

The effects of children's university activities on children's views and attitudes towards scientists and science

Huseyin Es^{*}, Sinop University, Education Faculty, Sinop 57000, Turkey

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Abstract

Children's universities introduce science to children at an early age. These universities are spreading across the world with an aim to popularize science and involve children in scientific activities. In this study, we have aimed to determine the effects of the children's university activities on children's views and attitudes towards scientists and science. The project lasted two weeks and included 27 activities including science, mathematics, arts and sports. The participants were 50 students from 6th grade. The data was collected through a 21 item-scale developed by Pell and Jarvis (2001) and by "The Images of the Scientist" scale developed by Song and Kim (1999). The results revealed that students' attitudes to science changed statistically. Therefore, the images of students to scientist changed positively at the end of the activities. The findings show that the children's university activities have reached its objectives. It is believed that children's universities should be expanded and supported, which may give children a chance to meet science and university at early ages.

Keywords: Children's university; science school; science education; image of scientist, gifted education

* ADDRESS FOR CORRESPONDENCE: Huseyin Es, Sinop University Education Faculty, Sinop 57000, Turkey.
E-mail address: huseyines@sinop.edu.tr / Tel.: +90- 368 -271-5526/2045

1. Introduction

Today, individuals it is desired for to easily reach information, analyze this information and make informed use of technological developments in their daily life (Kara and Akarsu, 2013). During the process of acquiring these skills, people are expected to behave like a scientist and follow, smell, hear, feel and wonder about the natural phenomena in order to understand them and learn how to deal with problems (Turkmen, 2010). Therefore, when giving science education to particularly young children, guidance should also be offered so that they learn by discovering, enjoying and minimizing their anxieties and fears so that children can greatly enjoy science (Cho & Choi 2003; Wilson, 2004). However, existing research has revealed that due to many reasons, such as the intensity of curriculums, lack of time, crowded classrooms and shortage of teachers, students develop negative attitudes towards courses that they need to learn, particularly experiencing this problem, towards science (Curebal, 2004; Cakır, Senler & Taskın, 2007; Greenfield, 1998; Gurkan & Gokce, 2000; Jelinek, 1998; Osborne, Simon & Collins, 2003; Ozsevgec, 2007; Tekbiyık v.d., I DO NOT UNDERSTAND THIS 2013; Weinburgh, 1995).

Einstein stated that problems can be solved by considering them within the context of the structures creating them (MacBeath & Waterhouse, 2008). Difficulties experienced in school environments hindering students from learning have, as pointed out by Einstein, increased the importance of informal learning environments (Stocklmayer & Gilbert, 2003). Informal learning environments are thus of great importance as they complement the information and skills attained by students within school settings, allowing inquiry and experimentation and contributing to students' questioning and multi-directional thinking (Noel-Storr, 2004). That is, these environments are important in terms of imparting skills that are difficult to acquire in formal learning environments because they provide students with first-hand observation opportunities and by reinforcing the formal learning activities (Emmons, 1997).

In the relevant literature, it is stressed that informal learning environments have positive effects on the attitudes towards science, scientific process skills and science-related professions (Gibson & Chase, 2002; Karatas & Aslan, 2012; Knox, Moynihan & Markowitz, 2003; Markowitz, 2004; Mittelstaedt, Sanker & Vanderveer, 1999; Orstein, 2006; Prokop, Tuncer & Kuasnicak, 2007). As a result of the contribution of informal learning setting to student achievement, these settings have started to gain an institutional identity (Es & Ozturk Geren, 2014). One of these institutional formations is children's universities bringing children and universities together. However, in developed countries, it has been known for a long time that children can capitalize on various educational opportunities offered by universities; the first children's university, according to some researchers, was established in Birmingham in 1993 (Overton, 2010) and, according to others, in Tubingen in 2002 (Eucu.net, 2010).

Depending on the conditions and needs of the region where children's universities are established, such universities serve some very important purposes, such as filling the gap between the students who are at low level of education and those who are at high level of education (Overton, 2010). They also provide students with educational opportunities outside school hours by means of exciting and innovative learning activities (Children's University, 2014) and introducing them to scholars (Kinderburo, 2014). Since the European Union 7th Framework Program (FP7) announced that children's universities programs would be conducted within the context of EUCU.NET (European Children's Universities Network) they have made great contributions to social development. The reasons lying behind the establishment of children's universities are to encourage children to think critically and acquire the sense of curiosity in the field of science, improving the academic culture of students, enabling students to meet with universities and make use of the opportunities offered by universities and offering guidance for students to make their future preferences (Eucu.net, 2013). In light of all this information, the basic goal of children's universities can be defined as introducing children to science at an early age and getting them engaged in scientific activities and thus, becoming fond of science. In a report evaluating children's universities in England, the statement was emphasized uttered by a

student having participated in children's university activity in Bichester "*at school the teacher shows us science but at CU we find out ourselves*" (MacBeath & Waterhouse, 2008 PAGE?), thus demonstrating the main goal of these universities. Children's universities promise to endear science to science in settings where they can learn by doing and experiencing.

The subject of the current study is the project called "Enjoyable Science, Art and Sports School in Sinop Children's University" supported by The Scientific and Technological Research Council of Turkey (TUBİTAK). The purpose of the current study is to determine whether the attitudes of students participating in the project towards science and the scientist has changed.

2. Method

The current study was conducted according to a single group pretest-posttest design, one of the experimental designs. In this design, the measurements related to connections between participants and the dependent variable are performed as pre-test before the application and as post-test after the application by using the same participants and same measurement tools (Buyukozturk et al., 2009). The reason for the selection of this method for the study is the need to include all students in the application stages alongside the impossibility of selecting a control group. The project lasted two weeks and included 27 activities from the disciplines of science, mathematics, arts and sports.

2.1. Study Group

The participants were 50 students from 6th grade. Project announcements were made throughout the city and applications were received. In order to provide all the applicants with an equal opportunity, a single random sampling selection method was used and selections were made from among the voluntary applicants. In the simple random sampling selection method, each constituent element of the universe had the same chance of being selected (Arıkan, 2004).

2.2. Data Collection Tool and Data Analysis

2.2.1. Participants' attitudes towards science

In order to determine the effect of the activities conducted within the project on the participants' attitudes towards science, we administered a 21-item scale of attitudes towards science developed by Pell and Jarvis (2001) prior to the application as pre-test and following the application as post-test. The scale is comprised of three sub-dimensions: "science enthusiasm", "the social context of science" and "science as a difficult subject". The measurement reliability of the original scale was calculated by Pell and Jarvis to be .82.

After translating the scale into Turkish, studies were made of its reliability; for the same sub-dimensions, the measurement reliability was calculated to be .86 on average (Bulus Kırıkkaya, 2008). In order to determine the difference between the pre-test and post-test attitude scores of the children participating in children's university activities, a dependent samples t-test was conducted by using the SPSS 21 program package.

2.2.2. The participants’ image of the scientist

In order to determine the participants’ image of the scientist and how their image was affected from the activities conducted within the project, “The Images of the Scientists” scale was developed by Song and Kim (1999) as pretest before the application and as post-test after the application was administered. A translation of the scale to Turkish was performed by Demirbas (2009). The data obtained from the scale, consisting of 5 sections, was analyzed with dependent samples t-test and descriptive analysis.

3. Findings

3.1. Findings related to the participants’ attitudes towards science

A dependent samples t-test in SPSS 21 program package was conducted to determine the difference between the students’ pretest and posttest attitudes towards science, with the findings are presented in Table 1.

Table 1: Dependent samples t-test results related to the difference between the students’ pre-test and post-test attitudes towards science

Test	N	\bar{X}	SS	Sd	t	p
Pre-test attitude	50	2,44	0.20			
Post-test attitude	50	2,55	0.24	49	-2.92	*0.005

*p<.05

As can be seen in Table 1, a statistically significant difference was found between the students’ pre-test mean attitude score and post-test mean attitude score ($t_{(49)}=-2.92$, $p<.05$). While the students’ pre-test mean score was found to be $X=2.44$ on a 3-point Likert scale, their post-test mean score was found to be $X=2.55$. Thus, it can be argued that the students’ attitudes towards science developed as a result of the activities performed within the project.

On a 3-point Likert scale, the students’ pre-test mean score ($X=2.44$) shows that the students had positive attitudes towards science before the implementation of the project. In this regard, it can be claimed that because the students participating in the project were voluntary, they were already expected to have positive attitudes towards the project.

3.2. Findings related to the participants’ image of the scientist

When we compared the results obtained from the post-test with the pre-test results following the implementation of project activities, we found that there is a significant difference between the results of the pre-test and post-test in relation to the characteristic of *being careful* favoring the posttest results ($p<.05$). When the results of the post-tests are examined, we seen that positive changes occurred in the students’ opinions about the characteristics of the scientist, although not statistically significant. These changes occurred in the positive direction for the following characteristics of the scientist; the scientist is hardworking ($t_{(49)}=-0.53$, $p>.05$), the scientist is creative

($t_{(49)}=-0.94$, $p>.05$), the scientist is considerate ($t_{(49)}=-1.92$, $p>.05$), the scientist has an inspiring personality ($t_{(49)}=-0.46$, $p>.05$), the scientist is humanitarian ($t_{(49)}=-1.99$, $p>.05$), the scientist is religious ($t_{(49)}=-0.85$, $p>.05$) and the scientist is peace-loving ($t_{(49)}=-1.45$, $p>.05$).

Both the pre-test and post-test results show that the majority of the participants think that the great majority of scientists are males. The results of the pre-test show that the students regard the average age of scientists to be in the following age groups: 30-40 ($f=19$, 38%), 50-60 ($f=10$, 20%), 40-50 ($f=8$, 16%) and 20-30 ($f=8$, 16%). When the results related to the age of the scientist in the post-test are examined, it is seen that the highest ratio of students think that scientists are in the age group of 20-30 ($f=17$, 34%). Moreover, the number of students stating that the scientist is in this age group increased compared to the number of students in the pre-test. As a result of the students' observation of the scientists participating in the activities conducted within the project, the number of students believing that the scientist is 20-30 years old increased.

The ratios of the students stating the job of the scientist as conducting experiments, making a discovery and doing research are close to each other both in the pre-test and post-test. Parallel to this finding, the students mostly illustrated that the scientist working in a laboratory environment both in pre-test and post-test ($f_{\text{pretest}}=26$, $f_{\text{posttest}}=31$). Yet the number of students illustrating the scientist in the laboratory ($f=31$) and in the house ($f=8$) is higher than the number of students in the pretest.

While illustrating the scientist before the application, the students were observed to be affected by the life stories of scientists ($f=23$) and science journals for children ($f=22$). On the other hand, the results of the post-test administered following the application showed that besides the life stories of scientists ($f=25$) and science journals for children ($f=24$), the students were observed to be affected by children's universities ($f=23$). This result can be interpreted as showing that children's universities are influential on students' formation of the image of the scientist.

According to the results of the pre-test, 31 of the students stated that there is no scientist around them. Some students think that some of their family members display the characteristics of the scientist ($f=5$), while some others ($f=2$) think that their teachers demonstrate the characteristics of the scientist. From the post-test results, it is clear that the number of students seeing no-one around them as a scientist ($f=10$) decreased, while the number of students seeing their teachers as scientists ($f=13$) increased. In the post-test, the students stated that the main reason for their seeing more people as scientists around is the instructors in the children's university ($f=15$). This may be because the students realized that the educators involved in the project are, in fact, scientists. Finally, the findings of the current study revealed that the scholars best known by the students are Edison and Einstein.

4. Results and Discussion

When the findings of the current study are examined, we can observe that the students developed positive attitudes towards science throughout the project. Given that the basic goal of children's universities can be defined as introducing children at early ages to science and to get them engaged in scientific activities. Thus, to endear science to the young, the activities conducted within the context of children's universities seem to have contributed to the accomplishment of this goal. It is indisputable that children introduced to science at early ages will go on displaying positive attitudes towards it in the following years (Crowther-Norman et al., 2005). Through the activities in the project, students learn new things and share them with their peers, teachers and families and these activities have positive effects on students (Tezcan-Gulpercin, 2008). The provision of students with such activities supported with scientific, artistic and sports activities helps student to acquire the skills expected from them in relation to different disciplines and activate their feelings and intuitions in different fields (Es and Ozturk Geren, 2014).

When comparing the results of the post-test administered following the activities conducted within the project with the results of the pretest, we may observe that there is a significant difference in

relation to one of the characteristics of the scientist: *being careful*, which is in favor of the post-test. In addition to the above, changes occurred in the opinions of the students in the positive direction, though they were not statistically significant, in relation to the following characteristics of the scientist: the scientist is hard-working, the scientist is creative, the scientist is considerate, the scientist has an inspiring personality, the scientist is humanitarian, the scientist is religious and the scientist is peace-loving. Thus, it can be argued that the activities conducted within the context of children's universities resulted in positive changes in the students' opinions about the characteristics of the scientist. Studies in literature support the findings of current study (Karacam, 2015; 2016). Moreover, it was observed that the students have positive opinions about the characteristics of the scientist in general. Another important finding of the current study is that although the numbers of male and female students are close to each other, a high majority of the students have the image of the male scientist. This finding is supported by some other research in the literature (Song and Kim, 1999; Ocal, 2007; Erkorkmaz, 2009; Sen Gumus, 2009; Korkmaz and Kavak, 2010; Bulus-Kırıkkaya et al., 2011; Nuhoglu and Afacan, 2011; Ozel, 2012; Kara and Akarsu, 2013; Ozsoy and Ahi, 2014).

When the findings of the present study were examined, we observed that the students mostly consider the age of scientists to vary between 30 years old and 40 years old. Song and Kim (1999) found that the students mostly think that scientists are in the age group of 20-50. Korkmaz and Kavak (2010) and Kara and Akarsu (2013) reported that the students identified the age of scientists as 30 or older. Nuhoglu and Afacan (2011) stated that the students mostly think that the age of scientists is in the age group of 40 or over. The highest ratio of the participants of the current study identified the age group of 20-30 as the age of scientists; moreover, the number of students identifying this age range increased after the application. As a result of the students' observation of the scientists participating in the activities conducted within the project, the number of students believing that the scientists are 20-30 years old might have increased. In a similar manner, Bulus-Kırıkkaya et al. (2011) emphasized that the change taking place in the participants' perception of the age of the scientist might be the instructors involved in similar activities conducted in a school of science, art and sports.

Moreover, when the findings of the current study are considered, it may be observed that the number of the students identifying the scientist's age ranging from 10 to 20 also increased. This might have resulted from the direct participation of the students in activities and their becoming personally involved in these activities. After all, one of the goals of children's universities is to get children engaged in scientific activities and activities planned with this purpose in mind are believed to make the students feel more like a scientist. A decrease was observed in the number of students identifying the age of the scientist in the age groups of 30-40, 40-50 and 50-60. This might be because of the low age level of the participating students.

When the findings of the current study are considered, we observed that the ratios of the students stating the job of the scientist as conducting experiments, making discovery and doing research are close to each other. Moreover, the highest number of students sees the laboratory as the working place of the scientist. This finding concurs with the findings reported in the literature (Chambers, 1983; Ocal, 2007; Erkorkmaz, 2009; Sen Gumus, 2009; Korkmaz and Kibar Kavak, 2010; Bulus Kırıkkaya et al., 2011; Kara and Akarsu, 2013; Ozsoy and Ahi, 2014).

The findings of the current study also revealed that while illustrating the scientist, the students were affected to the greatest extent by the life stories of scientists and science journals for children. Bulus Kırıkkaya et al. (2011) have also reported that the children are affected the most from the life stories of scientists and science journals for children. In addition, Korkmaz and Kibar Kavak (2010) stated that when constructing the image of the scientist, female students are affected by the biographies of scientists, textbooks, the Internet and films to the largest extent; on the other hand, male students are affected by the Internet, films and bibliographies of scientists to the greatest extent. Song and Kim (1999) found that students are most affected by films, animations, science journals for children, the life stories of scientists, caricatures and visit to museums when forming their image of scientists.

Another finding of the current study is that while the children did not include children's universities in their illustrations before the application, they did so after the application. This shows that the activities helped to accomplish the goal of introducing students to science and showed the importance of children's universities in the construction of the image of the scientist by the students. Through children's universities, children can construct a better image of scientists and they can thus develop more positive attitudes towards science.

Moreover, before participating in the activities conducted in the current study, the children did not see anyone around them working as a scientist, but they started to identify more people in the program as scientists, particularly the instructors. This finding also aligns with the goal of children's universities to introduce children to science.

Finally, the research findings revealed that the best-known scientists named by the students are Edison and Einstein. Similarly, while Demirbas (2009), Korkmaz and Kibar Kavak (2010) and Bulus Kırıkkaya et al. (2011) reported that Einstein is the best-known scientist, while Song and Kim (1999), Nuhoglu and Afacan (2011) and Ozsoy and Ahı (2014) reported that this scientist is Edison. Moreover, it can be argued that as a result of the activities conducted within the context of the children's university, some changes were observed in the students' image of scientists. In fact, the post-test results showed that the number of children having some image of scientists increased. Even the number of the students stating that they didn't identify themselves with any scientist decreased to some degree.

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