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EFFECT OF EXPLANATORY STORIES ON TRANSFORMATION OF SEVENTH GRADE STUDENTS' MISCONCEPTIONS ABOUT SCIENCE

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Abstract

The future of the individual and society in our age of information is produced rapidly restored, access to information, using the information and producing skills are connected. The acquisition of skills and continue of these skills lifetime require a modern education based on the production of information. There are many methods to improve these skills and one of them is explanatory story. The explanatory stories take key 'big ideas' in science and explain these in a rounded, relevant and interesting way that highlights their importance in current scientific understandings and developments. For this purpose, the effect of explanatory stories on 7th grade students' misconceptions about particulate nature of matter was investigated. A pre-experimental design was used. The sample of this study consists of 26 students. The chemistry achievement test which includes 15 true-false statements was used as a pre and post-tests for data collection. Pre-test and post-test scores were compared with Paired Samples Test. There was a significant difference between them. According to ANOVA results, there was no significant difference between girls' and boys' success for pre-test. But this result was changed for post-test. In the light of the results, it could be said that the explanatory stories help students to meaningful learning about science.

Key words: Particulate nature of matter, science, explanatory stories, misconceptions

INTRODUCTION

The studies indicate that students develop their own ideas about basic concepts before and after coming to science classes. Frequently, these ideas are different from accepted scientific knowledge (Driver, Squires, Rushworth, and Wood-Robinson, 1994; Demircioğlu, 2009). "Misconceptions", "alternative structures", "science of children", "pre-concepts", "common sense concepts", "spontaneous information" or "inadequate understanding" are used to express these types of ideas in the literature (Driver & Easley, 1978; Lin and Cheng, 2000). Although it is very important determine misconceptions of students, elimination of the misconceptions are more important (Christianson & Fisher, 1999). It is often emphasized that traditional teaching approaches may not effective on students' misconceptions. (Driver & Easley, 1978). Thus, the researchers have been focused on alternative methods to transform students' misconceptions with scientific understanding since 1980 (Pfundt & Duit, 1991). In the last century, the new approaches have been made to improve the quality of science education when development of educational methods and techniques are deemed necessary. One of these approaches is constructivist approach. With regard to constructivism, the learning takes place as a result of interaction with pupils' environment and the configuration of information in their minds. Further more recently, most of educators and researchers have made more emphasis to motivation of students for responsible from their learning and make students eager to learn instead of structured information. Therefore, not only students' prior knowledge but also willingness of students should be taken into account organizing learning environments. Alternative instruction materials which increase students' interest in science should be used for help students to develop their science concepts. Also these materials allow the active participation of students (Demircioğlu, Demircioğlu & Ayas, 2006). Science, especially chemistry, as a discipline is difficult for students because of including abstract ideas (Kee& McGovan, 1998; Reid, 2000). Therefore, students have insufficient understanding about contribution of chemistry for the development of society. Whereas, chemistry is not only a subject to prepare students for their careers but also an enjoyable field to understand world. However, enough emphasis hasn't been made associated with relation between concepts and daily events at schools. Science has stories about important and interesting inventions related to world. If stories are formed by relevant and consistent information, they will become extremely important tools to make information meaningful. It is thought that science could become more attractive with scientific stories. The relationship which is among science-technology-society will be understood better. Scientific illiterate individuals can be grown by this technique. In the literature, researchers have supported that the explanatory stories are effective instruction tools in science education (Fensham, 2001; Banister&Ryan, 2001).Instruction along with the stories, subjects associated with daily life linking the establishment of a bridge between theory and practice can be ensured (Ayvacı & Çoruhlu, 2009). On the other hand, there are a lot of studies about determination of

students' ideas related to particulate nature of matter in the literature (Abraham, Williamson, and Westbrook, 1994; Ayas, Özmen and Çalık, 2009; De Vos and Verdonk, 1996; Gabel, Hunn and Samuel, 1987; Griffiths and Preston, 1992; Haidar and Abraham, 1991; Novick and Nussbaum, 1978; Valanides, 2000). These studies show that particulate nature of matter and related concepts, to learn many other chemical concepts, are difficult for students. Thus, it is extremely important to make studies for elimination of students' difficulties about this concept and related concepts. The aim of this study is to investigate the effect of explanatory stories on transformation 7th grade students' misconceptions about particulate nature of matter.

METHOD

A pre-experimental design (one group pre-test/post-test design) was used in this study. Within the scope of this method was studied on one group. The study was designed to pre test-intervention-post test.

Sample

The study was carried out with 26 (16 girls, 10 boys) seventh grade students in a primary school in Trabzon for 2010-2011 academic years.

Data Collection Tool

A test which consists of 15 items has been prepared to determine students' misconceptions about "Particulate Nature of Matter". True-false items, 5 items of them written in the form correctly and 10 of them the wrong statements. Wrong items have been established the misconceptions obtained from literature review (Abraham, Williamson, and Westbrook, 1994; Ayas, Özmen and Çalık, 2009; De Vos and Verdonk, 1996; Gabel, Hunn and Samuel, 1987; Griffiths and Preston, 1992; Haidar and Abraham, 1991; Novick and Nussbaum, 1978; Valanides, 2000). Correct items have been prepared to ensure content validity related to aims and content of curriculum. The reliability of test items (KR-20) has been found 0,72.

The intervention

Five explanatory stories have been prepared by researcher for study. Explanatory stories have been prepared to misconceptions which 30% of students have result of pre-test. Some misconceptions have been considered with the same text. Prepared stories have been studied carefully by two academicians and an experienced science and technology teacher. Each story has been set up with keywords related to the topic. Explanatory stories have been assisted by visual presentations to help understanding stories. Implementation of explanatory stories has been made by researcher with her former students. Implementation has been taken 3 hours.

Data Analysis

Grading the test has been made the wrong answer 0 point, the correct answer 1 point and totally over 15 points. Quantitative data which obtained from pre-test and post-test have been compared using dependent t-test. Percentages of misconceptions obtained from pre-test and post-test have been explained.

FINDINGS

Percentages of misconceptions obtained from pre-test and post-test implementations have been given in Table 1. Table 1 was examined; percentages of correct answers of students in pre-test between 21%-85% and in post-test between 38%-96% have been changed. There is a significant increase from pre-test to post-test after application. When the results compared with paired samples test, results were found to be statistically significant ($t(24) = -7.33$, $p<0.05$) (Table 2). Although arithmetic average of scores of students from pre-test 7.92, arithmetic average of scores of students from post-test 10.2. The achievement is about 69%. According to Table 1, none of the students can eliminate their eight misconceptions totally but they have achieved significant success from all misconceptions. The explanatory stories haven't been prepared for every misconception in the chemistry achievement test. They have developed for 21% of students and over. However, other misconceptions also are discussed by students' and teachers' questions and class discussions. In the light of these results, the general perception has been occurred among students with explanatory stories. For example, 79% of students had misconception which is *"There is no mass of gases"* before application. During application, this misconception has been explained in detail with related explanatory story. As a result, a significant portion of students have left this misconception. Some of students have still continued their misconceptions (Table 1).

Table 1. The percentages of correct answers obtained from pre-test and post-test

STATEMENTS	Pre-test	Post-test	
	%	%	
1. Atoms similar to the solid plastic ball.	27	38	No explanatory story
2. All atoms in the nature are same size.	85	85	No explanatory story
3. All atoms of iron element are same size.	69	58	No explanatory story
4. Molecules consist of randomly combination of atoms.	46	56	No explanatory story
5. Copper element consists of copper atoms.	81	96	No explanatory story
6. The lemonade is pure substance.	46	85	Explanatory story was prepared

7. The physical changes are only phase changes.	21	56	Explanatory story was prepared
8. The creation of the mixture is chemical change.	35	58	Explanatory story was prepared
9. The evaporation is a physical change.	69	69	No explanatory story
10. The gases can compress.	63	63	No explanatory story
11. When a liquid substance which is in the container changed phase to gas, its' mass reduces.	27	54	Explanatory story was prepared
12. The crush is a chemical change.	46	77	No explanatory story
13. There is no mass of gases.	21	58	Explanatory story was prepared
14. Solids do only vibration, liquids do vibration and displacement and gases do vibration, displacement and rotation movements.	69	88	No explanatory story
15. Atom is the smallest part of showing the properties of the element.	63	85	No explanatory story

Obtained Findings from Paired Samples Test and ANOVA

Table 2. Results of Paired Samples Test According to Pre-test and Post-test

PRE-TEST	N	Mean	Std. Deviation	t	df	Sig.(2-taled)
POST-TEST	26	-2,19231	1,52366	-7,337	25	,000

$t(25) = -7.337$, $p<0.05$.

The results of ANOVA showed that there was no significant difference between girls' and boys' success according to pre-test (Table 3). But this result was changed for post-test. It can be concluded that this difference may be resulted from the boys' interests about explanatory stories are much more than girls' interests.

Table 3. Results of ANOVA According to Gender

		Sum of Squares	df	Mean Square	F	Sig.
PRE-TEST	Between Groups	2,804	1	2,804	,636	,433
	Within Groups	105,850	24	4,410		
	Total	108,654	25			
POST-TEST	Between Groups	28,446	1	28,446	10,768	,003
	Within Groups	63,400	24	2,642		
	Total	91,846	25			

$F_{(1;24)}= 0.636$, $p>0.05$(pre-test)

$F_{(1;24)}= 10.768$, $p<0.05$(post-test)

DISCUSSION

The results of study have showed that the explanatory stories are effective on transformation of students' misconceptions. This result has been supported by the other studies in the literature (Demircioğlu, Demircioğlu & Calik, 2009; Banister & Ryan, 2001; Ayvacı & Çoruhlu, 2009). Some of students' misconceptions didn't change after application. From here, it has showed that the instruction which is made with taking into account misconceptions of students is not effective to eliminate misconceptions about particulate nature of matter. Because, the misconceptions are resistant to change because of the students' mental structure settled. This situation is often emphasized in the literature (Driver et al., 1994). According to post-test, there was a significant difference between girls and boys. This result is supported by researcher in the literature. Becker (1989) and Weinburgh (1995) covering the literature between 1970 and 1991. Both the latter two papers summarize numerous research studies to show that boys have a consistently more positive attitude to school science than girls, although this effect is stronger in physics than in biology.

CONCLUSION

In this study, effect of explanatory stories on elimination of students' misconceptions about particulate of matter has been investigated. End of the study, it is concluded that explanatory stories are effective to transformation of students' misconceptions about particulate nature of matter. This result is consistent with results of similar studies in the literature. There isn't a significant difference between girls and boys according to pre-test. Traditional education is known to have no effect on misconceptions. But in this study, although preparation of explanatory stories to misconceptions, as a result of the application has been determined that students still had their own misconceptions (Table

1). This result shows that students' misconceptions are resistance to elimination. During application of the materials in the classroom, it has been observed that some students were reluctant to read the stories. In fact some students incorrectly interpreted what they read. But with visual presentations, students more focus on activities. It's concluded that students' reading and understanding skills developed enough. There are lots of different techniques for elimination students' misconceptions in the literature. Only one these techniques used in this study. The results obtained from this study can help to teachers from several ways. Especially, these results can be beneficial to increase teachers' perceptions about effective methods which are in the literature, to students' misconceptions and elimination of these misconceptions. On the other hand, the readability level of stories and comprehension levels of students certainly must be examined and stories must be short. Instead of scientific and explanatory texts which are in the textbooks, funny explanatory stories can be placed for understanding difficult topics. This is not only effective on transformation of students' misconceptions but also contributes to learn to the concepts associated with daily life.

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