The effects of using diorama on 7th grade students' academic achievement and science learning skills

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Contents

Abstract:

This study aims to investigate the effects of using diorama on 7th grade students' academic achievement and science learning skills in "human being and

environment relation" unit. The participants were 49 (E:25, C: 24) 7th grade students studying during 2015-16 academic year in Diyarbakir, Turkey. An achievement test and "science learning skills" scale was used to collect data. The study revealed that students in the experimental group were significantly more successful than the students in the control group in term of the academic achievement. Similarly, students taught with dioramas were better in science learning skills than those taught with traditional learning method. The study has implications for science teachers to include dioramas in their teaching activities and providing opportunities for teachers to develop diorama making skills.

Keywords: science education, diorama, achievement, science learning skills

Introduction

Rapid development in educational technology had led to the dissemination of knowledge in an unprecedented rate that changed the traditional role of a teacher from being the source of knowledge to a guide providing opportunities for students to discover different ways of reaching knowledge. This is also compatible with constructive way of learning where students construct their own learning through the interaction with the learning environment and making discoveries rather than being directly taught by teachers (Perkins, 1999; Çiçek, 2005). During this learning process students develop learning as well as problem solving and critical thinking skills (Orlich, et.al., 2001). Science is a fruitful are for discovery learning as it can help students to develop science learning skills while students' academic achievement increase. Because during investigations students go through flexible learning processes that help students to develop specific problem solving methods and at the end they reach alternative results (Hurd, 2000: Orlich et al., 2001). Science learning skills are skills that render science learning easy, help students become active, require students to take their own responsibility for learning, increase retention along with methods (Çepni et al., 1996), transferable to other areas and reflected in the behaviour of scientists (Pedilla, 1990), use scientific methods to reach and produce knowledge (Arslan and Tertemiz, 2004). Science teaching involves science learning skills (Saat, 2004). Discovery learning develops students' inquiry, critical thinking, scientific thinking, measuring and classification skills. Thus, students are given opportunities to think and work like scientists (Lynch, 1986). During this process the teacher's roles are to prepare the learning

environment where students can take their own learning responsibilities and guide them for making discoveries (Senemoğlu, 2001). Learning materials are important tools, therefore, as means to enrich the learning environments, render learning easy and enjoyable and, also, help students to make discoveries through active participation in learning activities. Nowadays, with the prevailing focus on teaching Science, Technology, Engineering and Mathematics (STEM) during formal education, different tools for enhancing student learning comes to the forefront. Instead of individuals trying to make sense of what is being taught as passive listeners, the new approach requires students to actively participate in the learning process, question what is being taught, investigate topics in unique plan and techniques, present and discuss the findings with their classmates.

Teaching materials and tools are elements of the educational environment that cause effective teaching by increasing student motivation for learning (Bilgen, 1994). A teaching environment with effective teaching tools play an important role in achieving the successful outcomes since using these tools can stimulate students, help them to become active participants, provide opportunities for individually suitable examples and real life experiences as well as high academic achievement and an ability for critical thinking, problem solving and creative thinking (Çelik, 2007). In addition, the use of teaching materials in the classroom enriches the educational experience and provides the meaningful learning for the subject (Lowe, 2000; Stokes, 2002; Kurtdede Fidan, 2008). The use of material and tools for the difficult and abstract concepts in science are particularly important (Begoray, 2001). Because teaching tools provide the opportunity to bring the world of abstract science, which does not fit into the class, into a concrete class environment (Taber, 2002). It gives students the opportunity to learn through living and producing (Schank, 1995; Aksoy, 2003). Another reason for using teaching tools in science teaching is that they provide students with a real-life environment (Arslan, 2007). It is important that science lessons are practiced with the help of teaching materials in order to contribute to the training of students who are interested in science, who are curious, observers, thinkers, thinkers, asking questions, solving problems, making inferences and designing and finalizing experiments (Justi & Gilbert, 2002, Marbach-Ad, 2001). One of the teaching materials used in science teaching is dioramas (Tunnicliffe & Scheersoi, 2015). Diorama can be defined as a scene from a certain time period. Because of the nature of dioramas, this definition cover a vast area (Tunnicliffe & Scheersoi, 2009). The reason dioramas have such a large scope is that any moment can be captured at any given time. All the details of the moment captured with the help of dioramas are revealed using many objects

(Assa&Wolf, 2007). In addition, in dioramas the relation of objects to each other and their surroundings are described. These described items are perfectly handled in dioramas as depiction of the reality (Tunnicliffe & Scheersoi, 2015). Dioramas can also be used to reach specific aims for teaching themes and topics. For example, in biological dioramas, the real habitat of an animal species can easily be demonstrated to students with real factors such as flora and soil structure. Also, dioramas can be used in teaching process to visualize the concepts such as prey-hunter, symbiotic life without the use of real animal examples. Furthermore, it helps identify biodiversity of the past, including extinct life forms (Marandino, Dias Oliveira & Mortensen, 2009). It also helps to demonstrate the changes that have taken place in the habitats of the living beings during a long period, from past to today, and facilitate learning in the process. All these features of the dioramas increase optimism for using them in educational instruction to reach the goals.

Aim of Study

In present study, the effect of using dioramas on learning "human and environmental relationships" in primary science has been investigated. In the study, answers for the following research questions were sought:

1. Are there differences between students' achievement in "human and environmental relationships" through learning with the help of using dioramas and learning in traditional way?

2. Are there any gender differences in achievement when the two ways of learning are compared?

3.Are there differences between students' competences in learning science on "human and environmental relationships" through learning with the help of using dioramas and learning in traditional way?

4. Are there any gender differences competences in learning science when the two ways of learning are compared?

Methodology

In the study an experimental design including pre-test post-tests was employed. This design was selected because it controls many variables inflecting its external and

internal validity. The experimental design was compared to a control group using conventional teaching method with the experimental group using dioramas.

Picture 1. Students working with dioramas.

Picture 2. Students working with dioramas

Picture 3. Students working with dioramas.

Picture 4. Students working with dioramas.

In the control group, the teacher was asked to teach in the way she does in general that included lecturing and questions and answers. The same science teacher taught the both groups during the study.

Participants

Due to the complication of the school program students could not be randomly selected for the experimental and the control groups. Instead, two of the 5 seventh grade classes were randomly selected as a control and an experimental group. In total, 49 seventh grade students at Fatih Secondary School in Diyarbakır participated in the study. There were 25 students (male:15, female:10) in the experimental group and 24

students (male:14, female:10) in the control group. The experimental study was carried out 6 weeks (24 hours) in spring semester during 2015-2016 academic year.

Variables of the study

The affects of dioramas and gender were used as independent variables while academic achievement and science learning skills were treated as dependent variables in the study.

Data collection instruments

In the study, pre-and post-tests for academic achievement and Science Learning Skills scale were used to collect the data. The achievement tests were prepared by the science teacher cooperated in the study and the researcher. The question on the test were based on the learning outcomes for year 7, outlined by the national ministry of education. The test included 30 questions. Two teacher educators and three science teachers scrutinised the test for the validity. The test was used with the 8 year students, who already study the topic, to calculate the item difficulty and discrimination. 5 items with low difficulty and low discrimination were left out and the final test included 25 questions. The reliability of the multiple-choice questions was calculated by using split half technique. Right answers were given 1 point and wrong answers were given 0 point. The reliability co-efficient for the half of test, r:.681 and for the whole test with Spearman-Brown formula was, r:.810.

The Science Learning Scale test was developed by Chang et al. (2011). The Cronbach alpha value was calculated as .92 for this study.

Data Analysis

The data was analysed through SPSS 21.0. Comparisons of achievement test results for experimental and control groups were carried out by using independent t-test. Differences between genders' responses were calculated by using independent t-test. The pretest results shows both experimental and control group students having similar results for academic readiness and similar level for science learning skill (Table I).

Table I. The comparison of 7th grade students' pre-test results for academic achievement and science learning skills.

Groups	Variable	N	$\bar{X}$	SD	Results
Control	Academic achievement	24	12.37	4.753	t: -.768
Experimental		25	13.44	4.950	sig: .447 p>0.05
Control	Science learning skills	24	3.93	.505	t:-1.186
Experiments		25	4.11	.573	sig: .242 p>0.05

Findings

In this section, firstly, the pre- and post-test results for academic achievement in the control and experimental group for "human and environmental relationship" unit is provided. Table II shows that there were statistically significant differences between pre- and post-tests results for the experimental group ($p<.05$). This result shows that the students in the experimental group where the diorama-assisted teaching method is applied for four weeks are successful. This indicates that the use of dioramas in science teaching has contributed to student success.

Table II. The comparison of the control and experimental groups pre-test and post-tests results

Groups	Variable	N	$\bar{X}$	SD	Results
Experimental	Pre- test	25	13.44	4.950	t: -5.176
Experimental	Post- test	25	20.72	3.702	sig: .000* p<0.05
Control	Pre- test	24	12.37	4.753	t: -3.578
Control	Post- test	24	15.37	4.856	sig: .002* p<.05

Table II shows that there is a statistically significant difference between pre-test and post-test scores in the control group where traditional teaching method was employed for the "human and environmental associations" unit ($p<.05$).

This result shows that the students in the control group who were taught with the traditional method for four weeks are successful. This can be considered to be due to the expectation of progress at a certain level in the students' achievement at the end of the program, whichever teaching method is used in the teaching process.

Table III. The comparison of the control and experimental group students' post-test scores of academic achievement tests

Group	N	$\bar{X}$	SD	Results
Control	24	15.37	4.861	t: -4.341 sig: .000* p<.05
Experiment	25	20.72	3.702	

Table III demonstrates that there is statistically a significant difference between final test achievement scores of control and experiment group students ($p < .05$). This result shows that students in the experimental group with diorama-assisted science teaching were significantly more successful than the students in the control group.

Table IV. The comparison of the control and experimental group students' post-test scores of academic achievement tests

Gender	N	$\bar{X}$	SD	Results
Female	20	18.35	5.575	t: .283 sig: .779 p>0.05
Male	29	17.93	4.742	

According to Table IV, there is no significant difference in gender between the post test scores of control and experimental group students ($p > .05$).

Table V. The comparison of the control and experimental groups' pre- and post-science learning skills scores

Groups	Variable	N	$\bar{X}$	SD	Results
Experimental	Pre-test	25	4.11	.573	t: -3.412 sig: .001*
Experimental	Post-test	25	4.55	.295	

					p<0.05
Control	Pre- test	24	3.93	.505	t: .838 sig: .407
Control	Post- test	24	3.80	.528	p<0.05

In the table V, the control and experimental groups pre and post science learning skills results for the "human and environmental associations" are compared. The table shows that the students taught through the dioramas for six weeks were more successful in comparison the control group who were taught by traditional teaching method. The results show a statistically significant difference between the pre and post test results of the experimental group (p<.05). This cannot be said for the control group as the pre and post test results does not reveal a statistically significant difference (p>.05).

Table VI. The comparison of the control and experimental groups based on the post- test results for science learning skills.

Group	N	$\bar{X}$	SD	Result
Control group	24	3.80	.528	t: -6.150 sig: 0.00* p<0.05
Experimental group	25	4.55	.295	

The comparison of the control and experimental groups' post test results for science learning skills (Table VI) reveals a statistically significant difference between the groups (p<.05). The higher mean scores for the experimental group students can be described as the affect of using dioramas during the instruction process.

Table VII. The comparison of the control and the experimental groups' post -test results for science learning skills based on gender

Gender	N	$\bar{X}$	SD	Result
Female	20	4.31	.556	t: 1.328 sig: .191 p>0.05
Male	29	4.10	.565	

The analysis of the findings did not reveal any statistically significant difference ($p>.05$) between the two genders in terms of their post test scores for science learning skills (Table VII).

Discussion

In this experimental study, dioramas were used in the experimental group while teaching the "human and environmental associations" unit. The results demonstrated that there was statistically significant differences in favour of the experimental group. This result shows that the use of dioramas for six week during teaching activities for "human and environmental associations" help students to enhance their academic achievement. Similarly, the control group students also exhibited progress for the same topic while being taught through traditional teacher centered teaching method. This is due to the fact any teaching method can contribute to students' learning experiences while the level of enhancement shows divergence from one method to the other. The study also revealed that students in the experimental group where they were taught through dioramas scored higher in comparison to the control group students who were taught by traditional method in the post test for academic achievement. When the related literature is examined, it is seen that the use of visual teaching materials for instruction in the classroom environment affects the success of the students positively (Şahin, 2000; Çiftçi, 2002; Sönmez, 2006; Can, 2009). Ciftci (2002) found that the use of visual materials significantly increased the success of middle school students. Similarly, in his research, Sönmez (2006) concluded that, during teaching/learning process, using visual teaching material had a positive effect on students' academic achievement of the students. Supporting contemporary educational environments with visual teaching materials increases the level of learning and retention (Dursun, 2006). Recent studies have pointed to the role of dioramas in providing learning environments that are close to the truth and their instructional potential in biology education (Ash, 2004; Piqueras et al., 2008; Reiss & Tunnicliffe, 2007; Scheersoi, 2009; Tunnicliffe, 2005). Particularly, the use of dioramas in teaching the ecosystem supports academic success. Because, with the help of dioramas, students are able to see different forms of plants and animals living in the ecosystem. Also, they are able to see the relation of living things in the ecosystem to their own species and to different species. Thus, students can compare the existing knowledge with the new knowledge and reconstruct the new knowledge in his mind through the interaction with the dioramas (Mifsud & Tunnicliffe, 2013). Scheersoi and Tunnicliffe (2009) emphasize in their studies that students visiting the

dioramas museums are more effective in defining biological species. Reiss & Tunnicliffe (2011) states that dioramas have contributed significantly to students' understanding of biology as well as their comprehension of biological constructs, interpretation of taxonomic structure, and description of species' behaviour. Specially, helps pupils identify relationships between organisms such as hunting-hunter, social group, mutual life. Similarly, Marandino, Dias Oliveira and Achiam (2009) point to the impact of dioramas on the teaching of biodiversity. In their study, with the help of dioramas, students were able to identify plants, animals, fungi species with their habitat, fauna, flora, soil type and rock form.

There was no significant difference between the test scores of the control and the experimental group in terms of the gender variable in the study. In addition, the research has revealed in a significant improvement in the level of science learning skills of students in the experimental group who were supported through dioramas for 6 weeks. In contrast, students who were taught in the control group through traditional teaching method did not exhibit a significant improvement for science learning skills. This can be taken as an evidence for the importance of teaching through students centred activities, dioramas in this case. Mifsud & Tunnicliffe (2013) argues that students who visit dioramas demonstrate higher development of scientific skills such as observing, matching observations, asking questions and hypothesising. Interaction with dioramas helps the development for identification, interest, interpretation and research skills with biological dioramas (Tunnicliffe ve Scheersoi, 2010).

The current research documented that the level of science learning skill for students taught through dioramas were significantly higher than the students who were taught through the traditional instruction in the control group. This suggests that diorama-assisted science teaching improves students' ability to learn science skills. The literature suggests that students' science learning skills develop as a result of comparing dioramas describing different ecologic event (Tunnicliffe, 2007). In the same vein, Reiss and Tunnicliffe (2011) emphasizes that teaching through discovery learning with the help dioramas improves students' ability for observing, measuring, making hypothesis, communicating, interpreting and making theories. Reynolds (1991), in his work with secondary school students, also emphasizes that activity-based science education is more significantly contributes to the success of science learning ability to develop science skills than academic achievements. Teaching biology lessons through hands-on activities, in comparison to the traditional teacher centred instruction, is important in improving students' scientific

learning skills as well as cognitive achievement, retention and problem solving skills (Thair ve Treagust, 1997; Preece ve Brotherton, 1997).

In terms of gender, the current study did not find any statistically significant difference in experimental and control group students' science learning skill levels at the end of the unit taught.

Conclusion and Suggestions

The study found that diorama supported science instruction contributes significantly to students academic achievement. In addition, diorama supported science teaching help for the enhancement of students' science learning skills. By taking the findings into consideration that it is important to integrate dioramas to preservice science teacher education curriculum to help future science teachers learn and develop their diorama using skills in their science classes. Also, dioramas should be an integral part of science textbooks and activity books.

References

Arslan, A. & Tertemiz, N., (2004). İlköğretimde bilimsel süreç becerilerinin geliştirilmesi, *Türk Eğitim Bilimleri Dergisi,* s.4, c.2.

Arslan, M. (2007). *Öğretim İlke ve Yöntemleri* (Aşılıoğlu, B., Başlıca Öğrenme ve Öğretim İlkeleri bölümü). Ankara: Anı Yayıncılık.

Aksoy, B. (2003). Deney yöntemi ile atmosfer basıncı konusunun öğretimi üzerine bir model. *Gazi Eğitim Fakültesi Dergisi*, 23(3), 207-226.

Ash, D. (2004). How families use questions at dioramas: Ideas for exhibit design. *Curator: The Museum Journal*, 47: 84–100.

Assa, J. & Wolf, L. (2007). Diorama construction from a single image, *EUROGRAPHICS*, v.26, no.3, 599-608

Begoray, D. (2001), "Through a class darkly: Visual literacy in the classroom", *Canadian Journal of Education*, 26(2) 201-217

Bilgen, H.N. (1994). *Çağdaş Demokratik Eğitim*. Ankara: MEB Yayınları.

Can, S. K. (2009). *İlkokul 4.ve 5. Sınıflarda Sosyal Bilgiler Dersinde (Araç-Gereç)Materyal Kullanımının Öğrenci Başarısına Etkisi*. (Yüksek Lisans Tezi). Kafkas Üniversitesi Sosyal Bilimler Enstitüsü. Kars.

Çelik, L. (2007). *Öğretim Materyallerinin Hazırlanması ve Seçimi*. Ö. Demirel, (Ed). Öğretim Teknolojileri ve Materyal Tasarımı, Ankara: Pegem A Yayıncılık.

Çepni, S., Ayas, A., Johnson, D. & Turgut, M. F. (1996). *Fizik Öğretimi.* Ankara: Milli Eğitimi Geliştirme Projesi Hizmet Öncesi Öğretmen Eğitimi Deneme Basımı

Çiçek, A.İ. (2005). Yeni öğretim programları ve yapılandırmacı eğitim anlayışı (http://www.kastamonu.meb.gov.tr/şubelerimiz/müfettişler/bizdensize

Erişim tarihi 11 Ocak 2007).

Çiftçi, Ü. (2002). *Sosyal Bilgiler 6, 7 ve 8. Sınıf Derslerinde Materyal Kullanımının Öğrenci Başarısı ve Tutumlarına Etkisi*. (Yayınlanmamış Yüksek Lisans Tezi).

Dursun, F. (2006). Öğretim sürecinde araç kullanımı. *İlk öğretmen Dergisi*, 1, 8-9.

Justi, S. R. & Gilbert, K. J. [2002). Modelling teachers' view on the nature of modelling and implications for the education of modellers. *International Journal of Science Education, 24* (4), 369-387.

Kurtdede Fidan, N. (2008). İlköğretimde araç gereç kullanımına ilişkin öğretmen görüşleri, *Kuramsal Eğitimbilim*, 1 (1), 48-61

Lowe, R. (2000). Visual literacy and learning in science, *ERIC,* Digest:ED463945

Mifsud, E. & Tunnicliffe, S.D. (2013). Children interpreting wildlife trough national history dioramas, *10th Conference of the European Science Education Research Association (ESERA)*, 2-7 September, Nicosia, CYPRUS

Marandino, M., Dias Oliveira, A. & Mortensen, M.F. (2009). Discussing biodiversity in dioramas: A powerful tool to museum education. *ICOM Natural History Committee Newsletter*, 29, 30-36.

Hurd, P.D. (2000). Science Education for the 21st Century. *School Science and Mathematics,* 100(6), 282-289

Lynch, P.P. (1986). Laboratory work in schools and universities; Structures and strategies still largely unexplored. *Journal of Science and Mathematics Education in South East Asia*, v.9, n.2, 51-60

Marbach-Ad, G. (2001). Attempting to break the code in student comprehension of genetic concepts. *Journal of Biological Education*. 35(4), 183-190.

Orlich, D.C., Harder, R.J., Callahan, R.C. & Gibson, H.W., (2001). *Teaching Strategies; A Guide to Better Instruction*, New York, Houghton Mifflin Company

Padilla, M. J. (1990). *Science Process Skills*. www.educ.sfu.ca/narstsite/-publications/research/skill.htm

Perkins D. N. (1999). The Many Faces of Constructivısm. *Educational Leadership*, 199:6-11

Piqueras, J., Hamsa, M. K., & Edvall, S. (2008). The practical epistemologies in the museum: A study of students' learning in encounters with dioramas. *Journal of Museum Education, 33* (2), 153-164.

Preece, P.F. & Brotherton, P.N. (1997). Teaching science process skills: Long-term effects on science achievement, *International Journal Science Education*, v.19, no.8, 895-901

Reiss, M. J., & S. D. Tunnicliffe. (2007). Opportunities for learning in biology. *Paper presented at NARST conference,* April 15-17, New Orleans, USA.

Reiss, M. J. & S. D. Tunnicliffe. (2011). Dioramas as depictions of reality and opportunities for learning in biology, *Curator The Museum Journal*, v.54, no.4, 447-459

Reynolds, A., (1991). Effects of an experiment-based physical science program on cognitive outcomes. *Journal of Educational Research,* v.84, n.5, 296-302

Saat, R.M, (2004). The acquisition of integrated science process skills in a web-based learning environment, *Research in Science & Technological Education*, v.22, n.1

Schank, R, C. (1995). What We Learn When We Learn by Doing. (Technical Report No. 60). Northwestern University, Institute for Learning Sciences. http://cogprints.org/637/1/LearnbyDoing_Schank.html.> adresinden 2.04.2013 tarihinde alınmıştır.

Scheersoi, A. (2009). Biological interest development at natural history dioramas. In the Important Role of Natural History Dioramas in Biological Learning, S. D. Tunnicliffe & A. Scheersoi, eds. *ICOM Natural History Committee Newsletter* 29: 10–13.

Senemoğlu, N. (2001). *Gelişim Öğrenme ve Öğretim Kuramdan Uygulamaya*, Ankara, Gazi Kitapevi.

Sönmez, Ö. F. (2006). *İlköğretim Sosyal Bilgiler 7. Sınıf Karadeniz Bölgesi Konusunun Görsel Araç-Gereçlerle Öğretiminin Öğrencilerin Akademik Başarısına Etkisinin Değerlendirilmesi*. (Yüksek Lisans Tezi). Gazi Üniversitesi Eğitim Bilimleri Enstitüsü. Ankara.

Stokes, S. (2002), Visual literacy in teaching and learning: A literature perspective, *Electronic Journal Fort the Integration of Technology in Education*, 1(1)10-19.

Şahin, M. (2000). *Sınıf Öğretmenlerinin, Öğretim Sürecinde Eğitim Teknolojileri ve Uygulamalarına İlişkin Etkinlikleri Yerine Getirirken Karşılaştıkları Problemler.* Yayınlanmamış Yüksek Lisans Tezi. Niğde Üniversitesi, Niğde.

Taber, K. S. (2002). Alternative conceptions in chemistry-prevention, diagnosis and cure. London: The Royal Society of Chemistry, Theoretical background.

Thair, M. & Treagust, D. (1997). A review of teacher development reform in indonesian secondary science: The effectiveness of practical works in biology, *Research in Science Educations,* 27(4), 581-587

Tunnicliffe, S. D. (2005). What do dioramas tell visitors? A study of the history of wildlife diorama at the museum of Scotland. *Current Trends in Audience Research and Evaluation, 18*, 23-31.

Tunnicliffe, S.D. (2007). The role of natural history dioramas in science education. *Informal Learning*. 87:11–14.

Tunnicliffe, S.D. & Scheersoi, A. (2015). *Catching the Visitor's Interest*. In: Tunnicliffe, S.D. & Scheersoi, A. (Eds.): Natural History Dioramas. History, Construction and Educational Role. Springer, 145-16.

Tunnicliffe, S. D. & A. Scheersoi. (2010). *Natural history dioramas: Dusty relics or essential tools for biology learning? In Science Exhibitions: Communication and Evaluation*, A. Filippoupoliti, ed. Edinburgh: Museums Etc., 186–216.

Tunnicliffe, S.D. & Scheersoi, A. (2009). The important role of Natural History dioramas in biological learning. *ICOM Natural History Committee Newsletter.* International Council of Museums: Natural History Committee Newsletter, 29. pp. 1-40. ISSN 1814-6058. DOI UNSPECIFIED