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SU BİLGİNLERİ MOGAN GÖLÜ'NDE: YARATICI DRAMA VE YAPILANDIRMACI YAKLAŞIM TEMELLİ BİLİM EĞİTİMİNİN ETKİLİLİĞİ[1]

Water Scientists at Mogan Lake: Effectiveness of Creative Drama and Constructivist Approach Based Science Education

Dr. Gülendam AKGÜL

Milli Eğitim Bakanlığı, gulendamakgl@gmail.com, Ankara/TÜRKİYE

Dr. Derya ATALAN ERGİN

Milli Eğitim Bakanlığı, deryaatalan@gmail.com, Ankara/TÜRKİYE

Prof. Dr. Ahmet ALTINDAĞ

Ankara Üniversitesi, altindag@science.ankara.edu.tr, Ankara/TÜRKİYE

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ÖZ

Bu çalışmanın amacı TÜBİTAK tarafından desteklenen Su Bilginleri Mogan Gölü'nde projesi kapsamında verilen eğitimin etkililiğini sunmak ve öğrencilerin bilime yönelik tutumlarını değerlendirmektedir. Çalışma 2016-2017 eğitim öğretim yılında Ankara'da farklı devlet okullarına devam eden 63 dördüncü sınıf öğrencisi üzerinde yürütülmüştür. Çalışmada Karma desen kullanılmıştır. Nicel veriler 15 çoktan seçmeli soruyu içeren bir başarı testi ve Bilime Yönelik Tutum Ölçeği'nden, nitel veriler ise açık uçlu sorulardan elde edilmiştir. Tüm nicel veriler için istatistiksel analizler SPSS 20 paket programı ile değerlendirilmiştir. Nitel veriler içerik analizi ile değerlendirilmiştir. Wilcoxon işaretli sıralar testi sonuçları çocukların başarı testi ve Bilime Yönelik Tutum Ölçeği son test puanlarını ön test puanlarından yüksek olduğunu göstermektedir. İçerik analizi sonuçlarının ise çocukların son testte bilim insanı olmak, bilimsel araştırma yapmak konusundaki isteklerini ve bilimin gerekliliğine inançlarını daha fazla ifade etmelerinden dolayı nicel verileri desteklediği belirtilebilir.

ABSTRACT

The purpose of this study is to present the effectiveness of educations of Water Scientists at Mogan Lake Project, supported by TÜBİTAK (The Scientific And Technological Research Council Of Turkey) and to examine the attitudes of students toward science. The study was conducted on 63 fourth grade students in 2016- 2017 school year, in different public schools in Ankara. The study used mixed method research design. Quantitative data were obtained using an achievement test consisting of 15 multiple choice questions and an Attitude Toward Science Scale while qualitative data were obtained through open-ended questions. All statistical analyses for quantitative data were performed through SPSS v.20.0. Qualitative data were analysed using content analysis procedure. According to the results of The Wilcoxon signed-rank test children got significantly higher scores on achivement test and attitudes toward science scale. Content analysis results supported the quantitative data in that after the Project activities children reported their desire to be a scientist, to make scientific research and believed the necessity of science more.

1. GİRİŞ

Childhood is a period when innate learning curiosity is at the highest levels. During this period children experiences intensive feelings of inquiry and curiosity. Stimulating their curiosity about environment, exposure to different environmental stimuli and showing them that science is part of real life are important ways to endear the science to children.

Studies shows that as the grade level of children increases, in other words as the children get older, their positive attitudes toward science decreases (Krinzinger, Kaufmann, & Willmes, 2009; Lyons, 2006; Speering, & Rennie, 1996). In addition, in Turkey science classes were found to be insufficient for improving basic scientific process skills (Böyük, Tanık, & Saraçoğlu, 2011). Thus in order to get

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children's attraction and curiosity for science, it will be an important step to arouse their curiosity by way of games, drama activities, observation, research, experiments and hands-on acivities especially at early ages.

Behavioral approach to education which was the dominant approach in Turkish Educational System until 2004 left its place to constructivist approach in 2005. Although the basic educational philosophy of the system has changed, in practice, it has been very common that teachers have continued to use traditional educational approaches based on memorizing. In the teacher-active methods, students usually memorize what the teacher presents rather than using creative thinking skills. Thus it is difficult to attract students' attention to science in the traditional classroom environment (Oh & Yager, 2004). In oder to get students attention more on science subjects, students should actively construct the information using more enjoyable and hands-on activities.

The new approaches in science education are based on students-active methods of constructivist approach. The basic philosophy of consructivist approach to education goes back to Jean Piaget's and Lev Vygotsky's Cognitive Developmental Theories (Vygotsky, 1978). The most fundemental assumption of this approach is that students actively construct the knowledge (Shiland, 1999). They are not passive learners. They are active in their own learning. In the light of their prior knowledge, they construct new meanings from the interaction with environment, materials and peers. In this way this approach value the importance of learner-centered education different from traditional approaches where knowledge are told, shown or explained by teacher to the students.

Laboratory activities or activities in the nature allows students to interact with materials to observe and understand the natural world (Hofstein & Lunetta, 2004). Students should be in interaction with not only the other learners but also the object in the environments. Learning occurs in the presence of others which emphasize the role of interaction among other learners and teachers. A learner together with others actively learns new skills, knowledge and behaviors (Akyol, & Fer, 2010). The new ideas come out as a result of the interaction between learners.

Constructivist approach differs from traditional approach in terms of the role of the teacher. Teacher facilitate students' exploration of the subject (Haney, & McArthur, 2002). They do not simply provide all the knowledge to the students. Rather, they provide oppurtunities so that students create meaning through active real life experiences. Moreover, the assessment in constructivist approach is different from traditional approach. Assessment coexists with learning activities instead of being a seperate activity. Activities such as portfolios and exhibitions are used as assessment in this approach.

The effcectiveness of constructivist approach has been evaluated in many studies. For example, use of this approach in social sciences class was found to increase academic achievement of students and permanence of their knowledge (Ünal, & Çelikkaya, 2009). Moreover, it was known that educational approaches based on constructivist approach supported high-level thinking skills and positive attitudes toward science classes. (Aydın, & Yılmaz, 2010). Thus, constructivist approach fosters both permanency of learnt knowledge and positive attitudes toward the subject.

In addition to constructivist approach, creative drama techniques are also favorable in education. Use of creative drama in Science Education was proven to be effective in fifth grade students achievements and scientific process skills (Taşkın-Can, 2013). Students who had creative drama based science and technology courses during four weeks not only learned academic subjects better but also improved in problem solving, critical and creative thinking when compared to students who were thought by teacher-centered methods. Similarly, another study (Hendrix, Eick, & Shannon, 2012) showed that integration of creative drama techniques to an inquiry-based science program has fostered both attitude toward science and learning outcomes among fourth and fifth grade students.

Creative drama is bringing a thought or a purpose to life using techniques such as improvisation and role-playing, based on a group of people and their experiences (Adıgüzel, 2010). It can be used both as purpose and a tool in education. In addition to its own techniques, it includes the general characteristics of play. During the process, group members are accompanied by a leader in order to achieve new gains. In the literature, although creative drama techniques have been widely used in social skills training, there have been studies where the effects of creative drama on impoving the academic skills have been examined (Akdemir ve Karakuş, 2016; Karaosmanoğlu & Adıgüzel, 2017; Özsoy, 2016).

The educational activities used in this project were all based on constructivist approach and creative drama techniques described above. First, the level of past knowledge about water and wetlands issue

was derived from the fourth grade curriculum of science subject and were taken into account in preparation of activities. Second, all the activities were organized in order to provide real life and hands-on experiences to students. Third, the educators are responsible for acilitating the learning of students rather than *teaching.* Fourth, throughout the educational activities, drawings, designed small sculptures using clay. And finally, creative drama techniques were implemented for warming up activities, tostrenghten the acquired material or provide social interaction between educators and learners in each of the educational activity. As a result, 20 educational activities to teach fourth grade students about water and wetland issues were prepared.

It is very difficult to be involved in nature for children living in Ankara since it is the second biggest city in Turkey. Especially children in the center areas of the city cannot access to wetlands. They do not have any chance to experience anything about water and wetleands other than the information from books or documentaries. Water education in this sense was thought to teach the children, water, waterlands and creatures living in water. Furthermore, during the education on water, the children will find oppurtunity to make observation, scientific research and experiments. Thus Water Scientists at Mogan Lake Project will introduce students with science through water education.

The aim of this study is to test the effectiveness of educational activities based on constructivist approach and creative drama on fourth grade students' knowledge about water and wetlands, and their attitudes toward science in general. With this aim, the following hypotheses were set:

1. Does teaching of educational activities about water by means of the constructivist approach and creative drama techniques bring about significant differences with regard to students' success on the achievement test about water and wetlands?

2. Does teaching of educational activities about water and wetlands by means of the constructivist approach and creative drama techniques bring about significant differences with regard to students' attitudes toward science in general?

2. METHOD

In this research mixed method research design was used. Both quantitative and qualitative data were obtained. In quantitative part, a quasi-experimental design was used. Pre-test and post-test measures of an achievement test and an attitude toward science test was utilized for study group. In the qualitative part of the research, the content analysis of open-ended question was performed.

2.1. Study Group

Water Scientists at Mogan Lake Project was planned as four groups, each one consisting of randomly selected 15 students from applicants. The announcement of the Project was performed by Ankara Provincial Directorate of National Education. A formal letter was sent to all public schools in Ankara and fourth grade students were invited to apply for the participation by means of applications in Project website. Besides, posters about Project, application period, dates and content of the Project were also sent to the schools and provincial directorates. During the selection of participants, especially schools which were thought to be from lower socioeconomic status were given priority in accordance with the Project aims. The approval of parents for participation of their children to the Project activities were obtained before Project activities started. Data were obtained from students both before and after the Project activities.

Total 63 students attended the Project activities. Analysis were carried out on 57 cases because the missing cases were removed from further analysis. The demographic information about the working group of the "Water Scientists at Mogan Lake" project is presented in Table 1.

Table1. *Demographic characteristics of the working group*

Characteristic	n	%
Gender		
Girl	31	49.2
Boy	32	50.8

Mother education level		
No school	0	0
Elementary	11	17.5
Middle	5	7.9
High School	22	34.9
University / higher	25	39.7
Father education level		
No school	2	3.2
Elementary	7	11.1
Middle	2	3.2
High School	22	34.9
University / higher	30	47.6
Birth year		
2006	4	6.3
2007	48	76.2
2008	11	17.5
Total	63	100

2.2. Instruments

2.2.1.Achievement Test. This test was developed by the researchers the for the purpose of this study to assess the acqusition of students about the subject. Twenty questions reflecting the content of the 20 educational activity were chosen from a question pool used in the Water School in Ankara University by the Project executer. Since the age group of the sample was low, multiple choice questions with four options were preferred and questions included some visual images as options. The achievement test consisting of 20 items was applied to a group of 45 students to calculate the reliability. Then, by taking opinions of a specialist group comprised of four persons, namely a professor working in the science faculty of a reputable university, a psychological counselor and two academicians working on biology, the questions which had low reliability levels were excluded from the test and total question number was reduced to 15. When the reliability coefficient of the academic achievement test was calculated, it was found as KR20=,85 Students were given 20 minutes to answer the test. Each correctly answered question was scored as 1. The range of the points from the test ranges 0 to 15.

2.2.2.Attitude Toward Science Scale. The 19 items with three-point Likert scale was originally developed to measure attitudes of students toward science (Duran, 2008). The points of the scale ranges from 19 to 57. The reliability of this scale is α= 0.79. Students were given 25 minutes to answer the scale.

2.2.3.Open-ended Questions. The 6 open-ended questions were developed by the researchers in order to learn the students' views about scientists, scientific research, the need for science and the advantages/disadvantages of science. Students were given 20 minutes to answer the questions. The questions were "Science is necessary because…", "science is unnecessary because…", "I want to be a scientist because…", "I don't want to be a scientist because…", "I like making scientific research because…" and "I don't like making scientific research because…". Answers to the questions were analyzed using content analysis.

2.3. Procedure

Each year TÜBİTAK supports activities which aim to transfer the scientific knowledge to the society through interactive and visual methods, and as result, fostering society's curiosity, research, inquiry and learning motivation (TÜBİTAK, 2017). Water Scientists at Mogan Lake Project was supported by TÜBİTAK in 2016 and aims to contribute to develop positive attitude toward science in fourth-grade

students in Ankara. The education material consists of 20 educational activities which contain information about water, wetlands and aquatic creatures. Both creative drama and constructivist approach based techniques were used in the preperation of education materials.

2.3.1. Education Program

The program was developed based on constructivist approach and creative drama methods. The educations were completed at four groups. In each group, students got five days education (six hours each day including break and lunch), using educational activity materials developed for the purpose of this study. The program consisted of 20 activities. Students were presented 3 activities after the application of pre-test in the first day. In the following three days, five activities were performed in each day. In the final day, 2 activities were applied and post-test data were obtained.

During the educations students performed different activities, in Ankara University Tandoğan Campus and Mogan Lake. In each of the 20 activities, a creative drama technique (such as animation or role-playing) was used for either warming or closing activity. Each activity also included a kind of game related to the content of that activity. Moreover, in each activity students did something by themselves in accordance with the constructivist approach. For example students did such things as having water samples from different places in the campus (Child University Pool and University Pool) and analyzing the samples using microscobes. They played games, did puzzles, drawings and aquatic creattures using clay. In addition, they visited Mogan Lake four days and did some activities at lakeside. Some example lakeside activies were finding bentic creatures in the mud from the bottom of the lake and fishing. If needed, a visually based presentation was used such as presentation of images of related to wet lands, bentic creatures or planktons. All of these activities were carried by educators specialized in biology. The educators were also thought about how to perform creative drama activies from an experienced creative drama leader.

2.4. Data Analysis

Both quantitative and qualitative methods were used to analyze the data. All statistical analyses for quantitative data were performed through SPSS v.20.0. To test the effectiveness of the science education program, The Wilcoxon signed-rank test was performed based on achievement test results obtained before and after the program. Similarly it is used to test if there were any changes in the students' attitudes toward science before and after the education program.

Finally, to analyze the qualitative data content analysis was used. Statistical content analysis was employed to analyze the qualitative data. A theme analysis was conducted on the answers of open-ended questions. Codes were obtained as a result of theme analysis. The frequencies and percentages of codes were computed so that comparison of themes and codes became possible (Yıldırım ve Şimşek, 2011).

3. FINDINGS

Two main purposes of this study were to compare the differences in the (i) achievement scores and (ii) attitude toward science scores of students before and after Project activities. The Wilcoxon signed-rank test was used to make comparisons and the results are presented in Table 2.

Tablo 2.

The Results of Wilcoxon Signed-Rank Test for Achivement Test and for Attitudes toward Science

Variable	Pre-test - Post-test	N	Mean Rank	Sum of Ranks	z	p
Achivement Test	Negative Ranks	6	15,42	92,50	-5,302	,000**
	Positive Ranks	44	26,88	1182,50		
	Ties	6				
	Total	56				
Attitudes toward	Negative Ranks	28	22,57	632,00	-2,275	,02*

Science	Positive Ranks	14	19,36	271,00
	Ties	14		
	Total	56		

*p<.05 ** p<.01

According to the results, post-test scores were statistically significantly higher than pre-test scores of students in the working group (z= -5,30, p< 0.05). In other words, students got higher achievement test scores on the post-test.

Attitudes toward science scores of students before and after Project activities were also compared using Wilcoxon Signed-Rank Test. The results indicated that there was a statistically significant difference between Attitude Toward Science scores of students before and after the Project activities (z= -2,28, p< 0.05). As can be seen from the Table 2, students' toward science scores were higher after the Project activities.

Content analysis of open-ended questions was also used to test if there were any differences in students' attitude toward science before and after Project activities. Open-ended questions were examined in three parts, desire to be a scientist, liking to make scientific research and the necessity of science. Percentages and frequencies both before and after the Project activities were calculated and tabulated for each themes and codes. The results for "desire to be a scientist" are presented in Table 3.

Table 3. ***Frequencies (f) and percentages (%) of themes and codes for "desire to be a scientist"***

Desire to be a scientist	**%**		**Themes**	**Codes**	**before**		**after**	
	before	**after**			f	%	**f**	**%**
want	66,67	83,05	**Personal reasons**	Learning new information	8	14,81	3	6,12
				Curiosity	8	14,81	8	16,33
				Making Research/ Experiment/ Observation	9	16,67	5	10,2
				Interested in the profession	13	24,07	16	32,65
				Inventing /developing new things	6	11,11	7	14,29
				Entertaining	5	9,26	4	8,16
				Total	49	90,73	43	87,75
			Social reasons	Helping people	2	3,7	3	6,12
				Making life easier	1	1,85	1	2,04
				Contribution to country development	2	3,7	2	4,09

				Total	5	9,25	6	12,25
			Personal reasons	Tiring profession	6	22,22	4	22,22
				Boring profession	3	11,11	2	11,11
				Not self-appropriate and interested in other professions	11	40,74	10	55,56
don't want	33,33	16,95		Other	4	14,81	1	5,56
				Total	24	88,88	17	94,45
			Social reasons	Accidental damages while doing experiments /danger	3	11,12	1	5,56
				Total	3	11,12	1	5,56

According to Table 3, 66,67 % of children wanted to be scientist and 33,33 % of them didn't want to be a scientist before the Project activities. On the other hand, after the Project activities 83,05 % of them wanted to be a scientist and 16,95 % didn't want it. The percentages reflected that number of children who wanted to be a scientist increased after the Project actvities. The data were gathered around the two themes, personal reasons and social reasons.

Both before and after the Project activities, children who wanted to be a scientist emphasized "Interested in the profession" in the personal reasons theme. Similarly "Not self-appropriate and interested in other professions" is the most rated personal reason for those who didn't want to be a scientist. Thus reasons for being and not being a scientist were similar both before and after Project activities.

Some examples from codes before the Project activities were listed as "I like doing experiments (C2)", "I like science (C13)", " I wonder the mechanism of life and the things which we use (C54)", "we can learn about science without being a scientist (C80)", "I am a child interested in science (C81)", " Scientists are patient, but I am not (C81), "Some experiments can cause accidents (C82) and "I am interested in other professions (C84)". After the Project activities, some examples from their answers were "I like making research(45)", "I want to contribute to my country's development and protect it (C66)", "I am interested in other professions (C101)" and "Scientists make research. I like researches (C116)".

The findings for the answers obtained from the " I like making scientific research/ I don't like making scientific research" questions are presented in Table 4.

Table 4.

Frequencies (f) and percentages (%) of themes and codes for "liking to make scientific research"

Liking to make scientific research	**%**		**Themes**	**Codes**	**before**		**after**	
	before	**after**			**f**	**%**	**f**	**%**
like	79,75	85,51	**Affective reasons**	Have fun	19	30,16	20	33,9
				Like/enjoy	14	22,22	14	23,73

				Total	33	52,38	34	57,63
			Cognitive reasons	Being curious	9	14,29	9	15,25
				Finding / acquiring new information	21	33,33	15	25,42
				self-developing			1	1,7
				Total	30	47,62	25	42,37
			Affective reasons	Do not have any fun	5	31,25	5	50
				To be angry/ to get bored when it doesn't work	1	6,25		
				To be interested in other things	1	6,25		
don't like	20,25	14,49		Don't like making research	3	18,75		
				Total	10	62,5	5	50
			Cognitive reasons	Time consuming	4	25	5	50
				Difficult/tiring	1	6,25		
				Not reasonable	1	6,25		
				Total	6	37,5	5	50

According to Table 4, 79,75% of children like making scientific research and 20,25 % of them don't want to be a scientist before the Project activities. After the Project activities, 85,51 % of them said they liked making scientific research while 14,49 % of them didn't like it. The percentages reflected that number of children increased after the Project actvities. The themes were affective reasons and cognitive reasons.

Before the Project activities, children who liked making research stated "Finding / acquiring new information" code under the cognitive reasons theme most frequently. Those who didn't like found making scientific rsearch as "don't have any fun". After the Project activities, the most frequnt reason for liking and not liking to make scientific research were the same as the ones before the Project activities. But those who didn't like it also stated that making scientific research was "time consuming". After the Project activities, only one student stated that it was"self-developing" which wasn't stated before.

Codes of "Liking to make scientific research" before the Project activities were "It is challenging (C13)" and "Science catch my attention (C41)". After the Project, some examples from children's answers were "I wonder the result of scientific research (C35)", "I am fond of learning new information (C47)", "I think making scientific research are so exciting (C105)", " time consuming (C22)" and "I wonder the movements of microscobic creatures (C54)".

Finally, the findings for the answers of "necessity of science" question are presented in Table 5.

Table 5

Frequencies (f) and percentages (%) of themes and codes for "necessity of sicence"

science is	%		Themes	Codes	before		after	
	before	after			f	%	f	%
necessary	83,33	98,28	**Personal benefits**	Develop ourselves / our minds.	1	2	3	5,26
				It is part of our lives.	3	6	3	5,26
				It makes our lives easier.	6	12	10	17,54
				It provides improvement and learning.	18	36	26	45,61
				It is funny.	3	6		
				Other	3	6		
				It will be useful in the future			2	3,51
				total	34	68	44	77,18
			Social benefits	It contributes the development and progress of countries	4	8	2	3,51
				Technology develops.	4	8	3	5,26
				It is useful for humanity.	5	10	4	7,02
				Other	3	6	4	7,02
				total	16	32	13	22,81
unnecessary	16,67	1,72	**Negative reasons**	It is not important/ necessary.	3	30	1	100
				It does not gain us much.	2	20		
				total	5	50	1	100
			Affective reasons	It is boring.	3	30		
				Other	2	20		
				total	5	50	0	0

According to the results, for those who believed that science is necessary, gave answers which gathered around personal benefiits and social benefits. Those who thought that the science is not necessary, stated answers which were clustered around negative reasons and affective reasons themes. Before the Project activities 83,33 % of children thought that the science is necessary, while 16,67 % thought that it was not. After the Project activities, almost all of the children came to believe

the necessity of science (98,28%) and very small number of them (1,72%) said it was not necessary. Project activities persuaded children that the science is necessary.

The most frequently stated reason for the necessity of science was "It provides improvement and learning" under the personal benefits theme. For the unnecessity of science "It is not important/ necessary" under the negative reasons theme and "It is boring" under the affective reasons theme were most frequently reported. After the Project activities the most frequent explanation for the necessity of science was the same that is "It provides improvement and learning". Only one student stated that "It is not important/ necessary".

Some explanations for the necessity of science before the Project activities were "It is useful for humanity (C1)", "We can't be scientist if we don't know science (C7)", "I don't think that it is necessary (C9)", "We can use our own minds instead of science (C13)" and " Always the same things are discussed (C16)". After the Project activities, some statements from the students resposes were "It is not so important (C66)", " Scinece is everywhere (C97)" and "It helps our worlds'development (C118)".

4. DISCUSSION

The study presented two important results. First the Project activities were effective in teaching water and wetland related science subject to primary school children. This outcome is in agreement with previous research results in fifth grade students' social sciences lessons (Ünal & Çelikkaya, 2009). They reported that constructivist based lessons elevated academic achievement of students in social sciences classes. Moreover, the result is also consistent with other findings in undergraduate science education (Freeman, et al., 2014). The studies which compared active learning versus traditional lecturing were metaanalysed and the results proved that strategies where students were active learners had better examination performances.

The second finding that students had more positive attitudes toward science after constructivist and creative drama based education is consistent with previous findings. For example, Oh and Yager, (2004) also investigated the effects of constructivits based science education in classroom encvironment in high school. They reported that the more constructivist the learning environment the higher the degree of positive attitudes toward science learning. The present study differs from theirs is that the age group of children was lower, primary school students. Thus, including the creative drama methods in addition to constructivist approach was thought to get better the children's attention. In eight grade students, Arisoy (2007) similarly reported positive relationship between constructivist learning environment variables and science attitudes, more specifically science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science. The present result differed from Ünal and Çelikkaya's (2009) finding that constructivist based lessons did not significantly changed the attitudes toward social science lessons. This might be due to the nature of social science lessons differ from science lessons is that in the former it is difficult to enable students hands-on experiences or experiments.

Educational activities in the present study were not only based on constructivist approach but also creative drama. The use of games in education were examined in another subject (Bakker, 2014). The results were consistents with the present study. Use of mini games for teaching mathematical subjects like multiplication and division in elementary school students. They have found that use of games positively influenced students attitude toward mathematics. In other words, primary school level children benefit from entertaining game activities in learning school subjects such as science or mathematics.

The present studies' qualitative findings showed that after the Project activities more students expressed their "desire to be a scientist" and " liking to making scientific research". Arisoy (2007) similarly reported positive relationship between constructivist learning environment variables and science attitudes, more specifically science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science. Thus it could be inferred from present and past studies that constructivist based approach to science education is beneficial in terms of adding a scientific career goal to children's repertoire.

This study has many educational implications. First of all, whatever the content is, a science education which includes non-traditional and entertaining different activites, games, hands-on experiences and out-door activities can have positive attitudes toward science. It has been clearly shown that a positive attitude toward a science increases students' academic achievement (Arisoy, 2007; Oh & Yager, 2004).

Therefore, to increase the academic achievement in science classes, these kinds of activities should be implemented in learning environments. At the same time, out-of-school learning environments, as Lake in the present study, should be utilized more in science education. Thus children will feel that science is part of everyday life, not an isolated boring school subject. Last but not least implication is that integrating creative drama activities (and games according to the age of children) would be beneficial. Especially knowing that playing games boosted the positive attitude towards science, drama activities and games can be actively used in science curriculum of especially the lower grades.

The present study is unique in terms of integrating constructivist based approach and creative drama methods in science education about water and wetlands. This integration seems to result in more positive attitudes towards science among primary school children. But it is not without its limitations. The most striking limitation of is that it lacks a non-treatment control group. This study was part of a Project supported by TÜBİTAK. Therefore the data was obtained from only sudents who participated to the Project activities. It would be even better that the same content on water education would be presented to a control group in the traditional classroom environment with classical didactic methods. Another limitation is that the it is not for sure that attitude change in students are permanent. A follow-up after three months would be useful in order to see the changes in the effectiveness of constructivist approach and creative drama based science education. A follow-up test would also would be used to see if this Project education has an advantage over the classical traditional didactic education in terms of the stability of scientific information.

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