

The Effect of the Science-Fiction Books on Arousing Curiosity about Science in Secondary School Students*

Esra KARADENİZ¹ , Şerif Ali DEĞİRMENÇAY²

¹ Science Teacher, Giresun-TURKEY, ORCID ID: 0000-0002-9432-8087

² Assist. Prof. Dr. Giresun University, Giresun-TURKEY, ORCID ID: 0000-0003-1528-7406

*This study is the namesake and a part of the master's thesis prepared together with Assist. Prof. Dr. Şerif Ali DEĞİRMENÇAY and has been supported by Giresun University BAP department (Project No: EGT-BAP-C-140316-16)

Received: 27.05.2018

Revised: 30.12.2019

Accepted: 01.04.2020

The original language of article is English (v.17, n.2, June 2020, pp.225-241, doi: 10.36681/tused.2020.23)

Reference: Karadeniz, E. & Degirmencay, Ş. A. (2020). The Effect of the Science-Fiction Books on Arousing Curiosity about Science in Secondary School Students. *Journal of Turkish Science Education*, 17(2), 225-241.

ABSTRACT

The aim of this research is to determine the effect of science-fiction books on arousing secondary school students' curiosity about science. The research was conducted with 60 students attending 5th and 6th grades in a secondary school in Giresun, Guce district, during 2015-2016 academic year. The students were divided into two groups as one control group and one experimental group. In the control group, 2013 Science Curriculum was followed. In the experimental group, 12 different science-fiction books were added to the exact same curriculum. In this research, quantitative data were collected via Science Curiosity Scale and qualitative data were collected via semi structured diaries. After the application process, the quantitative data were analysed with SPSS (Statistical Package for Social Science) 16 software and the qualitative data were analysed with content analysis method. As a result of the research, a significant difference was found in favour of the experimental group in terms of science curiosity, compared to the control group who had not read the books. In addition to this, the semi-structured diaries revealed some remarks which state that science-fiction books pique their curiosity about science.

Keywords: Secondary school, science-fiction books, curiosity, science education.

INTRODUCTION

From the moment that we are born into the world, our exploring and learning experience begins as we try to understand our new physical environment. The curiosity motive which drives us to explore is lifelong, enabling us to develop (Acun, Kapikiran & Kabasakal, 2013). Curiosity is defined as a desire for acquiring new knowledge and new sensory experience that motivates exploratory behaviour (Berlyne, 1954; Loewenstein, 1994; Litman & Spielberger, 2003; Collins, Litman & Spielberger, 2004). There are various assumptions of curiosity on



whether it is acquired or is an innate motive that potentially exists in an individual. However, a rather recent study on the body of literature on Psychology would show that human curiosity is regarded as innate (Demirel & Coskun 2009).

When the body of literature on the concept of curiosity is examined, Berlyne's theory of curiosity appears to be widely accepted (Reio, 1997; Unal, 2005). Berlyne's theory defines two kinds of curiosity: perceptual and epistemic. Perceptual curiosity is firstly aroused by new, complicated, eccentric, suspicious or confusing stimulus models (stated as 'collative variables' in the sources). These stimuli then evoke a perceptual conflict or uncertainty which leads the individual to compare the knowledge acquired through sense organs and initiates explorative behaviour (Reio, 1997). Epistemic curiosity, on the other hand, includes the testing of questions and prepositions which are triggered by conceptual uncertainty or complex ideas (theories of knowledge, cognitive puzzles etc.) and intend to acquire the correct knowledge (Berlyne, 1954).

Children are most curious and investigative when they are 6-14 years old. An examination on this age range would prove that they are curious about science most and their questions are vastly on scientific subjects (Gurdal, 1992). Teachers, therefore, have a big responsibility to maintain students' relevant curiosity and investigative ambitions. For it is due to the efforts of searching, questioning, exploring and curious imaginative individuals with a strong ability of interpretation that any progress in the field of science would be possible (Eke, 2010).

Science as a school subject consists of several topics and concepts which include various disciplines such as physics, chemistry, biology, and technology. Consequently, the term science may appear as a set of complicated, abstract, and insolvable topics in many students' minds. The students with such state of mind may not hold the desired levels of knowledge; readiness; general state of arousal; interest in, approach to and motivation for the topic at hand and they might even lack the curiosity about science which is one of the significant triggers for learning in science education. Therefore, various methods and techniques should be employed so that students like the subject, have fun while learning it and feel more curious about it (Yilmaz Korkut & Sasmaz Oren, 2018). In this sense, children's books are quite useful.

Children's books are the fastest path to be suggested to familiarize with the reality of human and life and develop a certain amount of sensitivity (Akal, 2006). According to Huck, Hepler, Hickman and Kiefer (1997), children's books have benefits such as providing children with a chance to have fun and joy while learning; enhancing their inner world; enabling them to establish a natural bond between their own lives and what they read; offering them an opportunity to meet with new and different life experiences (Kaya, 2006). Thus, science-fiction books are one sort of the children's books that would both increase the students' curiosity about science and improve their creativity while providing them with a critical point of view.

With their storytelling, science fiction books urge the reader to be creative (Sudaryat, Nurhadi & Rahma, 2019). In these books, new scientific and technical inventions, assumptions, or some contemporary facts are developed in imaginary ways and narrated accordingly (Karatas & Firat, 2006). Ekem (1990a) stated properties of science-fiction movies as "scientific content, future as a theme, suggestions about the future of technological products, discussion on the concepts of good and evil, appealing to the individual's imagination" are also applicable to science-fiction books. Yet, in addition to demonstrate how far people's imagination might reach, these books have a prominent role in enlightening people and preparing them for the future (Ismihan, 2005). Because, a child who meets with different worlds in the science-fiction books can analyse the real world more easily (Balta, 2014).

Science-fiction books can provide the child with knowledge while offering enjoyable fictions. This fantasy-based genre presents the knowledge to the children in a way that is not authoritative, does not simplify the subject, or underestimates the child, contains educative and instructive elements and transmits its message so clear that every age group can easily deduce it from the context within a playful fictionality (Karatas & Firat, 2006). Therefore, the

instructive and educative function of science-fiction books can be utilized in science education. Yet, since science-fiction stories include practice of science, they can be effective on students' attitude towards science and they can serve as a useful means of instruction in developing positive attitude towards science among students (Arikan & Demirbas, 2006).

Science-fiction, above all, starts and resumes its topics on a scientific line. Thus, it has to discuss many scientific facts. We can see that unreal knowledge is also presented along with real scientific law as the facts are discussed in science-fiction works (Ekem, 1992). Nonetheless, science-fiction is still eligible as a means of education. While using science-fiction books for science education, what we need to pay attention to is that, the students should not possess any conceptual fallacies. After all, science-fiction books are not science books. The sole purpose of utilizing them is to make science enjoyable and deliver knowledge and learning by adding some fun to the process.

In view of the findings of the studies on utilizing science-fiction in science education (Ekem, 1990b; Cavanaugh & Cavanaugh, 1996; Fraknoi, 2003; Acar, 2003; Ongel Erdal, Sonmez & Day, 2004; Barnett, Wagner, Gatling, Anderson, Houle & Kafka, 2006; Bixler, 2007; Yazici & Altiparmak, 2010; Laprise & Winrich, 2010; Surmeli, 2012; Lin, Tsai, Chien, & Chang, 2013; Orcan, 2013; Tang, 2014; Orcan & Kandil Ingec, 2016; Ozturk Onen, 2017) the benefits of using science-fiction in teaching science as a school subject can be summarized as:

- It enhances scientific curiosity, enables the scientific content to be comprehended,
- It promotes a positive attitude towards science and technology, improves success in the field of science,
- It visualizes abstract topics, provides scientific thinking, improves creativity,
- It enables scientific literacy, motivates students to gain scientific knowledge,
- It improves the relationship between scientific disciplines, encourages the students to explain scientific concepts,
- It gives the students an understanding of scientific and technological ethics during the scientific process.

As a result, with the adventures, times and places yet-to-be lived, science-fiction books would attract children's attention (Balta, 2014), arouse their curiosity about science, encourage them to read, do research, ask questions, think the answers over and to explore the relationship between the pieces of knowledge. Thus, these books would take the students one step closer to become science literate individuals which is the eventual objective of science education. In the research that we have conducted for this purpose, the effect of science-fiction books on arousing curiosity about science among secondary school students has been examined and answers have been sought to the following questions:

1. Do the pre-test scores and post-test scores of Science Curiosity Test, that applied to experimental group and control group consisting respectively of the students who read science-fiction books and the students who did not, show a significant difference between the groups?
2. Do the Science Curiosity Test scores of the students in experimental group and control group show a significant difference between the pre-test and post-test applications on the groups?
3. Do the Science Curiosity Test scores of the students in experiment groups differ significantly according to the students' grade?
4. In view of the content analysis of the diaries, what science concepts arouse the most curiosity in the students?

METHODS

The aim of this research is to determine to what degree the science-fiction books arouse 5th and 6th grade students' curiosity about science. Accordingly, the experimental group pre-test – post-test is used in this experimental design study. Thus, the dependent variable is measured using the same instrument both before and after the experiment. During the application, the effect is given to the experimental group to be tested and not to the control group (Buyukozturk, Kilic Cakmak, Akgun, Karadeniz & Demirel, 2012). The processes performed for the experiment group and the control group during the study are summarized in Table 1.

Table 1. Research design

	Before the Experiment (Pre-Test)	Experimental Process	After the Experiment (Post-Test)
Experimental Group	Science Curiosity Test	Teaching the science lesson according to the plan + Reading 12 science fiction books	Science Curiosity Test
Control Group	Before the Operation (Pre-Test) Science Curiosity Test	During the Operation Teaching the science lesson according to the plan	After the Operation (Post- Test) Science Curiosity Test

a) Participants

The population of the research is composed of all the students who studied in the Boarding Regional Middle School in Giresun during 2015-2016 academic year. Sampling group includes 60 students in 5th and 6th grades in Zubeyde Hanim Boarding Regional Middle School. The information about experimental and control groups is given in the Table 2.

Table 2. Sampling related data

Groups	Grade level	The number of female students	The number of male students	Total	Grand total
Experimental group	5	12	3	15	30
	6	10	5	15	
	Total	22	8		
Control group	5	2	13	15	30
	6	7	8	15	
	Total	9	21		

b) Data Collection Tools

In this study, "Science Curiosity Scale" which was developed by Harty and Beall (1984) and translated into Turkish by Serin (2010) is used in order to collect quantitative data. The students are asked to keep diaries and these semi-structured diaries are used in order to collect qualitative data.

Science Curiosity Scale

In this study, by using "Science Curiosity Scale", it is aimed to determine whether there has been any change in the experimental group and the control group students' science curiosity

levels measured at the beginning of the application, through the end of the application. For the research, Science Curiosity Scale that was developed by Harty and Beall (1984) and translated into Turkish by Serin (2010) is used. The original name of the scale is "Children's Science Curiosity Scale". It is a 5-point Likert scale consisting of total 30 items, 8 of which are negative. The scale is based on four factors. These are novelty, lack of clarity, complexity of stimuli, surprise/bafflement.

The Cronbach's α reliability coefficient for the English version of the scale was measured to be 0.85. That of the Turkish version of the scale was measured to be 0.87 (Serin, 2010). As for this research, Cronbach α reliability coefficient is measured to be 0.81 in the study conducted with a total of 100 students in 5th grade and 6th grade. In the field of education and social sciences, this reliability coefficient of 0.81 is regarded as a highly reliable scale.

Semi-Structured Diaries

In this research, the students are asked to keep a diary in the course of the reading process and write down their opinions about each book they finished reading. Since we cannot be sure whether the students answer the "Science Curiosity Scale" questions with full comprehension or not, these diaries are used in order to make them spell out what they hold in their minds. The semi structured diary consists of 6 questions. First 4 questions consist of "collative variables" (novelty, lack of clarity, complexity of stimulus, surprise) which are also the elements of "Science Curiosity Scale" and the stimuli of perceptual curiosity; the 5th question is about science curiosity and the 6th is related to the evaluation of the book in terms of science, and to the process itself. The researcher ensured the reliability and validity of the questions by taking the required expert opinion.

Table 3. *Questions about students' diary about reading books*

-
- 1) Did you come across with new or unusual things in the book you have read? Explain briefly.
 - 2) Did you come across with any pointless, uncertain situation in the book you have read? Explain briefly.
 - 3) Did you come across with any situation that you found complex, confusing in the book you have read? Explain briefly.
 - 4) Did you come across any situation that surprised you in the book you have read? Explain briefly.
 - 5) Are there any situations or events that increase your curiosity about science in the book you have read? Explain briefly.
 - 6) How do you like the book in the context of science? Briefly describe your thoughts about the book.
-

c) The Process of Selecting the Science Fiction Books

At first stage of the study, the books to be employed in the research have been selected. This selection is done according to the following criteria:

1. It should be written by a well-known author;
2. It should be a scientific book;
3. It should be appropriate to the age-group level of the students;
4. It should be funny and informative;
5. It should be recommended by the performing experts in the field of children's literature.

By considering these criteria, 9 science fiction children's books are selected. In addition, 3 non-science fiction books alternating the genre (*Catalhoyuk Stories Series: First Dawn of Our World, Children of Fire, Abundance and War*) have also been selected as they fictionalize the past anew. As a result, the students have read 12 books in total.

Table 4. *The Names and authors of science fiction books that have been read by the experimental group*

№	Name of the Book	Author	№	Name of the Book	Author
1	<i>From the Earth to the Moon</i>	Jules VERNE	7	<i>Time Accident</i>	Bilgin ADALI
2	<i>Twenty Thousand Leagues Under the Sea</i>	Jules VERNE	8	<i>Cipher of Genes</i>	Bilgin ADALI
3	<i>Journey to the Center of the Earth</i>	Jules VERNE	9	<i>Aliens Are Coming</i>	Bilgin ADALI
4	<i>Journey to Mars at the Speed of Light</i>	Aydogan YAVASLI	10	<i>The First Dawn of Our World</i>	Bilgin ADALI
5	<i>Time Bike</i>	Bilgin ADALI	11	<i>Children of Fire</i>	Bilgin ADALI
6	<i>Guests from the Past</i>	Bilgin ADALI	12	<i>Abundance and War</i>	Bilgin ADALI

d) Data Analysis

As a non-parametric analysis method, Mann Whitney U Test; and as a parametric analysis method, Paired Samples T-Test have been applied in order to determine whether the experimental group and the control group differ in terms of science curiosity score or not. In addition, two-way ANOVA is used in order to determine if the pre-and post-practice science curiosity scores would show any significant difference according to the grade level. The two-way ANOVA is used for repeated measures on a single factor (Buyukozturk, 2012).

In Likert-type Scientific Curiosity Scale consisting of 30 items, 5 options have been offered for each item. These are "absolutely agree", "agree", "indecisive", "disagree" and "strongly disagree". These options were given the points 5, 4, 3, 2, 1 respectively. There are 8 negative items on the scale. These have been scored vice versa. The highest possible score for the test is 150 points and the students, whose score were close to this, proved to be very curious about science. The lowest possible score is 30 and the students whose score were close to this proved little interest in science (Serin, 2010). The level of significance (p) is generally taken as 0.05 when in analysing the research findings.

Semi-structured dairies have been analysed via 'content analysis' which is one of the qualitative research methods. The content analysis defines the data and reveals the facts hidden within the data. In other words, it reaches the concepts and correlations that could reveal collected data (Yildirim & Simsek, 2016). The qualitative data in this research are composed of the students' opinions about 12 different science fiction books. The data obtained from the semi-structured dairies have been coded by content analysis and the themes are determined accordingly. The themes obtained from every diary include extra-terrestrials, celestial bodies, space vehicles, force, density, biodiversity, environmental problems, genetics, reproduction, light, electricity, simple machines, layers of the Earth, fossils, elements, heat, food storage conditions, laboratory work, invention, and the personal characteristics and work discipline of scientists.

FINDINGS

a) Findings Related to "Science Curiosity Scale"

When the results obtained from the research were examined, the results of the Mann Whitney U-test has been used in order to see if there is a significant difference between the scores that control and experimental groups achieved in preliminary test, and the findings are given in Table 5.

Table 5. *The SCS pre-test sequence averages and Mann-Whitney U-test results for experimental and control groups*

Groups	N	Mean Rank	Rank Sum	U	p*
Experiment Pre-test	30	35.70	1071.00	294.00	.021
Control Pre-test	30	25.30	759.00		

*p<0.05

According to Table 5, there is a significant difference between the pre-test point average of control group and that of experimental group ($p= 0.021$; $p<0.05$). According to this result, it is obvious that before the science fiction books are read, the science curiosity scores of the students in each group are close to each other, and the groups are not homogenous. The mean rank suggests that, there is a difference in favour of the experimental group.

For the students of the experimental group, in order to test if there were any difference between their scores of "Science Curiosity Test" which was applied both before and after they've read science-fiction books, Paired Samples T-Test has been used and the findings are given in Table 6.

Table 6. *Averages of the SCS pre-test and post-test scores of the experimental group and Paired Samples T-test results*

Experimental Group	N	X	S	sd	t	p*
Pre-test	30	1.22	14.57	29	-3.40	.002
Post-test	30	1.28	15.21			

*p<0.05

According to Table 6, the point average of the students before the application is 1.22 whereas it is 1.28 after the application. As a result, the average of the test scores is increased by 0.06 points. This finding reveals that science-fiction books are effective in increasing science curiosity. According to T-test results, there is a significant relationship between pre-test and post-test of the experimental group ($p=0.002$; $p<0.05$). With reference to this, the increase in the students' science curiosity point average after they read the science-fiction books, is not accidental but substantive.

For the students of the control group, in order to test if there were any difference between their scores of "Science Curiosity Test" which was applied both before and after the study, Paired Samples T-Test has been used and the findings are given in Table 7.

Table 7. *Averages of the SCS pre-test and post-test scores of the control group and Paired Samples T-test results*

Control Group	N	X	S	sd	t	p*
Pre-test	30	1.13	14.62	29	-1.30	.204
Post-test	30	1.16	13.51			

*p<0.05

According to Table 7, the point average of the students before the application is 1.13 whereas it is 1.16 after the application. As a result of the application, the score average of the test is increased by 0.03 points. This finding reveals that without science-fiction books, there is also an increase in the point average of the science curiosity. However, according to T-test results, there is no significant relationship between pre-test and post-test of the control group ($p= 0.204$; $p>0.05$). This indicates that, the increase in the point average is accidental. In other words, there is no significant increase in the science curiosity point average of the students who did not read science-fiction books.

In order to test whether the control group and the experimental group differ in their post-test scores or not, Mann Whitney U-Test results are employed and shown in Table 8.

Table 8. The SCS post-test sequence averages and Mann-Whitney U-test results for experimental and control groups

Groups	N	Mean Rank	Rank Sum	U	p*
Experimental Post-test	30	36,95	1108.50	256.00	.004
Control Post-test	30	24,05	721.00		

*p<0.05

As seen in Table 8, there is a significant difference between the final post-test science curiosity point averages of control group and the experimental group ($p=0,004$; $p<0.05$). When the mean rank is taken into consideration, it is determined that the final post-test point average of the experimental group is higher. This finding indicates that reading science-fiction books has a positive effect on increasing the science curiosity.

The findings related to the pre-test and post-test scores of the experimental group students according to their grade levels are given in Table 9.

Table 9. According to grade levels, pre-test, and post-test statistics of the experimental group

Experimental Group	Grade Level	N	X	S
Pre-test	5	15	1.22	13.89
	6	15	1.22	15.70
	Total	30	1.22	14.57
Post-test	5	15	1.29	14.59
	6	15	1.27	16.28
	Total	30	1.28	15.21

As seen in Table 9, the 5th grade students' pre-test science curiosity point average is 1.22, while this value is 1.29 after the experiment. The pre-test science curiosity point average for grade 6 students is 1.22, while this value is 1.27 after the test. Accordingly, there is an increase in the science curiosity point average of both 5th and 6th grade students who participated in the experiment.

In order to test whether the experimental group in grade level (5th and 6th grades) differ in their pre-test and post-test scores or not, two-way ANOVA is used, and the findings are shown in Table 10.

Table 10. Results of two-way ANOVA analysis of pre-test-post-test scores and grade levels in the experimental group

Source of Variance	Sum of Squares	X	Sd	Mean Square	F	p*
Between Groups	633.750	1.13	1	633.750	11.257	.002
Between Groups* Grade Level	10.417	1.16	1	10.417	.185	.670

*p<0.05

As seen in Table 10, pre-and post-practice science curiosity scores do not differ significantly in terms of the grade level ($p = 0.670$; $p > 0.05$). Accordingly, there is no grade

level related difference between the pre and post experiment science curiosity scores of 5th and 6th grade students, but there is a significant increase in post-experiment science curiosity scores of the students in general ($p=0.002$; $p<0.01$) compared to the pre-experiment scores.

b) Findings Related to Semi-Structured Diaries

The 30 students who participated in the research have been asked to write diaries about 12 books that they read. At the end of each book, students wrote their own feelings and thoughts in the context of the given questions about the book they read. So, 360 content analysis of the diaries were made. The data from the diaries have been tabulated to provide an easier examination on the situations that increase students' curiosity, and the findings have been identified by charts.

Table 11. Findings from science fiction books

The name of the Book	Findings
<i>From the Earth to the Moon</i>	A trip to the Moon, to try to go to the Moon by bullets, the size of the bullet as a vehicle for the trip and that of the barrel that would eject it, how the crew survive in the outer space are found to be the most remarkable parts of the book for the students. And 29 students stated that the book increased their science curiosity. All students stated that the book was entirely about science and most of them said that it contained useful information.
<i>Twenty Thousand Leagues Under the Sea</i>	The interiors and the structure of the submarine, the way it sinks and moves under the sea, marine life and <i>league</i> as a unit of measurement are found to be the most important parts of the book for the students. 26 students stated that the book increased their science curiosity. 29 students stated that the book was entirely about science and most of them said that it contained useful information. Yet, 1 student did not think the book was relevant to science.
<i>Journey to the Center of the Earth</i>	To try to reach the centre of the World, the interiors of volcanoes, and information about underground life are found to be the most interesting parts of the book for the students. 29 students stated that the book increased their science curiosity. All the students expressed that the book was entirely about science and most of them said that the book contained useful information.
<i>Time Bike</i>	Invention of Time Bicycle, to travel in time, continually inventing new things in order to make life easier, burning a fire without using a lighter are found to be the most interesting parts of the book for the students. 27 students stated that the book increased their science curiosity and that the book was completely related to science. 3 students stated that the book was partly related to science. And also, most of the students said that the book contained useful information.
<i>Guests from the Past</i>	Benefits of innovations, the fact that Anin and Cuka referred to the new things they saw for the first time as 'magic', future germs infecting people in the past, changes in the past being effective on the future, how the mirror that Cuka took home with her affected the future are found to be the most interesting parts of the book for the students. 25 students stated that the book increased their science curiosity. 23 students said that the book was entirely about science, 4 students stated that the book was partly related to science and 3 students noted that the book was not about science. Most of the students said that the book contained useful information.

<i>Time Accident</i>	<p>The characters being trapped in time, activating the broken time machine by kicking it, inventing things that would make life easier are found to be the most interesting parts of the book for the students. 24 students stated that the book increased their science curiosity. 29 students thought that it was totally science related, 1 student stated that the book was not related to science, most of the students said that the book was exciting and curious.</p>
<i>Cipher of Genes</i>	<p>Genes, information contained within our genes, nuclear research laboratory and Ilke's dream about the past are found to be the most interesting parts of the book for the students. 28 students have found that the book increased their science curiosity. 21 students thought that the book was totally science related and 9 students stated that the book was partly related to science. Most of the students said that the book contained useful information.</p>
<i>Aliens Are Coming</i>	<p>The existence of extra-terrestrials, the changes in animals due to nuclear leaks, extra-terrestrials asking for human beings' help and using music notes as a means of communication for this purpose are found to be the most interesting parts of the book for the students. 28 students stated that the book increased their science curiosity. 25 students noted that the book was totally science related. 5 students stated that the book was partly about science and most of the students said that the book contained useful information.</p>
<i>Journey to Mars at the Speed of Light</i>	<p>Lightspeed space travel, space shuttle and information about Mars are found to be the most interesting parts of the book for the students. 28 students stated that the book increased their science curiosity. 28 students said that the book was totally science related, 2 students stated that the book was partly about science. Most of the students said that the book contained useful information.</p>
<i>The First Dawn of Our World</i>	<p>Inventing new things for a more comfortable life, making glass from sand, making needles from deer antler and information about ancient life are found to be the most interesting parts of the book for the students. 29 students stated that the book increased their science curiosity. 28 students stated that the book was totally science related and 2 students stated that the book was not about science. Most of the students said that the book was exciting and curious.</p>
<i>Children of Fire</i>	<p>The discovery of copper, making tools from copper, the discovery and domestication of horses, and inventing things are found to be the most interesting parts of the book for the students. 29 students stated that the book increased their science curiosity. 28 students noted that the book was totally science related and 2 students stated that the book was not about science. Most of the students said that the book contained useful information in terms of science.</p>
<i>Abundance and War</i>	<p>The people of Catalhoyuk being very sharing, women accidentally making cheese and yogurt from milk, making rope from animal intestines and inventing new things are found to be the most interesting parts of the book for the students. 28 students stated that the book increased their science curiosity. All students stated that the book was about science. Most of the students said that the book contained useful information about science.</p>

When the diaries written by the students for each book are examined it is observed that certain concepts are mutually found curious by the students and these concepts are given in Table 12.

Table 12. *The Scientific concepts that students are most curious about, according to content analysis of diaries*

Theme	The name of the Book											
	<i>From the Earth to the Moon</i>	<i>Twenty Thousand Leagues Under the Sea</i>	<i>Journey to the Center of the Earth</i>	<i>Cipher of Genes</i>	<i>Aliens Are Coming</i>	<i>Journey to Mars at the Speed of Light</i>	<i>Time Bike</i>	<i>Guests from the Past</i>	<i>Time Accident</i>	<i>The First Dawn of Our World</i>	<i>Children of Fire</i>	<i>Abundance and War</i>
Extra-terrestrials					X							
Celestial bodies	X				X	X						
Space vehicles	X				X	X						
Force	X	X								X		
Density	X	X										
Biodiversity		X	X				X	X	X	X	X	X
Environmental problems	X				X							
Genetics				X	X							
Reproduction							X					X
Light				X	X	X						
Electricity					X							
Simple machines							X	X	X	X	X	X
Layers of the Earth			X							X		
Fossils			X					X	X			
Elements	X						X			X	X	
Heat			X									
Food storage conditions									X			
Laboratory work				X		X						
Inventing things							X	X	X	X	X	X
Characteristics of scientists	X		X			X						

According to Table 12, science concepts that increase students' curiosity include the extra-terrestrials, celestial bodies, space vehicles, layers of the Earth, fossils, density, biodiversity, genetics, reproduction, environmental problems, force, density, light, electricity, heat, simple machines, elements, food storage conditions, invention, laboratory work, and the personal characteristics and work discipline of scientists.

DISCUSSION and CONCLUSION

Discussion

Science begins with curiosity. Feeling of curiosity is one of the important factors that affect human learning (Harty & Beall, 1984). That is because curiosity brings along the desire to know and initiates the act of learning. Hence, knowledge and curiosity are inseparable (Yigit, 2011). Considering the importance of curiosity in the process of reaching information, teachers should organise the learning experiences with due diligence towards the stages of drawing attention and raising curiosity (Demirel & Coskun, 2009).

What nourish and develop our feeling of curiosity on the other hand, are the formations in the Universe and the human imagination (Balbag, Yenilmez & Turgut, 2012). From this point

of view, science fiction books are one of the most important instruments for improving human imagination.

The purpose of science fiction is first to entertain and then to provide science education. It is capable of predicting possible future developments in scientific knowledge as long as it adopts the expected future conditions and technologies. In this respect, science fiction enhances the imagination of young readers, arouses their lasting interest in science, and stimulates their prediction skills while educating them (Lundquist, 2012).

The study on the results of pre-tests and post-tests that applied to the 5th and 6th grades has indicated an increase in science curiosity point averages of both control and experimental groups. However, a relevant analysis has shown that the increase in the average score of the experimental group is meaningful, whereas that of the control group is random, namely chance based. When the relationship between the SCS pre-test and post-test scores of the experimental group has been analysed, it did not differ significantly according to the class level.

While choosing what books to read, students prefer the ones that would stimulate their imagination. They seek adventures and achievements on different planets, in outer space etc. with the company of real beings such as humans and animals; extra-terrestrials and aliens that have superpowers. Science fiction books can fulfil such expectations (Karatas & Firat, 2006). Science fiction authors write their books in an imaginative manner, fictionalizing some scientific facts (Ismihan, 2005). Besides, they make a point of writing books that would enhance the readers' imagination and have an educational function; and where the students are the main audience, they pay attention not to cause any misconceptions and to employ an amusing narrative through playful, mystical scenes and characters. The students who read science fiction books travel to the places where they have never been before, explore the tools yet to be explored and go on adventures with fictional heroes by using their imagination (Karatas & Firat, 2006).

According to the findings obtained, science fiction books have been effective in increasing students' curiosity about science because these books have penetrated their fantasy world, allowing them to concentrate their attention on some scientific concepts. Having created new, complex, strange, suspicious, or confusing situations in students' minds, these scientific concepts aroused curiosity about science.

When the body of literature is examined there are several other studies similar to this one that also prove science fiction to be positively effective on science learning. For example, Acar (2003) and Orcan (2013) explain that science fiction stories enhance attitudes toward physics. Ekem (1990b) notes that science fiction films promote attitudes toward science. Laprise and Winrich (2010) and Barnett and his friends (2016) state that science fiction films affect students' attention and imagination, consequently, enhance their interest in science. Orcan and Kandil Ingec (2016) found that science fiction stories are effective on students in developing creative thinking skills. Ozturk Onen (2017) established the positive contributions of science fiction films to science, technology, and community related opinions. Considering these studies, we can say that science fiction books are also effective in increasing science curiosity.

We can explain the role of the science fiction books read by the students in increasing their science curiosity as follows:

In *From the Earth to the Moon* the writer fictionalises his curiosity about the mysteries of outer space within a scientific framework. Thus, he shows us that being curious and dreaming make the most important contributions to the development of science. Here, the most intriguing topics for the students are the trips to the Moon, the bullet shaped spacecraft and the life in outer space. Mainly the students' interest in 'World and Universe' subject area has been stimulated by this book.

The book *Twenty Thousand Leagues Under the Sea* offers students a wide range of culture from physics to chemistry, hydrology, and biology. It suggests the importance of research,

curiosity, and discovery. What students find the most interesting in this book are the construction process and the interiors of the submarine; how it floats and sinks in water; marine life and *league* as a unit of measurement. Mainly the students' interest in 'Living beings and Life' subject area has been stimulated by this book.

The book called *Journey to the Center of the Earth* helped the students to grow an interest in and curiosity about geology and paleontology. Here, the most intriguing topics for the students are the centre of Earth, volcanoes, and underground life. Mainly the students' interest in 'World and Universe' subject area has been stimulated by this book.

The book *Cipher of Genes* helped to enhance the students' curiosity about subjects such as genes, DNA, and relevant professions. Here, the most intriguing topics for the students are the information contained within our genes, nuclear research laboratory and Ilke's dream about the past. Mainly the students' interest in 'Living beings and Life' subject area has been stimulated by this book.

The book *Aliens Are Coming* attracted the students' attention to the possible hazards of using nuclear energy sources. What students find the most interesting in this book are the existence of extra-terrestrials; the changes in animals due to nuclear leaks; extra-terrestrials asking for human beings' help and using music notes as a means of communication for this purpose. Mainly the students' interest in 'World and Universe' subject area has been stimulated by this book.

The book titled *Journey to Mars at the Speed of Light* promoted the students' interest in outer space and planet Mars. What students find the most curious in this book are lightspeed space travel, space shuttle, information about Mars. Mainly the students' interest in 'World and Universe' subject area has been stimulated by this book.

What students find the most curious in the book called *Time Bike* are the invention process of the time travel bicycle; time travel itself; continually inventing things in order to make life easier; how fire occurs without any ordinary lighters.

In the book called *Guests from the Past*, the most intriguing topics for the students are the benefits of inventions; the fact that Anin and Cuka referred to the new things they saw for the first time as 'magic'; future germs infecting people in the past; changes in the past being effective on the future; how the mirror that Cuka took home with her affected the future.

In the book *Time Accident*, the most curious topics for the students are the characters being trapped in time, activating the broken time machine by kicking it; inventing things that would make life easier.

In *Time Bike* series, the author connotes that human beings who have only begun to explore the world comprehend it in the same way as children comprehend the events around them. He suggests that the fictional characters, who are able to adopt pre-obtained knowledge when necessary and apply them to newly aroused situations via imitation or modelling, encourage children to comprehend, question and study during their lives. The author also notes that human beings have achieved breakthroughs in artistic pursuits, hunting, discovering and inventing things by observing other living beings in nature (Cihaner, 2007).

In the book *The First Dawn of Our World*, the most curious topics for students are inventing things for a more comfortable life; making glass from sand; making needles from deer antler and information about ancient life.

In the book *Children of Fire*, the most interesting topics for students are the discovery of copper, making tools from copper, the discovery and domestication of horses, and inventing things.

In the book *Abundance and War*, what students find the most intriguing are the people of Catalhoyuk being very sharing; women accidentally making cheese and yogurt from milk; making rope from animal intestines and inventing new things.

In *Catalhoyuk Oykuleri* series, the author sought to reflect the children's world in full while creating his stories. The students found the facts that people are constantly on the move, making short trips to nearby places; children being close to animals; inventions being narrated in an amusing way; children's plays being depicted as inspirations for new inventions interesting and intriguing. Generally speaking, the books of this series attempt to portray the daily life of Catalhoyuk people, their struggle to fulfil their own needs and to overcome the difficulties they came across, as well as how they might have contributed to civilisation. Although the inventions are presented as the results of such struggles, the starting point of the invention process is fictionalised around the daily lives of the children (Ozcelebi, 2006). Thus, the students are expected to get the impression that inventing new things is not a difficult process. In fact, they are encouraged to invent new things themselves. Hereby, the students who have read *Time Bike* series and *Catalhoyuk Stories* series have been rather stimulated to be curious about Science, Engineering and Entrepreneurship Practices.

Yet, when their personal diaries about each book was analysed, the students proved to be the most interested in and curious about the topics such as extra-terrestrials, celestial bodies, space vehicles, layers of the Earth, fossils, biodiversity, genetics, reproduction, environmental problems, force, density, light, electricity, heat, simple machines, elements, food storage conditions, invention, laboratory work and the personal characteristics and work discipline of scientists.

Conclusion

The aim of this research is to determine to what degree the science-fiction books arouse 5th and 6th grade students' curiosity about science. The experimental study which has been conducted for this purpose has indicated a meaningful increase in average science curiosity scores of the students who have read science fiction books. Yet, according to the research, the variation among the science curiosity scores of the students is not correlated with the class levels.

As the students turn what they read into personal experiences in their imagination, their interest in and curiosity about the subject areas such as World and Universe, Living Beings and Life, Physical Phenomenon, Matter and Its Nature along with the scientific concepts that they have been or are going to be taught at school within the context of Sciences, Engineering and Entrepreneurship has increased. They have tended to think about these subjects, ask questions and seek answers to those questions.

In sum, science fiction books have been effective on students in both arousing new and promoting the existing interest and curiosity about science. Hence, the results obtained in this research have significant role with regard to Science education.

Suggestions

According to the results obtained in this study:

1. Science-fiction books can be used in order to enhance the students' interest and curiosity about science lessons.
2. In science lessons, at the beginning of each unit, reading science-fiction books can get more attention to the subject.
3. Reading science-fiction books can make the science subjects more enjoyable during the lessons.
4. By reading science-fiction books, students can make reading a habit in general.

REFERENCES

- Acar, H. (2003). *Using science-fiction stories in physics education*, Marmara University, Institute of Educational Sciences, Master's Thesis, Istanbul.
- Acun, N., Kapikiran, S. & Kabasakal, Z. (2013). Trait Curiosity and Exploration Inventory II: Exploratory and Confirmatory Factor Analysis and Its Reliability. *Turkish Psychological Articles*, 16(31), 74-85.
- Adali, B. (2013). *The First Dawn of Our World* (13th Edition). Istanbul: Can Art Publications.
- Adali, B. (2014). *Cipher of Genes* (9th Edition). Istanbul: Can Art Publications.
- Adali, B. (2014). *Aliens Are Coming* (6th Edition). Istanbul: Can Art Publications.
- Adali, B. (2015). *Children of Fire* (6th Edition). Istanbul: Can Art Publications.
- Adali, B. (2015). *Abundance and War* (11th Edition). Istanbul: Can Art Publications.
- Adali, B. (2015). *Guests from the Past* (20th Edition). Istanbul: Can Art Publications.
- Adali, B. (2015). *Time Bike* (36th Edition). Istanbul: Can Art Publications.
- Adali, B. (2015). *Time Accident* (13th Edition). Istanbul: Can Art Publications.
- Akal, A. (2006). *An approach to solution from different perspectives in literature books produced for children: leadership education with fairy tales, stories and poems*. Paper presented at 2nd National Child and Youth Literature Symposium, 4-6 October, Ankara.
- Arikan, N. & Demirbas, M. (2006). A Research on the Determination of Factors Affected by University Students in Creating Science Fiction Stories. *Sakarya University Journal of Education*, 11, 168-173.
- Balbag, M. Z., Yenilmez, K. & Turgut, M. (2012). Investigation of Pre-Service Elementary Mathematics and Science Teachers' Opinions on Science Fiction Movies According to Some Variables. *Journal of Research in Education and Teaching*, 1(3), 239-248.
- Balta, E. E. (2014). The Science Fantasy of Gulden Dayioglu in the Circle of Children's Literature. *Journal of International Social Research*, 7(31), 59-67.
- Barnett, M., Wagner, H., Gatling, A., Anderson, J., Houle, M. & Kafka, A. (2006). The impact of science fiction film on student understanding of science. *Journal of Science Education and Technology*, 15(2), 179-191.
- Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology*, 45, 180-191.
- Bixler, A. (2007). Teaching evolution with the aid of science fiction. *The American Biology Teacher*, 69(6), 337-340.
- Buyukozturk, S. (2012). *Manual of data analysis for social sciences* (16th Edition). Ankara: Pegem Academy.
- Buyukozturk, S., Kilic Cakmak, E., Akgun, O. E., Karadeniz, S. & Demirel, F. (2012). *Scientific Research Methods* (Improved 13th Edition). Ankara: Pegem Academy.
- Cavanaugh, T. & Cavanaugh, C. (1996). *Learning science with science fiction films*. Paper presented at the annual meeting of Florida Association of Science Teachers, Key West, FL. Retrieved from the ERIC database. (ED411157).
- Cihaner, C. (2007). *Bilgin Adali's children's books in terms of providing critical thinking*. Abant Izzet Baysal University Institute of Social Sciences, Master's Thesis, Bolu.
- Collins R.P., Litman J.A. & Spielberger C.D. (2004). The measurement of perceptual curiosity. *Personality and Individual Differences*, 36, 1127-1141.
- Demirel, M. & Coskun, Y. D. (2009). Investigation of curiosity levels of university students in terms of some variables. *Mehmet Akif Ersoy University Journal of Education Faculty*, 9(18), 111-134.
- Eke, C. (2010). Students' interest in science subjects. Paper presented at *International Conference on New Trends in Education and Their Implications*, 11-13 November, Antalya-Turkey.

- Ekem, N. (1990a). Attitudes towards science and science fiction movies. *Online Journal of the Faculty of Communication Sciences*, 7: 549- 570.
- Ekem, N. (1990b). The effect of science fiction films on educational attitudes and personality development in educational communication. *Online Journal of the Faculty of Communication Sciences*, 8: 501- 541.
- Ekem N. (1992). Scientific facts in cinema through science fiction movies. *Online Journal of the Faculty of Communication Sciences*, 10: 71- 86.
- Fraknoi, A. (2003). Teaching astronomy with science fiction: a resource guide. *Astronomy Education Review*, 2(1): 112-119.
- Gurdal, A. (1992). The importance of science in primary schools. *Hacettepe University Journal of Education*, 8, 185-189.
- Harty, H. & Beall, D. (1984). Toward to development of a children' science curiosity measure. *Journal of Research in Science Teaching*, 21(4): 425-436.
- Ismihan, E. (2005). The basic concepts and heroes in science fiction. *The Journal of Turkish Educational Sciences*, 3(2), 153-162.
- Karatas, E. & Firat, H. (2006). *The place of science fiction in children's literature and children's novels in this context by Gülten Dayioglu*. Paper presented at 2nd National Child and Youth Literature Symposium, 4-6 October, Ankara.
- Kaya, M. (2006). *Methods and techniques in the use of children's literature for teaching purposes in teaching literacy*. Paper presented at 2nd National Child and Youth Literature Symposium, 4-6 October, Ankara.
- Laprise, S. & Winrich, C. (2010). The impact of science fiction films on student interest in science. *Journal of College Science Teaching*, 40(2), 45-49.
- Lin, K-L., Tsai, F-H., Chien, H-M. & Chang, L-T. (2013). Effects of a science fiction film on the technological creativity of middle school students. *Eurasia Journal of Mathematics, Science & Technology Education*, 9(2), 191-200.
- Litman J.A. & Spielberg C.D. (2003). Measuring epistemic curiosity and its diverse and specific components. *Journal of Personality Assessment*, 80(1), 75-86.
- Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, 116(1), 75-98.
- Lundquist, C. A. (2012). The science and fiction of Robert L. Forward. *Physics Procedia*, 38, 109 – 115.
- Orcan, A. (2013). *The effect of science-fiction stories developed by comics technique, on creative thinking skills and physics attitudes of students*. Gazi University Institute of Educational Sciences, Master's Thesis, Ankara.
- Orcan, A. & Kandil Ingec, S. (2016). The effect of science-fiction stories developed by comics technique on creative thinking skills in physics teaching. *H. U. Journal of Education*. 31(4), 628-643.
- Ongel Erdal, S., Sonmez, D. & Day, R. (2004). *Science fiction movies as a tool for revealing students' knowledge and alternative conceptions*. Paper Presented at NARST, April 1-3, Vancouver.
- Ozcelebi, B. (2006). *History of civilization in Catalhoyuk stories*. Paper presented at 2nd National Child and Youth Literature Symposium, 4-6 October, Ankara.
- Ozturk Onen, F. (2017). The impacts of science fiction films on prospective science teachers' views about science-technology-society, *Bartın University Journal of Faculty of Education*, 6(2), 715-736.
- Reio, T. G. Jr. (1997). *Effects of curiosity on socialization-related learning and job performance in adults*. Virginia Polytechnic Institute and State University, Doctoral Dissertation.

- Serin, G. (2010). Investigation of 7th grade elementary students' science curiosity, *Mustafa Kemal University Journal of Social Sciences Institute*, 7(13), 237-252.
- Sudaryat, Y., Nurhadi, J. & Rahma, R. (2019). Spectral topographic brain mapping in EEG recording for detecting reading attention in various science books. *Journal of Turkish Science Education*, 16(3), 440-450.
- Surmeli, H. (2012). Examination the effect of science fiction films on science education students' attitudes towards Sts Course. *Procedia Social and Behavioral Sciences*, 47, 1012-1016.
- Tang, M. (2014). *The impact of science fiction media on student interest and learning*. Montana State University, Master's Thesis.
- Unal, H. (2005). *The influence of curiosity and spatial ability on preservice middle and secondary mathematics teachers' understanding of geometry*. The Florida State University, Doctoral Dissertation.
- Verne, J. (2014). *From the Earth to the Moon* (5th Edition). Ankara: Arkadas Publications.
- Verne, J. (2014). *Journey to the Center of the Earth* (5th Edition). Ankara: Arkadas Publications.
- Verne, J. (2015). *Twenty Thousand Leagues Under the Sea* (3rd Edition). Ankara: Arkadas Publications.
- Yavasli, A. (2011). *Journey to Mars at the Speed of Light* (4th Edition). Istanbul: Bulut Publications.
- Yazici, N. N. & Altiyaprak, M. (2010). Science fiction aided biotechnology instruction: Effects of bioethics group discussions on achievement and attitudes. *Procedia Social and Behavioral Sciences*, 2, 4125–4129.
- Yigit, S. (2011). *Curiosity as an intellectual and ethical virtue*, Bogazici University, The Institute for Graduate Studies in Social Sciences, Master's Thesis, Istanbul.
- Yildirim, A. & Simsek, H. (2016). *Qualitative research methods in the social sciences* (Improved 10th Edition). Seckin Publishing: Ankara.
- Yilmaz Korkut, T., Sasmaz Oren, F. (2018). The effect of the science stories' supported with concept cartoons on the academic achievement, attitude and motivation. *Western Anatolia Journal of Educational Sciences*, 9(1), 38-52.