The Question of ‘Where is The Gravity?’ From The Elementary School Students’ Point of View

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SYNOPSIS

INTRODUCTION

The place of concepts used in science lessons is important to teach those lessons effectively and efficiently due to abstract nature of the concepts involved in the science lessons (Osborne & Freyberg, 1985). It has been pointed out that the concepts are the abstract ideas taking place in people’s minds and decrease the complexity of the everyday life. They also help to learn objects and events existed around us and in the world. According to the constructivism, a learner integrates new ideas into previous ones and thus s/he relates the previous ideas to the new ones during her/his learning (Çepni, 2007).

While comparing new knowledge with previous one in mind, students may not make connections or they may misconstrue if the new knowledge is not meaningful (Köseoğlu et al., 2003). As a result of those misconstructions, ideas conflicting with scientifically acceptable notions emerge in their minds. Those alternative ideas of students are described as misconceptions, misunderstandings, pre-conceptions, alternative frameworks, children’s science, general sensory concepts or insufficient understanding (Bacanak, Küçük & Çepni, 2004; Driver, 1985; Driver & Easley, 1978; Gunstone, 1990; Mike & Treagust, 1998; Osborne & Freyberg, 1985).

It has been reported that misconceptions originate principally from a student’s pre-knowledge, social environment, language or textbooks used in classes and teachers’ teaching strategies or methods used (Bozkurt, Salman Akın & Uşak, 2004; Hammer,
Having described the nature and sources of misconceptions to realize meaningful learning in classrooms, it is required to diagnose those misconceptions.

PURPOSE OF THE STUDY

In this study, elementary school students’ misconceptions on gravity have been investigated. It has been aimed to contribute to the previous studies that explored elementary school students’ misconceptions about gravity. Moreover, it has been aimed to draw implications, including concrete teaching situations to remedy detected misconceptions.

METHODOLOGY

This study, which aims to make interpretations and to follow the way of outlining perceptions and phenomena in their natural settings realistically and entirely, is a qualitative research in its own nature. The sample of the study consists of 370 grade-8 primary school students. A conceptual understanding test (CUT) involving four open-ended questions has been designed to reveal students’ ideas about gravity. After the CUT had been evaluated on the basis of its content and face validity and also administered to all students, 18 students were selected to conduct semi-structured interviews.

The categorization system (Driver & Erickson, 1983; Kocakülah, 2002) used in data analysis had two main steps: the first step was nomothetic approach, which required the determination of the full response of each question by asking the experts’ views. The second step was idiographic approach, which put scientifically unacceptable responses of the students in sub-categories according to the content of each response after all responses had carefully been read.

In order to check internal reliability of the analyses, a second coder coded randomly selected 60 students’ responses which were given to the open-ended questions in the CUT. Consistency between the codings of two independent coders (Kocakulah, 2011) was calculated for each question separately. Overall inter-rater reliability was found to be as 0.81.

FINDINGS

In question one, majority (26.75%) of the students gave explanations principally based on air pressure and difference in pressure. Students indicated that air pressure increased or decreased when someone/something gained height. As a result of change in air pressure, that object encounters an increase or decrease in its weight. It was evident during the interviews that the use of the statement of ‘‘air pressure decreases as we move upwards in the sky’’ during teaching of the topic of pressure in general encouraged to believe the above idea.

As 62.43% of the students referred to gravity or gravitational force in a scientifically unacceptable way in the second question, the idea that ‘‘gravity does not exist in space out of Earth’’ comprised the main category for responses in this group and expressed by 17.57% of the students. Students, who did not make reference to gravity or gravitational force in their responses, constituted 19.20% of the participants in the sample.

Findings obtained from the third question, showed that students mostly (17.57%) emphasized that ‘‘gravity does not occur in space or on the Moon and the same rule applies in the water due to upthrust which cancels the effect of gravitational force and the situation resembles to the one in space or on the Moon’’. Here, the notion of ‘‘gravity does not exist in space or on the Moon’’ confused the students and resulted as misconceptions. Another
misconception detected from the answers of the students (15.14%) responding scientifically unacceptable ideas that was ‘‘gravity does not act on objects in water’’.

In the fourth question, many students (59.72%) indicated that the objects with a larger mass or heavier than the other hit the ground first. Students (32.44%), who referred to the concept of gravity in a scientifically unacceptable terms, stated that ‘‘gravity does not exist on the Moon, hence objects do not drop besides they are suspended or floated in air’’.

CONCLUSION AND SUGGESTIONS

Having examined the findings obtained from this study, it was revealed that students were generally unable to differentiate the concept of gravitational force from the concept of gravitational acceleration, and they confused the concept of mass with the concept of weight and they also thought that gravitational forces did not act on objects in space and on the moon. The results of the present study appear to be in agreement with other published findings (Bar, Zinn & Rubin, 1997; Bar et al., 1994; Berg & Brouwer, 1991; Chandler, 1991; Gürel & Gürdal, 2002) regarding the occurrence and types of alternative conceptions on gravity.

The misconceptions about gravity revealed in this study showed that they impeded the meaningful learning of students and were formed by the contribution of one or of a combination of numerous situations involving incomplete knowledge presented during teaching. They caused memorized knowledge but not internalized in terms of making sense of it. Moreover, abstract nature of the concept of gravity and finally the lack of learning by doing and learning by experiencing were thought to be the sources of those misconceptions.

It can be suggested that the concepts of gravitational force, gravitational acceleration, weight and mass should be taught meaningfully to all students by presenting sample classroom activities reconciled with everyday life. Questions used in this study can also be suggested to science teachers to diagnose the students’ pre-conceptions which they brought to the classroom before teaching and to reveal misconceptions emerged throughout or after teaching of the topic of gravity. These kind of questions may both make students curious about the phenomena which were heard or seen in media before or existed in their social plane if they are used at the beginning of teaching.
REFERENCES


