences (Büyüköztürk, 2010).

### 2.3. Analyzing the Data

The findings of the study were analyzed through the TAP analysis program and SPSS 20 package program, and the answers to open-ended questions were subjected to content analysis.

## 3. FINDINGS AND COMMENT

When the findings of the research were examined, the item difficulty index and item discrimination values of 20 questions, which were piloted to 70 students, were examined first. Table 1 shows item difficulty index and item discrimination values.

**Table 1.** Item difficulty index and item discrimination values

Question Number	Item Difficulty Index (P)	Item Discrimination (d)	Question Number	Item Difficulty Index (P)	Item Discrimination (d)
1	0,57	0,56	11	0,68	0,59
2	0,72	0,56	12	0,69	0,62
3	0,65	0,59	13	0,63	0,56
4	0,76	0,41	14	0,93	0,15
5	0,49	0,62	15	0,57	0,38
6	0,87	0,26	16	0,56	0,47
7	0,74	0,53	17	0,35	0,18
8	0,40	0,21	18	0,57	0,50
9	0,69	0,38	19	0,65	0,53
10	0,62	0,65	20	0,66	0,68

When Table 1 is examined, in line with the expert opinion received; 5, 6, 9, 12, 13, 14, 16, 17, 18 and 20. Questions were excluded from the test based on the opinions that item difficulty was very high, item discrimination was low and it was not appropriate to use in the test. Cronbach's Alpha reliability results are shown in Table 2.

**Table 2.** Reliability analysis results

Question Number	Pre			Post		
	Test Variance When Item Is Deleted	Adjusted Item-Total Correlation	New Cronbach's Alpha Value If Item Is Deleted	Test Variance When Item Is Deleted	Adjusted Item-Total Correlation	New Cronbach's Alpha Value If Item Is Deleted
1	8,097	,008	,541	11,039	,416	,868
2	7,917	,123	,517	10,038	,616	,853
3	7,639	,208	,502	10,799	,392	,872
4	8,076	,070	,525	9,625	,747	,842
5	7,690	,202	,503			
6	8,495	-,115	,559			
7	7,814	,187	,507	10,756	,587	,857
8	7,567	,167	,510	10,408	,534	,860
9	7,340	,390	,473			
10	7,192	,454	,461	9,719	,733	,843
11	7,866	,075	,529	10,584	,582	,856
12	8,289	,024	,527			
13	7,495	,175	,509			
14	7,752	,110	,522			
15	7,390	,279	,487	9,827	,728	,844
16	7,089	,358	,469			
17	7,979	,053	,532			
18	7,009	,398	,460			
19	8,097	,008	,541	10,479	,528	,860
20	7,917	,123	,517			
General Cronbach's Alpha		,513			,868	

When Table 2 is examined, it is seen that the first version of the success test has a very low reliability ( $\alpha = .513$ ). Considering that the total correlation values of the item should be higher than 0.25, it can be stated that these values are quite low. When the necessary arrangements and the questions that are not suitable for use in the success test are removed one by one, it is seen that the reliability value ( $\alpha = .868$ ) is increased and the total correlation values of the item are in the appropriate ranges. As such, it can be said that the success test is reliable. In Table 3, there are misconceptions obtained as a result of open-ended questions and success test.

**Table 3.** Misconceptions detected

Question	Misconception	Right Concept
1	There is no gravitational force per month. There is no weight.	There is a little gravitational force in the month.
2	The mass does not change relative to the planet, the mass increases.	Mass is the amount of unchanged substance. Since gravity changes on different planets, the weight changes.
3	The mass increases as you go to the equator. The weight does not change.	The amount of the substance does not change according to the location. Weight is gravity that affects mass. Since gravity decreases in the equator, the weight decreases.
4	Ton is the weight unit.	The unit of the weight is Newton. Ton is the unit of kilogram or gram mass.
5	The mass increases on the Moon, the weight does not change.	Mass does not change on the moon, weight changes.
6	Because the mass does not change, 600 N is the same everywhere.	It is the weight of the object measured as 600 N. Weight varies according to gravity.
7	Mass is more at the poles.	Gravity is high at the poles. So the weight changes.
8	The mass increases sharply as the weight increases.	Weight depends on mass and gravity. Increased weight may result from gravity.
9	It depends on weight, not mass, when objects fall on the ground.	Gravity is applied due to the mass of objects.
10	The weight increases as you climb higher than the earth.	As we move away from the earth, the force of gravity decreases and the weight decreases.

#### 4. CONCLUSION AND DISCUSSION

When the results of the research are examined, it is seen that middle school 7th grade students have some misconceptions about mass and weight. These misconceptions are similar to the misconceptions previously found in the literature or appear as some differences. It can be said that the success test used in the research process is reliable and usable (Yılmaz, Ertuğrul Akyol & Kalgı, 2017).

## 5. REFERENCES

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