EKUAD JETPR
Eğitim Kuram ve Uygulama Araştırmaları Dergisi

ISSN 2149-7702
e-ISSN 2587-0718

DOI: 10.38089/ekuad.2025.213

Vol 11 (2025) Issue 1, 52-73

Case Study Method Supported by Educational Films in the Teaching of the Solar System and Beyond Unit

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Abstract

The purpose of this research is to investigate whether the case study method supported by educational films in the teaching of the Solar System and Beyond Unit of the 7th grade has an effect on academic achievement and interest level in science subjects. Study group of the research consisted of 43 students who were studying in the 7th grade of secondary school in Şırnak in the fall semester of 2021-2022 academic year. Research was designed according to a quasi-experimental design. The data collection tools used in this research were the Solar System and Beyond Academic Achievement Test, developed by the researchers, and the Science Interest Scale, introduced by Laçin Şimşek and Nuhoğlu (2009). As a result of the study, it was found that the post-test scores of the academic achievement test and interest scale for science subjects of the experimental and control group students differed significantly in favor of the experimental group. In other studies, participants from different age groups can be selected and the effect of the educational film-supported case study method on different variables can be investigated.

Key Words

Achievement
Case study
Educational film
Interest
Solar system and beyond

About Article

Sending date: 14.01.2025
Acceptance date: 06.03.2025
E-publication date: 30.04.2025

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Introduction

In today's world, where globalization is accelerating, technology is transforming education, and access to information is becoming easier, it is of great importance for education systems to respond to current developments and needs (Aşkar, Topçu, Altun, Cırık, & Kandırmaz, 2023). At this point, education systems are being updated rapidly, and teaching programs that are synthesized with a contemporary education approach, aim to develop individuals mentally, socially, emotionally, physically, and morally, and that train individuals equipped with the knowledge and skills appropriate for the needs of the 21st century are being developed (Arslankara & Arslankara, 2024; MoNE, 2024). Similar updates are also needed in science curricula. One of the main reasons for this need is the difficulty encountered in teaching and learning certain science subjects. This is particularly evident when it comes to abstract concepts, as students often struggle to comprehend them. Concretization of abstract concepts is one of the most meaningful components of the science teaching process (Ayvacı & Durmuş, 2016; Gülçiçek & Güneş, 2004; Suprapto, 2020). Especially astronomy units, which are the subject of this study and included in the science course, contain abstract concepts. Astronomy units are accepted by students as one of the science subjects that are difficult to understand and perceive at the conceptual level. In teaching these subjects, learners need to visualize the spatial positions of the celestial bodies, their relative sizes, the distances between them and their geometric shapes (Şensoy & Yıldırım, 2018; Türk, Alemdar & Kalkan, 2012). This is only possible with the use of innovative teaching methods and technologies in the classroom. In these courses, students should actively participate in the process, and the process should be made understandable and remarkable for students (Akbay et al., 2022; Gökmen, 2021, Kiraz, Gökmen, & Çimen, 2024; Özel, Taşdelen, Güven-Yıldırım, & Önder, 2022; Taşdelen & Özel, 2024). Based on this, it is thought that the case study method, which makes students have to deal with real life problems that are problematic to them, includes mystery, and encourages them to actively participate in learning tasks (Bonney, 2015), will be especially effective in teaching astronomy subjects.

The case study method is an intensive and systematic teaching method that creates a student-centered and active learning environment, allows for the in-depth examination of a real event, the establishment of cause-effect relationships, and effective decisions (Cantimer & Şengül, 2022; Heale & Twycross, 2018). The case study method is also defined as the “best practice” by many educators in the education-training process, which enables the development of learners' analytical and critical thinking skills by establishing a relationship between theory and practice (McFarlane, 2015). The method is based on the principle that students examine problems and construct their own views on the basis of problems found in real-life stories with many solutions (Pilato & Ulrich, 2014). The main purpose of this method is for the student to examine the real situation or problems in full detail and make a decision based on the mentioned case study (Ateş Yerköy & Yerköy, 2024; Doğan & Aslan, 2024; Forsgren, Christensen, & Hedemalm, 2014). In this respect, the method provides the opportunity to transfer theoretical knowledge to practice, integrates what is learned with real life, and makes students responsible for their own learning (Caveião et al., 2018; Gallego et al., 2013). Students who experience learning with the case study method develop their thinking and communication skills, students analyze the events in the environment where they occur, approach events from a different perspective, and produce solution suggestions for problems (Ol & Kabapınar, 2021). Therefore, during the learning experience, learners develop skills such as analysis, seeing relationships, creativity, generating options, and future-oriented problem solving (Büchler et al., 2021; Doğan & Aslan, 2024). In addition, since the case study method is a completely student-centered method, it increases interest in the course, develops higher-order thinking skills, encourages students to work collaboratively, ensures active participation of students in the course, and has positive effects on academic achievement (Bonney & Escartin, 2015; Gözütok, 2020). Again, especially in science courses conducted with the case study method, students work together with their peers while searching for a solution to a complex and serious problem that requires skills from daily life, and in this way, they can produce answers to problems, learn concepts and principles, develop ideas, and develop thinking skills (Nkhoma et al., 2016). In this study, case studies are supported by educational films. It is believed that educational films can be used alongside the case study method to help concretize abstract concepts in science education. Educational films are considered highly effective instructional tools, as they allow students to gain experience with topics they are unfamiliar with, facilitate the concretization of abstract concepts, and help learners observe theoretical knowledge in practice (Güven-Yıldırım, Köklükaya, & Selvi, 2015). Films are defined as teaching

materials or resources that address events that have occurred or are likely to occur, appeal to more than one sense organ of students, and create an impressive educational environment (Korkmaz, 2017). Educational films are defined as films with educational content that address educators, educational environments, and stakeholders of these environments in a multifaceted manner (Oruç & Sarıbudak, 2015). When applied in an educational context, educational films can foster the development of critical thinking, a variety of new ideas, and respect for social justice activities inside and outside the classroom (Selman & Testa, 2021; Cromarty, Young, & Elias, 2023). These films provide a general experience even on subjects and events that students have never seen, embody the concepts in the lesson and offer the learners the chance to see the theory in practice (Yılmaz, 2018). For this reason, it is thought that educational films will be suitable for both in-class and extra-curricular learning environments with the support of technology, and will provide great convenience in teaching units such as Astronomy, which are difficult to experience, especially to secondary and primary school students.

The significance of the study

Following the COVID-19 pandemic in 2019 and the earthquake disaster in our country in 2023, distance education was initiated. As a result of this transition, the digitalization of education and training also began. Despite the reduced impact of the pandemic today, the use of technology-based learning activities in schools continues to increase. This is due to factors such as enabling uninterrupted education beyond school boundaries, facilitating learning processes, and engaging students more effectively than traditional methods. Educational films are also included in these learning technologies. Educational films can be an effective tool in both educational practice and theory, particularly in stimulating students' imagination, which in turn can enhance motivation for learning (Cromarty, Young, & Elias, 2023). However, a review of the literature reveals that there is a limited number of studies focusing on educational films (Bilbokaitė, Bilbokaitė-Skiauterienė, & Marmokaitė, 2022; Güvenir & Güven-Yıldırım, 2023; Kızılcık, 2021; Kızılcık, 2024; Kurtdaş, 2021; Uzun, Güven-Yıldırım, & Önder, 2020; Topal, Güven-Yıldırım, & Önder, 2020). These studies examine the effectiveness of educational films on different variables, especially in science education. Similarly, the case study texts included in the case study method can be easily converted into digital text. Various studies were found in the literature review on the use of the case study method in science teaching (Karaosmanoğlu 2018; Pehlivan & Şahin, 2007; Sancar 2010; Şahin & Çakmak, 2016; Temiz 2010). Furthermore, these studies examine the effectiveness of the case study method in the context of science education. However, a review of the literature revealed no previous studies in which the case study method was supported by the use of educational films. Studies on the subject show that both educational films and the use of case study method in teaching activities increase students' academic achievement, interest, motivation, etc. reveal its contribution to the variables. As a result, the effect of the case study method supported by educational films on the students' interest levels and academic achievement in the Solar System and Beyond Unit of the 7th grade science course was examined with this research. In order to ensure the teaching of the Solar System and Beyond Unit and to enrich the learning activity, while the lesson was taught by applying the case study method, educational films were also shown to the students in accordance with the outcomes. At this point, it is thought that both educational films and case studies will be suitable for both in-class and extra-curricular learning environments with the support of technology. At the same time, it is believed that the case study method supported by educational films will offer significant advantages in teaching units such as Astronomy, which are difficult to experience directly—particularly for primary and secondary school students. Therefore, this study is considered both original and important, and it is expected to contribute meaningfully to the field. With this study, it is aimed to examine the effect of the case study method supported by educational films on the academic achievement and interest levels of the students in the 7th grade science course Solar System and Beyond Unit.

Method

Research design

In this research, quasi-experimental design, one of the quantitative research designs, was used to obtain the data for the purpose of the research. Quasi-experimental designs are explained as the designs in which the experimental and control groups are randomly planned. However, individuals to

be included in the groups in this design cannot be randomly assigned to the experimental and control groups. Quasi-experimental designs are defined as designs that include all the characteristics of experimental research, except that participants cannot be randomly assigned to groups (Mertler & Charles, 2011).

Study group

Convenience sampling method was used to determine the study group of this research (Cohen, Manion & Morrison, 2007). The researcher determines a sample group that is convenient and easy to access as the study group in convenient sampling (Gravetter & Forzano, 2012). Based on this, research study group consisted of 43 students selected from two branches, studying in the 7th grade of a secondary school in Şırnak Province in the fall semester of the 2021-2022 academic year. One of the groups in two branches, which were decided to be equal because they had the same learning experiences in the same school, was determined as the experimental group by drawing lots. Additionally, the pre-test scores showed that the groups were equivalent.

Data collection tools

The data collection tools for this research included the Solar System and Beyond Academic Achievement Test, developed by the researchers, and the Science Interest Scale, introduced to the literature by Laçin Şimşek and Nuhoğlu (2009). Information on the development stages of the achievement test developed by the researchers is summarized below.

Development of the achievement test

During the development of the test, the stages of creating the item pool, seeking expert opinions, conducting the pilot application, and analyzing validity and reliability were followed (Özkan & Yadigaroğlu, 2020). In the process of developing the Solar System and Beyond Unit Achievement Test, first of all, questions were prepared for all the learning outcomes of the unit in the 2018 Science Curriculum. Sample questions of the Ministry of National Education, the textbook of the Ministry of Education, textbooks based on science learning outcomes were used while preparing the questions (MoNE, 2018).

The Solar System and Beyond unit consists of 10 outcomes. To select questions with high item difficulty and discrimination indices, a total of 29 multiple-choice questions were prepared, ensuring that at least two questions were included for each outcome. This was done to ensure content validity. In the next stage of the development of the prepared achievement test, expert opinions were sought. The content validity of the test prepared by three faculty members working in the Science Education Department and a faculty member working in the Physics Education Department, measurement-evaluation by a faculty member working in the Measurement and Evaluation Department in Education. The questions were also reviewed for grammar and clarity by an instructor from the Department of Turkish Education. After receiving feedback from experts, test questions and answer options were reviewed, necessary changes/corrections were made, and an experimental achievement test consisting of 29 questions were prepared. The trial form, prepared based on expert feedback, was administered to 12 eighth-grade students at a public school for the pilot study. The pilot study was used to assess the clarity of the test items and determine the duration of the test administration. Since all the items were found to be understandable by the students, no change was made in the number of questions. The application time of the test was determined as 30 minutes.

In the next stage, 29 items in the trial form were applied to a total of 208 eighth-grade students studying at a public school. After this application, item and test analysis was started and the answers to the questions were evaluated in the SPSS 26 package program. During the analysis of the items, the difficulty (pj) and discrimination (rjx) indices of each item were calculated. Difficulty level of the test developed as a result of the analysis. Two questions below .29 and five questions above .70 were excluded from the test. Then, item discrimination (rjx) indices of the questions were calculated. Since there was no item with a discrimination index less than .30 in the test, no item was removed from the test. As a result, the test consisted of a total of 22 items with item difficulties ranging from .30 to .69 and discrimination indices ranging from .30 to .64. The difficulty and distinctiveness indices of the items are given in Table 1.

Table 1. Achievement test item analysis

Item number	Pj	rjx	Item number	Pj	rjx
1	.69	.51	16	.75**	.60
2	.53	.45	17	.57	.55
3	.63	.48	18	.60	.64
4	.50	.50	19	.30	.41
5	.29*	.31	20	.29*	.47
6	.70**	.55	21	.46	.57
7	.46	.48	22	.48	.55
8	.59	.55	23	.54	.30
9	.48	.48	24	.64	.63
10	.73**	.63	25	.48	.57
11	.46	.46	26	.65	.61
12	.47	.46	27	.54	.56
13	.71**	.61	28	.71**	.46
14	.60	.45	29	.47	.54
15	.55	.46			

* Items with an item difficulty index of .29 and below
**Items with an item difficulty index of .70 and above

After the item analysis, whether there were a differences between the lower and upper 27% slices was tested with the independent samples t-test. Then, it was seen that all the items in the test were in accordance with the desired criteria and no items were removed from the test. The t-test results of item analysis based on the mean difference of the lower and upper groups are given in Table 2.

Table 2. Item analysis t-test results based on lower and upper group mean difference

Dependent variable	Group	n	M	SS	Sd	t	p
Item 1	Sub group	56	.36	.49	110	7.49	.00
	Upper group	56	.93	.26	83.82	7.49	.00
Item 2	Sub group	56	.29	.46	110	7.81	.00
	Upper group	56	.88	.33	100.80	7.81	.00
Item 3	Sub group	56	.33	.47	110	7.17	.00
	Upper group	56	.88	.33	99.08	7.17	.00
Item 4	Sub group	56	.18	.39	110	7.33	.00
	Upper group	56	.75	.44	108.38	7.33	.00
Item 7	Sub group	56	.16	.37	110	8.05	.00
	Upper group	56	.77	.43	107.93	8.05	.00
Item 8	Sub group	56	.18	.39	110	9.70	.00
	Upper group	56	.86	.35	109.12	9.70	.00
Item 9	Sub group	56	.22	.42	110	7.65	.00
	Upper group	56	.80	.40	109.89	7.65	.00
Item 11	Sub group	56	.18	.39	110	7.01	.00
	Upper group	56	.73	.45	107.76	7.01	.00
Item 12	Sub group	56	.13	.34	110	8.51	.00
	Upper group	56	.75	.44	102.88	8.51	.00
Item 14	Sub group	56	.36	.49	110	6.60	.00
	Upper group	56	.88	.33	97.71	6.60	.00
Item 15	Sub group	56	.24	.43	109	7.20	.00
	Upper group	56	.80	.40	108.21	7.20	.00
Item 17	Sub group	56	.20	.40	110	9.30	.00
	Upper group	56	.88	.33	105.25	9.30	.00
Item 18	Sub group	56	.16	.38	110	10.72	.00
	Upper group	56	.88	.33	108.81	10.72	.00
Item 19	Sub group	56	.05	.23	110	6.65	.00
	Upper group	56	.57	.50	87.76	6.65	.00

Table 2. Item analysis t-test results based on lower and upper group mean difference (Continued)

Dependent variable	Group	n	M	SS	Sd	t	p
Item 21	Sub group	56	.16	.37	110	11.31	.00
	Upper group	56	.89	.31	106.91	11.31	.00
Item 22	Sub group	56	.16	.37	110	10.72	.00
	Upper group	56	.88	.33	108.81	10.72	.00
Item 23	Sub group	56	.38	.50	110	3.80	.00
	Upper group	56	.71	.46	109.48	3.80	.00
Item 24	Sub group	56	.18	.39	110	13.91	.00
	Upper group	56	.98	.13	67.08	13.91	.00
Item 25	Sub group	56	.13	.34	110	9.30	.00
	Upper group	56	.79	.41	105.25	9.30	.00
Item 26	Sub group	56	.27	.45	110	11.46	.00
	Upper group	56	.98	.13	64.76	11.46	.00
Item 27	Sub group	56	.16	.37	110	10.21	.00
	Upper group	56	.88	.33	107.71	10.21	.00
Item 29	Sub group	56	.36	.49	110	10.72	.00
	Upper group	56	.84	.37	108.81	10.72	.00

During the test development process, the K-20 reliability analysis of the final test was started. Findings related to the analyzes performed are given in Table 3.

Table 3. Achievement test analysis results

n	M	SD	Med.	Mod	Average difficulty	Average distinctiveness	KR-20
208	15.85	7.15	17	20	.53	.51	.89

When Table 3 is examined, it is seen that the average difficulty and discrimination indices of the developed test comply with the criteria determined in the literature. The Kuder-Richardson 20 (KR-20) reliability coefficient was calculated to determine the internal consistency coefficient of the test. The KR-20 coefficient varies between 0 and 1, and as the value approaches 1, the reliability of the test increases. KR-20 coefficient values of .70 and above are interpreted as indicating sufficient internal consistency of the measurement tool (Kuder & Richardson, 1937; Tavakol & Dennick, 2011). The KR-20 reliability coefficient for the developed test was calculated as .89. The value found shows that the test is a highly reliable test.

The test, whose validity and reliability analyses had been completed, was finally rechecked for content validity to ensure it aligned with the unit outcomes. The achievement test questions were aligned with the outcomes of the relevant unit, resulting in the following specification table, which confirmed the test's consistency with the unit outcomes (Table 4).

Table 4. Table of outcome–question alignment for the 'Solar System and beyond' unit

Learning outcome number	Question number
7.1.1.1.	1, 2 and 3
7.1.1.2	4
7.1.1.3	7,8 and 9
7.1.1.4	11 and 12
7.1.1.5	14 and 15
7.1.1.6	17
7.1.2.1.	18 and 19
7.1.2.2.	21, 22 and 23
7.1.2.3.	24,25 and 26
7.1.2.4.	27 and 29

After the validity and reliability analyzes were completed, an achievement test consisting of 22 questions was obtained (Appendix 1). The highest score that can be taken from the test is 22, the lowest score is 0, and considering the first pilot application, the response time of the test was determined as 25 minutes.

Science interest scale

Another data collection tool used in the study is the Science Interest Scale, which was brought to the literature by Laçin Şimşek and Nuhoğlu (2009). This scale includes 27 Likert type items. Originally developed by Harty and Beall (1984), it is an interest scale that aims to measure children's interest in science. Laçin Şimşek and Nuhoğlu (2009) completed the validity and reliability analyzes during the development of the scale and the KMO value of the scale was calculated as .68. As a result of the factor analysis, it was revealed that there were 6 factors in the scale and the factor loads of the items in these factors were found between .46 and .75. Finally, the researchers used the reliability coefficient calculations of the scale and the reliability value of the scale was calculated as Cronbach Alpha reliability coefficient α= 79. In this study, the reliability value of the scale was recalculated by the researchers and the Cronbach Alpha reliability coefficient was found as α= .72.

Data collection

This research continued for 4 weeks and 16 lesson hours within the scope of the 7th grade science lesson Solar System and Beyond Unit. Before the application started, the Solar System and Beyond Unit Achievement Test and the Science Interest Scale were applied to the experimental and control groups as a pre-test. Then the application was carried out.

In the experimental group, teaching was carried out in accordance with the learning outcomes, by supporting the case studies selected by the researchers beforehand with the educational films selected by the researchers. In the control group, the learning methods and activities specified in science curriculum were applied in the teaching of the unit. Prior to the application phase of the research, five case studies, selected from current news sources by the researchers to ensure the scope validity of the unit, were reviewed multiple times to assess their suitability for the students and the course content. Questions appropriate to the students' levels were added to the case studies selected by the researchers. The finalized case studies were examined by two faculty members in terms of content validity and by one expert in terms of intelligibility for language and age groups. As a result of the comments from the experts, three of the questions in the case studies were corrected. The case study texts used according to the unit outcomes and the questions asked to the students after these texts are given below (Table 5).

Table 5. Case studies based on unit outcomes

Learning outcome number	Case Studies and Questions to Students
7.1.1.1. 7.1.1.2.	Case Study 1: https://tr.euronews.com/next/2017/11/23/uzayin-buyuyen-sorunu-atiklar
7.1.1.3	1. Which space explorations do you think have contributed to the emergence of space pollution? 2. According to the first solution in the text, what kind of actions should we take to avoid producing too much waste? 3. What kind of different problems do you think space pollution can cause? 4. In your opinion, what kind of technological studies can be done to clean up the garbage existing in space at the moment? 5. Do you think this method is sufficient to eliminate space pollution? What are their shortcomings? What could be added? 6. Does the advancement of technology cause space pollution to increase or decrease? 7. Which of the developed spacecraft do you think is more effective in the formation of this pollution than the others?

Table 5. Case studies based on unit outcomes (Continued)

Learning outcome number	Case Studies and Questions to Students
7.1.1.4. 7.1.1.5. 7.1.1.6.	Case Study 2: https://www.ntv.com.tr/turkiye/galileonun-teleskobu-400-yasinda,ETomHy6b6EyHB4Cn5rNv7A 1. What do you think the telescope is good for? 2. What contribution do you think the existence of telescopes might have made to space studies? 3. At what stage do you think space studies would be today if Galileo had never invented the telescope? 4. If you were to design a telescope, what kind of telescope would you design? In addition, which celestial objects would you like to observe with your telescope that you have designed? 5. Do you think that only a telescope designed by Galileo, or one similar to it, should be used for space observations?
7.1.1.4. 7.1.1.5. 7.1.1.6.	Case Study 3: https://www.trthaber.com/haber/bilim-teknoloji/dag-teleskobu-erzuruma-ulasti-559881.html 1. In your opinion, what are the differences between the telescope designed by Galileo and the one built in Erzurum? 2. What do you think might be the reason for the telescope built in Erzurum to be built on an area of 3170 attitudes? 3. What contribution do you think such large telescopes make to space studies? 4. If Galileo had not invented the telescope, could we build large observatories like the DAG or space telescopes that work in space? 5. Do you think that the development of science and technology occurs in stages?
7.1.2.1. 7.1.2.2.	Case Study 4: https://www.hurriyet.com.tr/teknoloji/gokyuzundeki-en-parlak-yildizlardan-biri-patlamak-uzere-41430605 1. What is the reason for the explosion of stars? What cycle do you think they have? 2. Do you think the Sun will explode one day? 3. When we read the news, it is seen that the sizes and colors of the stars can be different. What characteristics of stars do you think these differences might be due to? 4. Do you think the explosion event mentioned in the news is a common occurrence only in stars or in other celestial bodies? 5. Based on the explosion of the Betelgeuse Star, what do you think might happen to the Earth during the end of the Sun's life?
7.1.2.3. 7.1.2.4.	Case Study 5: https://www.bbc.com/turkce/haberler-dunya-43626858#:~:text=Bilim%20insanlar%C4%B1%2C%20g%C3%BCne%C5%9F%20sistemimizi%20de,Galaksisi%20saniyede%20500%20metre%20geni%C5%9Fliyor. 1. Let's start with this news. Do you think there is a concept bigger than galaxies? 2. Which feature of the Universe do you think shows the convergence of the Milky Way and the Andromeda Galaxy? 3. How do you think the shapes of galaxies are formed? 4. Do you think that all the lights we see in the night sky come from celestial bodies in the Milky Way Galaxy?

In the research process, case studies were also supported by educational films. Before the application, 22 educational films that were thought to provide the content validity of the unit were selected by the researchers. Then films watched several times by the researchers to determine whether they were suitable for the students and the course content. Care was taken to ensure that the educational films selected for the application were both in a way that would meet the unit's outcomes and that they were suitable for the level that the students could understand. Additioanlly, while choosing the films affective, psychomotor, cognitive developments of the participants and the fact that the films were completed in a time that would not because distraction were taken into account. Twenty-two films that

were considered to be suitable for these criteria were then examined by two faculty members for content validity, and by one expert in terms of intelligibility for language and age groups. After the feedback from the experts, it was decided that four educational films were not suitable, and the implementation process continued with eighteen educational films.

In the control group, lessons were carried out with the research inquiry-based teaching foreseen by the curriculum without using the educational film-supported case study method. Similar to the experimental group, the teaching of the same unit was planned to be 4 weeks and 16 lesson hours. Before starting the teaching of the unit, detailed lesson plans were developed, and lessons were carried out by taking into account the activities in the curriculum. During these activities, students were actively involved in the activities and other in-class activities in accordance with the curriculum. The same test and scale were applied to both groups as a post-test and the application process was concluded upon its completion.

Data analysis

The data of this research were analyzed with the SPSS 26.0 package program. Descriptive statistics techniques were used to decide whether the data obtained from the answers given by the students to the test and scale showed normal distribution, and the central deviation and central distribution values of the answers were reported. Independent samples t-test was used for inter-group comparisons. The significance level of the data in the analysis was determined as .05.

Research ethics

Ethical rules and principles were followed during the data collection, planning, analysis, reporting of the research. The study was carried out after obtaining the permission of the ethics committee of GaziUniversity.

Findings

Before analyzing the data of the study, it was aimed to decide on the statistical method to be used in the analysis of the data obtained from the test and scale. In the analysis of the data collected in quantitative studies, parametric or non-parametric tests can be used depending on whether the data provide the normality assumption. The use of parametric tests in the analysis of data is possible if the data set collected within the study shows a normal distribution. Therefore, the normality of the data obtained from the measurement tools used in the studies should be investigated first and one of the parametric or non-parametric tests should be preferred according to the findings (Çepni, 2007; Sim and Wright, 2002). In this study, first of all, normality analysis was performed on the data obtained from the test and scale, which was used as a data collection tool, and the analysis method to be applied to the data set was selected according to the findings. The results of the analysis are given in Table 6.

Table 6. Descriptive data on the solar system and beyond unit achievement

Test	Group	N	M	Sd	Med.	Mod	Kurto.	Skew.	Var.
Pre-Test	Experimental	22	8.72	4.86	10.50	11	-1.53	-.23	23.63
	Control	21	8.85	3.94	8.00	7	.34	.35	15.52
Post-Test	Experimental	22	16.23	4.13	17.00	17	1.37	-1.24	17.09
	Control	21	13.80	4.08	13.00	13	-.56	-.18	16.62

Table 6 shows the descriptive data regarding the mean achievement test scores applied to both groups as a pre-test and post-test. The data in the table show that the achievement pre-test mean score (M=8.72) in the experimental group and the mean pre-test achievement score (M=8.85) in the control group are close to each other. It is seen that there is a difference in favor of the experimental group between the post-test mean scores of the experimental and control groups. When Table 6 is examined, it is seen that the mean, median and mode values of the achievement test pre- and post-test scores of the experimental and control group students are close to each other. The fact that these values are close to each other is interpreted as a normal distribution of the data in the literature (Büyüköztürk, Çokluk, & Köklü, 2018). The kurtosis skewness values between +2 and -2 also show that the data are normally distributed (George & Mallery, 2012). As a result of descriptive statistics, it was concluded that the data obtained from the Solar System and Beyond Unit Achievement Test showed a normal distribution. For

this reason, parametric tests were used in the analysis of the data. Before the application, independent samples t-test was applied to the pre-test achievement scores of the Solar System and Beyond Unit Achievement Test in order to determine whether there is a statistically significant difference between the achievement pre-test mean scores of the students in the experimental and control groups. The data obtained are tabulated and presented in Table 7.

Table 7. Independent samples t-test results of the achievement test pre-test scores

Group	N	M	Sd	t	p
Experimental	22	8.72	4.86	-.096	.92
Control	21	8.85	3.94		

When the data in Table 7 are examined, the students' mean scores on the Solar System and Beyond Unit Achievement Test before the application were calculated as M=8.72 in the experimental group and M=8.85 in the control group. There was no statistically significant difference between the pre-test achievement scores of the groups (t=-.096, p > .05).

The fact that there is no significant difference between the achievement scores of the groups before the application process supports the evaluation of the effectiveness of the educational film-supported case study method on students' academic achievement. Before the application, it was determined that the pre-test mean scores of the Solar System and Beyond Unit Achievement Test did not show a statistically significant difference between the experimental and control groups, and the independent samples t-test was applied to the post-test scores of the groups. Data obtained are presented in Table 8.

Table 8. Independent samples t-test results of the achievement test post-test scores

Group	N	M	Sd	t	p
Experimental	22	16.23	4.13	2.08	.04
Control	21	13.80	4.08		

When the data in Table 8 were examined, it was found that the Solar System and Beyond Unit Achievement Test post-test mean score of the experimental group students was M=16.23, and the Solar System and Beyond Unit Achievement Test post-test mean score of the control group students was M=13.80. It was determined that there was a statistically significant. difference in favor of the experimental group between the post-test mean scores of the students in the experimental and control groups (t=2.08, p < .05). Effect size calculations were made for the result obtained and it was seen that the effect size “d value” was 0.60. Researchers state that this effect size value is “medium” (Cohen, 1988).

In the research, normality analyzes were conducted to determine the statistical method to be applied to the quantitative data obtained from the Science Interest Scale. For this reason, the data taken from the relevant scale were analyzed and it was examined whether the data showed a normal distribution. The obtained results are given in Table 9.

Table 9. Descriptive statistics for the interest scale in science subjects

Test	Group	N	M	Sd	Med.	Mod	Kurto.	Skew.	Var.
Pre-Test	Experimental	22	104.77	12.59	108.50	109	-.51	-.48	158.66
	Control	21	104.33	12.15	106	106	.44	-.03	147.63
Post-Test	Experimental	22	116.04	11.26	117.50	116	.08	-.79	126.80
	Control	21	108	10.55	109	109	.69	-.02	111.40

When the data in the table were examined, it was determined that the students in the experimental group had an interest in science pre-test score average of M=104.77, and the students in the control group had an interest in science pre-test score average of M=104.33. It was determined that the mean scores of the scale were close for both groups. When the post-test mean scores of the groups are examined, it is seen that the interest scale mean score of the experimental group students (M=116.04) is higher than the interest scale post-test mean score of the control group students (M=108). When the table is examined, it is seen that the average, median and mode values of the students in both the

experimental and the experimental group and the control group of the Science Interest Scale pre- and post-test scores are close to each other. The fact that the median, mode and mean values for the Science Interest Scale are close to each other is interpreted as a normal distribution in the literature (Büyüköztürk, Çokluk, & Köklü, 2018). In addition, the fact that the kurtosis skewness values in the table are in the range of +2 and -2 shows that the data are normally distributed (George & Mallery, 2012). As a result of descriptive statistics, it was concluded that the data obtained from Science Interest Scale showed a normal distribution. For this reason, parametric tests were used in the analysis of the data. The independent samples t-test was used to determine whether there was a significant difference between the groups' pre-test scores on the Science Interest Scale. The data obtained are given Table 10.

Table 10. Independent samples t-test results on the pre-test scores of the science interest scale

Group	n	M	Sd	t	p
Experimental	22	104.77	12.59	.12	.91
Control	21	104.33	12.15		

According to the data in Table 10, the pre-test means scores of the students on the Science Interest Scale are M=104.77 for the students in the experimental group and M=104.33 for the students in the control group. When the data in the table are examined, there is no statistically significant difference between the students in the experimental and control groups in the pre-test scores of the Science Interest Scale (t= ,12, p > .05).

Independent samples t-test was applied for the post-test scores of the experimental and control groups and the findings are given in Table 11.

Table 11. Independent samples t-test results on the post-test scores of the science interest scale

Group	n	M	Sd	t	p
Experimental	22	116.04	11.26	2.42	.02
Control	21	108.00	10.55		

According to the data seen in Table 11, the students' average scores on the Science Interest Scale post-test mean scores are M=116.04 for the students in the experimental group and M=108 for the students in the control group. When the data in the table are examined, there is a statistically significant difference between the pre-test scores of the Science Interest Scale in favor of the experimental group (t=2.42, p < .05). Effect size calculations were made for the result obtained and it was seen that the effect size “d value” was 0.74. Researchers state that this effect size value is “medium” (Cohen, 1988).

Discussion, Conclusion and Suggestions

As a result of this research, it was concluded that the educational film-supported example method positively affected the academic achievement of the students. This situation was attributed by the researchers to the fact that the educational films attracted the attention of the students to the lesson and the case study method ensured the active participation of the students in the lesson. In addition, it is thought that this situation is due to the fact that the educational films provide students with the opportunity to read the information visually and evaluate it critically (Bilbokaitė, Bilbokaitė-Skiauterienė, & Marmokaitė, 2022). Furthermore, Önen Öztürk (2017) stated that with the use of educational films in the teaching process, students understand scientific terms better and can be associated more with daily life, the teaching process becomes easier, and students gain questioning skills. This situation can be considered as the reason for the increase in the academic achievement of the students. The researchers also recommend that educators incorporate educational films, multimedia, sound design, music, and screen theory into the curriculum to nurture the imagination, particularly of students with learning difficulties (Stokes, 2017). Educational films, in particular, can help students develop their imaginations in transformative ways, generate new ideas and possibilities, and ultimately achieve greater success in their classes (Kushnir, 2022; Seligman et al., 2013). Similarly, learning environments designed with the case study method present students with problem situations that can be encountered in real life and have more than one solution, and then students develop ideas for these situations and produce solutions (Davis, 2009; Pilato & Ulrich, 2014). Students who have the

opportunity to learn on their own actively participate in the lesson more in learning environments where the case study method is used (Candaş, Kıryak, & Suat, 2021; Çiftçi & Topçu, 2021; Escartín et al., 2015), and this situation is reflected positively in academic achievement (Anderson & Baker, 1999; Bonney, 2015; Demircioğlu & Selçuk, 2018). There is no other study in the literature where educational films and case study methods are used together in a way that supports each other. However, it is possible to reach the results of the studies showing that educational films and case study methods affect learning effectiveness positively both alone and when combined with different methods, techniques, strategies or materials. The literature review reveals that the results of the studies on the subject are parallel to the results obtained from this research.

The use of films in learning environments offers numerous educational benefits, such as capturing students' attention, enhancing the retention of learned information, facilitating the understanding of complex concepts, and increasing students' motivation and sensitivity toward the subject matter (Duchastel, Fleury, & Provost, 1988; Martins, 1990). This is because films can expose students to contemporary issues and help them gain a deeper understanding of problematic situations (Smieszek, 2019). Moreover, films encourage students to engage in self-directed learning, a process that positively influences both their overall learning experience and the effectiveness of their learning (Bilbokaitė, Bilbokaitė-Skiauterienė, & Marmokaitė, 2022). Öztaş (2008) also states that as a result of his research, educational films improve students' thinking skills and success. Similarly, as a result of other studies conducted in science education, it is revealed that educational films increase the academic achievement of students (Güvenir & Güven-Yıldırım, 2023; Uzun, 2019; Uzun, Güven-Yıldırım, & Önder, 2020; Topal, Güven-Yıldırım & Önder, 2020). It is thought that the use of the case study method in educational activities increases academic achievement, as in educational films. Because the higher-order thinking skills of the students who receive education with the case study teaching method develop and their success increases as they actively participate in the course (Yadav, Prabhu, & Chandy, 2007). In the study conducted by Gençoğlan (2017), the effect of argumentation-supported case study teaching method on students' academic achievement and scientific process skills in Acids and Bases in the 8th grade science course of middle school was investigated. At the end of the study, an increase was observed in the students' academic achievement. Moreover, in another study conducted by Demir (2017), it was stated that science subjects were perceived as difficult by students due to reasons such as being abstract and not being able to relate them to daily life. As a result of the study in which the researcher taught the course with the case study method, an increase in the students' academic achievement was observed. İbrahimoğlu (2010) explains the positive effect of the case study method on students' academic achievement as the method encourages students to think critically and the method positively affects students' attitudes towards the course. Jones (1997) also states that students like to teach using the case-based learning method. In his study, the researcher formed student groups in order to enable students to perceive the science lesson as a part of their lives, and approximately 200 students participated in the study. At the end of the study, the students stated that they liked this activity and the roles they assumed and stated that they found this educational activity and method, which made the science lesson consistent with their own lives, enjoyable. He also stated that this method can be applied to other science courses as well. Lincoln (2006) stated that the case study method was loved by the students, student participation in his work was at high levels throughout the application process, and this situation was very effective in increasing the academic achievement of the students. This result shows parallelism with the results of other studies that show that the case study method increases course success (Çakır, Berberoğlu, & Alpaslan, 2001; Field, 2003; Gabel, 1999; Kesner, Hofstein, & Ben-Zvi, 1997).

With the research, it was aimed to investigate the effect of the educational film-supported case study method on the level of interest in science subjects. For this purpose, the Science Interest Scale was applied to the control and experimental groups as a pre-test before the application, and it was determined that there was no significant difference between the groups' pre-test mean scores. Thereupon, the education and training activity was completed as planned. Afterwards, the Science Interest Scale was applied to the experimental and control groups again as a post-test, and it was found that there was a statistically significant difference between the post-test mean scores of the groups in favor of the experimental group. From this point of view, it was concluded that the educational film-supported case study method positively affected students' interest in science subjects.

When the relevant literature is examined, it has been determined that educational films are only few study examining the level of interest of students in science subjects (Laprise & Winrich, 2010; Sen, 2022; Uzun, Güven-Yıldırım, & Önder, 2020; Wyss, Heulskamp, & 2012). As a result of one of these research conducted by Uzun, Güven-Yıldırım and Önder (2020), it was concluded that educational films positively affect students' interest levels in science subjects, similar to the result obtained from this study. Apart from this study, some studies investigating the effects of educational films on motivation and interest towards the lesson were encountered. In the study by Laprice and Winrich (2010), science fiction films were used in science courses as a pedagogical tool to motivate student interest in science. At the end of the study, similar to the findings obtained from this study, the students stated that science fiction films increased their interest in science. For example, in another study, Topal, Güven Yıldırım and Önder (2019) aimed to reveal the opinions of pre-service teachers about the use of educational films in science lessons. The results obtained from the study showed that pre-service teachers stated that educational films increase the interest in the lesson, facilitate learning the subject, concretize the subject and provide permanent learning. It is also stated by researchers that educational films should be used to align the education system with students' interests, as appropriately prepared and selected films offer stories, perspectives, and visuals that help shape students' ideas and worldviews. Through films, students not only learn but also discover new hobbies, acquire new knowledge and skills, and develop a deeper interest in the field of film (Bilbokaitė, Bilbokaitė-Skiauterienė, & Marmokaitė, 2022). When the literature on the case study method used in this study was reviewed, no other research was found that specifically examined the effect of the case study method on students' interest in science subjects. However, it has been determined that there are studies investigating the effect of the method on the students' interest, attitudes and motivations. As a result of his research, Çolak (2017) states that students' attitudes towards the case study method are positive and points out that this situation may have an effect on the problem solving skills of the case study method. In another study, Yalçınkaya (2010) determined that the case study method created a significant difference in students' motivations and attitudes towards the lesson. Furthermore, according to the research results of Tarkın (2014), the case study method is an effective method in increasing students' attitudes towards course subjects, their motivation and self-efficacy beliefs.

The research focused on students' achievement levels and their interests in science subjects. Teachers' knowledge and experience in these subjects is important in order to apply both the case study method and educational films in science lessons. With other studies to be done, teachers' competencies in case management and educational films can be examined. Within the scope of this research, no comparison was made according to the gender of the participants. In the light of these findings, the effect of educational film-supported case study method on academic achievement and interest levels in science subjects can be investigated for different units/subjects in science with future research. In other studies, the application process can be repeated by choosing participants from different age groups, the effect of the educational film-supported case study method on different variables can be investigated, the effects of the case study method supported with different learning objects on different variables can be investigated.

Limitations

The educational films used in this study were chosen in small numbers and for a short time due to the limitation of the course hours. In different studies to be conducted, the duration of educational films can be increased.

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Appendices

7.SINIF GÜNEŞ SİSTEMİ VE ÖTESİ UNITESI AKADEMIK BAŞARI TESTI

Soru1) Yakın geçmişe kadar insansız, tek kullanımlık ve manevra kabiliyetleri kısıtlı olarak bildiğimiz, ancak günümüzde insanlı, çok kez kullanılabilen ve gelişmiş manevra kabiliyetleri yapabilen oldukça hızlı uzay aracı hangisidir?

a.) Yapay Uydu
b.) Uzay Sondası
c.) Roket
d.) Uzay Istasyonu

Soru2) Bazı teknolojik buluşlar veya icatlar Uzay teknolojilerinin gelişimi ile ortaya çıkmıştır. Aşağıdakilerin hangisi Uzay teknolojilerinin gelişimiyle beraber icat edilip hayatımıza giren teknolojik ürünlerden değildir?

a.) Hassas Termometreler
b.) MR Cihazı
c.) GPS Sistemleri
d.) Internet

Soru3) Dünya'mızın yörüngesinde bulunan Yapay uydular, gezegenimizdeki haberleşme, iletişim, hava durumu tahmini, televizyon yayınları, askeri gözlem vb. amaçlarla kullanılmaktadır. Ülkemizin Dünya yörüngesinde bulunan hangi uydusu haberleşme, iletişim ve televizyon yayını gibi amaçlarla kullanılmaktadır?

a.) GÖKTÜRK 2
b.) TÜRKSAT 4B
c.) RASAT
d.) BILSAT

Soru4) Uzay kirliliğinin sebeplerinden bazıları; uzaya gönderilen araçların kullanım sürelerinin dolması, kullanım süresi dolan araçların meteorlarla veya birbirleri ile çarpışarak parçalanmaları, uzay istasyonlarından bırakılan çöplerdir. Uzay kirliliği son 40-50 yıldır ortaya çıkmış bir sorundur. Dünya dışındaki ortamda kullanımını yitirmiş tüm insan yapımı nesneler Uzay kirliliğine neden olur. Uzay kirliliği sorunu bu hızda büyümeye devam ederse ve önlemi alınmazsa 20-30 yıl içerisinde Uzay araştırmaları açısından çok büyük bir sorun olacaktır. Bu metindeki bilgiler içerisinde aşağıdaki sorularından hangisinin cevabı yoktur?

a.) Uzay kirliliğinin gelecekte ortaya çıkaracağı sorunlar nelerdir?
b.) Uzay kirliliğinin önlenmesi için alınacak tedbirler nelerdir?
c.) Uzay kirliliği sorunu ne zaman ortaya çıkmıştır?
d.) Uzay kirliliğinin nedenleri nedir?

Soru5) Teleskopun keşfedilmesi ve teleskobun gök cisimlerini incelemek için kullanılmaya başlamasından sonra Uzay araştırmaları hız kazanmış ve çok hızlı bir şekilde gelişme göstermiştir. Bu bilgiler doğrultusunda aşağıdaki ifadelerden hangisine ulaşılabilir?

a.) Teleskop Uzay araştırmaları için keşfedilmiş bir araçtır.
b.) Teknolojik gelişmeler Uzay araştırmalarının daha hızlı gelişmesine katkı sunmaktadır.
c.) Teleskop Uzay araştırmalarında kullanılan tek araçtır.
d.) Uzay araştırmaları her zaman çok hızlı gelişim göstermiştir.

Soru6) Uzay araçlarının yüksek hızlar ile Atmosfere giriş ve çıkış yaparken yanıp parçalanmaması için dış kaplamalarının dayanıklı malzemelerden üretilmesi gerekmektedir. Bu amaçla üretilen ve şimdilerde günlük yaşamımızda da sıklıkla kullandığımız ürün hangisidir?

a.) MR Cihazı
b.) Teflon
c.) Hassas Termometre
d.) GPS

Soru7) Uzay araştırmaları ile teknoloji arasındaki ilişki aşağıdakilerin hangisinde doğru bir şekilde ifade edilmiştir?

a.) Uzay araştırmaları olmazsa teknolojik gelişim gerçekleşemez.
b.) Teknoloji olmazsa Uzay araştırmaları alanında çalışma yapılamaz.
c.) Teknolojik gelişmeler Uzay araştırmalarından bağımsız gerçekleşir. Ancak Uzay araştırmalarını olumlu yönde etkiler.
d.) Her ikisi de birbirini etkilemektedir. Uzay araştırmaları ve teknolojinin gelişimi birbirine bağımlı olarak gerçekleşir.

Soru8) Aşağıdakilerden hangisi teleskop çeşitlerinden değildir?

a.) Aynalı Teleskop
b.) Radyo Teleskop
c.) Işık Teleskop
d.) Mercekli Teleskop

Soru9) Teleskopun çalışma mantığı aşağıdakilerden hangisi gibidir?

a.) Teleskop yakında bulunan cisimleri küçülterek cisimleri daha uzaktaymış gibi görmemizi sağlar.
b.) Teleskop yakındaki cismi olduğu gibi görmemizi sağlar.
c.) Teleskop uzaktaki cismi olduğu gibi görmemizi sağlar.
d.) Teleskop uzaktaki cisimlerin

Soru10) Teleskoplar genellikle yeryüzünden gökyüzünü incelemek amacıyla kullanılır. Ancak bazı teleskoplar Dünya'nın yörüngesine oturtularak daha net bir gözlem yapmak amacıyla kullanılır. 1990 yılında Dünya yörüngesine yerleşerek görevine başlayan ve adını ünlü bir bilim insanından alan bu teleskobun adı nedir?

a.) Hubble Uzay Teleskobu
b.) Newton Uzay Teleskobu
c.) Einstein Uzay Teleskobu
d.) Galileo Uzay Teleskobu

Soru11) Farklı özelliklere sahip teleskop çeşitleri vardır. Bu teleskopların her biri farklı yöntemlerle gözlemler yaparak Uzay araştırmalarına katkı sunarlar. Aşağıdakilerden hangisi teleskopların Uzay araştırmalarına sağladığı faydalardan değildir?

a.) Yeni gök cisimlerinin keşfedilmesini sağlarlar.
b.) Gök cisimlerinin hareketleri hakkında bilgi edinmemizi sağlarlar.
c.) Evren hakkında daha detaylı bilgilere sahip olmamızı sağlarlar.
d.) Kara delikleri görüntüleyerek haklarında bilgi edinmemizi sağlarlar.

Soru12) Aşağıdaki seçenekte verilen malzemelerden hangisi basit bir teleskop modeli içerisinde kullanılabilecek malzemelerdendir?

a.) Metal Levha
b.) Büyüteç
c.) Buzlu Cam
d.) Cam

Soru13) Uzayda gaz atomları ve toz parçacıkları belirli yerlerde yoğunlaşırlar. Yoğunlaşan bu yapılar Yıldızların oluşum sürecini başlatan yerlerdir. Uzaydaki bu yapıların adı nedir?

a.) Asteroit Kuşağı
b.) Yörünge
c.) Bulutsu (Nebula)
d.) Kara Delik

Soru14) İnsanlar nasıl doğar, yaşar ve ölürse Yıldızlar da doğarlar ve belirli bir süre sonra ölürler. Zamanla Yıldızların yapısında değişiklikler meydana gelebilir. Aşağıdakilerden hangisi Yıldızların oluşturabileceği bir yapı değildir?

a.) Kırmızı Dev
b.) Siyah Cüce
c.) Kara Delik
d.) Beyaz Dev

Soru15) Aşağıdakilerden hangisi Yıldızların özelliklerinden değildir?

a.) Doğal ısı ve ışık kaynağıdırlar.
b.) Mavi renkli Yıldızlar daha soğukturlar.
c.) Bazıları tek başına gözlemlenebilirken bazıları takım halinde gözlemlenebilirler.
d.) Dünya'dan bakıldığında ışıkları titreşimli bir görüntüye sahiptir

Soru16) Aşağıdakilerden hangisi bizim Yıldızımız olan Güneş'in özelliklerinden değildir?

a.) Orta büyüklüktedir.
b.) Sarı renklidir.
c.) Ömrünü tamamladığında Kara delik oluşturabilir.
d.) Yüzey sıcaklığı 5.500 C derece civarındadır.

Soru17) Son dönemde adını sıkça duyduğumuz ve Orion (Avcı) takımyıldızı içerisinde yer aran Betelgeuse yıldızı bir Süper Dev yıldızdır. Yapılan gözlemler sonucunda Yıldızın enerjisini yavaş yavaş kaybettiği tespit edildi. Bu yıldız ömrünü tamamladığında aşağıdakilerden hangisini oluşturabilir?

a.) Kızıl Dev
b.) Gezegenimsi Bulutsu
c.) Siyah Cüce
d.) Kara Delik

Soru18) Milyonlarca Yıldız, Gezegen, uydu, gaz bulutu vb. yapıları içerisinde barındıran sistemlere ne ad verilir?

a.) Bulutsu (Nebula)
b.) Gökada (Galaksi)
c.) Kara Delik
d.) Gezegenimsi Bulutsu

Soru19) Aşağıdakilerden hangisi Gökada (Galaksi) çeşitlerinden değildir?

a.) Sarmal Galaksi
b.) Eliptik Galaksi
c.) Dağınık Galaksi
d.) Düzenli Galaksi

Soru20) Dünya'nın içerisinde bulunduğu Samanyolu galaksisi sarmal yapıda bir galaksidir. Samanyolu uzayda çok yavaş hareket etmektedir. Yine sarmal yapıda olan ve Galaksimize en yakın olan diğer galaksinin adı nedir?

a.) Anten
b.) Siyah Göz
c.) Andromeda
d.) Cüce Karina

Soru21) İçerisinde Galaksileri, yıldızların, meteorların, kuyruklu yıldızların ve Dünya'nın da bulunduğu yapıya ne ad verilir?

a.) Evren
b.) Uzay
c.) Kara Delik
d.) Bulutsu

Soru22) Evren ile ilgili aşağıdakilerden hangisi doğrudur?

a.) Sürekli genişleyecek şekilde hareket halindedir.
b.) Boşluktan oluşmaktadır.
c.) Büyük ve hareketsizdir.
d.) Sürekli daralacak şekilde hareket halindedir.