

Research Article

Developing an Achievement Test about 7th Grade “Solar System and Beyond” Unit: Analysis of Validity and Reliability

Fatih DOĞAN^{*1}  Burcu ÖZDEMİR² 

¹ Çanakkale Onsekiz Mart University, Faculty of Education, Çanakkale, Turkey, fatihdogan@comu.edu.tr

² Ministry of National Education, Çanakkale, Turkey, b.kelebek17@hotmail.com

* Corresponding Author: fatihdogan@comu.edu.tr

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Abstract

The aim of this research is to develop a reliable and valid achievement test to measure academic success of pupils about 7th grade’s “Solar System and Beyond” unit. For this reason, depending on the objectives of “Solar System and Beyond” unit, which is included in middle school science program, which was published in 2018, 42 multiple-choice test questions were prepared. The clearness of the test questions, cohesion with the objectives and scientific knowledge were designed with the care of various sights of the authorities in teaching science field which depend on the technic which was suggested by Lawshe (1975). According to this, content validity score was calculated as .94. The pilot study for this test put into practice with 254 students who had studied 7th grade in 2018-2019 academic years. As a consequence of the item statistic which was realized in the process of test development by the answers of the students for each question, difficulty score and item discrimination were calculated for each of the item. As a consequence of item statistic, 8 items were excluded from the test and the last form of the “Solar System and Beyond Academic Achievement Test” was designed with 35 questions. As a result of the analysis, the last form’s KR-20 reliability co-efficient was calculated as .87. Average item difficulty index was calculated as .61 and average item discrimination index was calculated as .48. According to this outcome, average item difficulty was identified as midlevel, and average item discrimination was identified as high-level.



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Introduction

Assessment and evaluation instruments have used in every level of education system. There are questionnaires, oral examinations, true/false items, multiple choice tests, matching questions, fill-in-the-blanks questions, written examinations, open-ended questions and some other assessments and evaluation instruments (Kempa, 1986). Each of these instruments has some flaws and also superiorities depending on the aim and students’ group. When the literature analyzed it was seen that one of the most used assessment and evaluation instruments is multiple choice test because of its superiorities (Özçelik, 2011). There are lots

of achievement test development works which were designed by multiple choices tests in the literature (Jayanthi, 2014). There are lots of achievement tests in the literature about science education. These kinds of achievement tests range can be sorted as; simple electric circuit, dynamic, heat and temperature, sound, earth crust, buoyancy, pushing and momentum and so on. Moreover, in the literature there are so many achievement test developments studies for “Solar System and Beyond: Riddle of The Space” unit. On the Table 1 a short summary for some achievement tests which were developed from past to present is demonstrated.

Table 1. Achievement tests, which was found in literature

Name of tests	Researcher(s), year
Alternative conceptions test in Earth and space science	Schoon, 1992
The earth and the universe (for University Students)	Trumper, 2000c
The earth and the universe (for Junior High School Students)	Trumper, 2001b
The earth and the universe (for Senior High School Students)	Trumper, 2001a
Astronomy Diagnostic Test	Zeilik, 2003
The Lunar Phases Concept Inventory (LPCI)	Lindell & Sommer, 2004
Greenhouse Effect Concept Inventory (GECI)	Keller, 2006
Light and Spectra Concept Inventory (SPCI)	Bardar, 2006
The test of evaluating the basic level of astronomical items	Türk, 2010
Survey of astronomical terms	Küçüközer, Bostan & Işıldak, 2010
Astronomy achievement test	Düşkün, 2011
Astronomy achievement test	Gündoğdu, 2012
Solar system and beyond: Riddle of the space academic achievement test	Çeliker & Balım, 2012
Solar system and beyond: Riddle of the space academic achievement test	Arıcı, 2013
Newtonian Gravity Concept Inventory (NGCI)	Williamson, 2013
The Test of Astronomy Standards (TOAST)	Slater, 2014
Solar system and beyond: Riddle of the space academic achievement test	Gülen & Demirkuş, 2014
Solar system and beyond: Riddle of the space academic achievement test	Çepni & Çoruhlu, 2014
Solar system and beyond: Riddle of the space academic achievement test	Ürün, 2015
Solar system and beyond: Riddle of the space academic achievement test	Kaya, 2015
Astronomy knowledge interrogation test	Taşcan & Ünal, 2016
Science and technology achievement test	Şahin, 2016
Solar system and beyond: Riddle of the space achievement test	Demirçalı, 2016
Astronomy achievement test	Albayrak, Yalçın & Yalçın, 2017
Solar system and beyond academic achievement test	Çoban, 2017
Solar system and beyond: academic achievement test	Kırıkkaya & Şentürk, 2018
Solar system and beyond: academic achievement test	Coşkun, 2018
Basic astronomy achievement test	Kalkan, 2018
Solar system and beyond academic achievement test	Uçar & Aktamış, 2019
Solar system and beyond: Riddle of the space academic achievement test	Şekercioğlu & Akkuş, 2019
Solar system and beyond achievement test	Gökçe, 2019
Astronomy achievement test	Demir & Armağan, 2019

According to Table 1, it is seen that Schoon (1992) developed a multiple choice test which includes 18 items and has the participants as primary school students, middle school students, and university students, with the aim of analyzing the alternative concepts popularity in astronomy between ages. A resembling work was developed by Trumper

(2000) also. Trumper (2000) designed a 19 items multiple choice test by collecting and changing the questions which were used in literature before, and he practiced it with the teacher candidates (Trumper,2001c) middle school students (Trumper, 2001a) and high school students (Trumper 2001b). By this means he tried to determine the students' misconceptions about basic astronomy. Zeilik (2002), with a group of astronomy lecturers, developed Astronomy Diagnostic Test (ADT) which includes standardized conceptual multiple-choice questions and defines the most popular astronomy misconceptions. One of the strong features of ADT is that, while the teachers regard the questions as easy the students do not regard them easily. Lindel & Sommer (2004) developed phases of the moon concept inventory (LPCI) aiming to help teachers to evaluate students' phases of moon cognitive models. Keller (2006) fulfilled two research; one of them includes Mars's surface composition and the other one included planetary science education research. By this means he developed greenhouse effect concept inventory (GECI) with the aim of evaluating the conceptual change of greenhouse effect. Bardar (2006) developed various teaching materials with the aim of making students understand the light and spectroscopy concepts and also he designed light and spectroscopy concept inventory (LSCI).

On the other hand, Türk (2010) aimed to evaluate readiness of students about basic astronomy concepts which are included in "Solar System and Beyond "Unit, and effects of planetariums and observatories on teaching the basic concepts of this unit; Küçüközer, Bostan and Işıldak (2010) stated the ideas of elementary mathematics teaching department's 2nd graders about basic concepts of astronomy before education and after education and effects of education on conceptual differences; Düşkün (2011) analyzed that development a Solar-Earth-Moon model and its effect on success of science education department students; Gündoğdu (2014) analyzed the correlation between 8th graders success and conceptual comprehension level and their attitude towards science lesson. Çeliker and Balım (2012) analyzed the effects of project-based teaching technics on students' success in solar system and beyond: space riddles unit. Arıcı (2013) have searched effects of virtual reality programs on success and learning permanency of students about astronomy. Williamson (2013) developed Newton Gravity Concept Inventory (NGCI) which is a multiple-choice evaluation instrument for characterizing the cognitive models of students about gravity. Slater (2014) developed Test of Astronomy Standards (TOAST) which is an extensive evaluation

instrument with the aim of evaluating students' knowledge about content of astronomy. Gülen and Demirkuş (2014) determined the effects of using visual materials in solar system and beyond: space riddles, on students' success. Çepni and Çoruhlu (2014) analyzed the effects of learning conditions which are proper for 5E education model on students' success in solar system and beyond: space riddles unit. Ürün (2015) analyzed the effects of process evaluation method on students' academic success and attitudes in solar system and beyond: space riddles unit. Kaya (2015) realized the effectiveness of technology advanced directory materials which were developed considering cognitive load theory, in solar system and beyond: space riddles unit. Taşcan and Ünal (2016) researched the analyzing of science teachers' knowledge about fundamentals of astronomy according to demographic variables. Şahin (2016) analyzed the effects of computer-assisted education on students' success and attitude in solar system and beyond: space riddles unit. Demirçalı (2016) analyzed the effects of modelling-based science education on academic success, scientific process skills, and mental model development of students. Albayrak, Yalçın and Yalçın (2017) stated the effects of station technique on academic success of students. Çoban (2017) analyzed the effects of 3D computer models on academic success in science education. Kırıkkaya and Şentürk (2018) analyzed the effects of using augmented reality technics in solar system and beyond: riddle of the space unit on students' academic success. Coşkun (2018) analyzed the effects of the education, which is supported by augmented reality and mobile applications, on academic success of students in solar system and beyond: space riddles unit. Kalkan (2018) analyzed the effectiveness of teaching objectives of "solar system and beyond: space riddles" unit, with the material and model supported activities. Uçar and Aktamış (2019) studied on development of achievement test and attitude scale about astronomy for 7th grade "solar system and beyond: space riddles" unit. Şekercioğlu and Akkuş (2019) analyzed the effects of the drama techniques on students' academic success in "solar system and beyond: space riddles" unit. Gökçe (2019) analyzed the effects of STEM technics on academic success and permanency in solar system and beyond: space riddles" unit. Demir and Armağan (2019) developed an astronomy achievement test. It is claimed that, by this research this deficiency will be remedied in the literature. In this research a reliable and valid achievement test developed for evaluating the students' success at "solar system and beyond" unit caring the test development process.

Method

Research Pattern

In this research scan pattern from the quantitative research methods was used. Frankel, Wallen & Hyun, (2012) identified the scan pattern as the research which are practiced on all population or a group of samples which were taken from the population, with the aim of making generalizations for the population in the selected samples which have so many similarities.

Participants

The pilot study of this study was applied 254 seven grade students (128 females, 126 males) who study three different secondary schools in Gelibolu, Çanakkale/Turkey. These state schools which belong to ministry of national education were chosen randomly without any care of academic success. Sample distribution according to the schools is demonstrated on Table 2.

Table 2. Number of students who attended the pilot study

Sex	Secondary school A		Secondary school B		Secondary school C		Total	
	f	%	f	%	f	%	f	%
Female	41	48.80	44	51.16	43	51.20	128	50.39
Male	43	51.20	42	48.84	41	48.80	126	49.61
Total	84	100	86	100	84	100	254	100

Data Collection Tools

In this research academic achievement test belonging to solar system and beyond unit was used as the data collection tool. In the process of the education, evaluating the sub-concepts of the unit, assessing the evaluation, and evaluating how much the unit was learned were provided by using a multiple-choice test as an achievement test. The academic achievement test belonging to solar system and beyond unit which is used in research were prepared caring the aims of solar system and beyond unit of ministry of national education's science teaching program. While the test items were being creating by the researchers, 7th grade science lesson books which was prepared by education ministry, leaf tests, various questions which were asked in various exams, and the exams for secondary school students took in consideration. In this context 42 multiple choice test items (each of them has 4 choices), which are in consisting with 7th graders readiness level, were created.

General Description about the product

In the solar system and beyond unit there are two sub-topics. Space researches and beyond the solar system: celestial bodies. Totally 16 course hours for the 10 objectives of the units has given in the education ministry teaching program (MoNE, 2018). The sub-topics and contents are demonstrated on Table 3.

Table 3. The content of ' Solar System and Beyond ' unit in middle school science teaching program

Unit topics	Content	Number of objectives	Time	
			Class hour	Percent (%)
Space Studies	Space technology, space pollution, the relationship between technology and space, the shape of telescope, the importance of telescope, making a simple telescope.	6	8	11.1
Beyond the Solar System: Celestial Bodies	Star, star formation, shape of galaxy, universe	4	8	

Data Analysis

In order to analyze the data which were collected from the participants during the test, for each item these things were statistically calculated; standard deviation, arithmetic mean, item discrimination, item difficulty, skewness-kurtosis test for normalization test, Point biserial correlation, KR-20 for correlation and reliability calculations. For, Test Analyzed Program (TAP version 4.2.5) was used.

Findings

Development of achievement test process which had been developed by Hanson and his colleagues (1980) was applied after the literature which is about academic achievement test belonging to solar system and beyond unit, had been analyzed. Hanson & his colleagues (1980) reported the achievement test development process under three criteria as analyzing about teaching (description), preparing a test (applying), and test verification process (analysis) according to this, academic achievement test which was belonging to “solar system and beyond” unit were developed by taking into considering, designing, item writing, item analyzing, and item choosing process consideration. The achievement development process which was used in this study has shown on Table 4.

Table 4. The process of preparing a test

Identification	1. Identifying the aim of the test	
	2. Identifying the population and sample of the behaviour which needs to be evaluated	
	3. Preparing the table of specifications	
	4. Creating the item pool	1. Analyzing the achievement tests in literature 2. Analyzing the course books and test books about the unit, analyzing the web sites
	5. Creating the sketch test form	1. Receiving the expert opinion 2. Receiving the science teachers' opinions
Execution	1. Application of pilot study	Receiving the expert opinion
Analysis	1. Scoring	
	2. Calculation of item statistics	
	3. Choosing the items	
	4. Calculation of test statistics	
	5. Preparing the final form	

Analysis of Validity

In this study at least 3 test items were prepared for each objective while the academic achievement test belonging to solar system and beyond unit. The content validity of the test items was calculated by the method which was developed by Lawshe (1975). In Lawshe (1975) method; in order to find content validity ratio and content validity index at least 5, at most 40 expert opinions are needed. For this purpose, 2 academicians from Çanakkale 18 Mart University, 2 doctorate students, and 4 science teachers share their opinions as experts. There are 3 statements I expert report; which are “proper”, “needs to be edit”, “needs to be excluded” for the purpose of evaluating each of the items in the academic achievement test belonging to solar system and beyond unit. According to the opinions of the experts which were concluded from the expert evaluation form, content validity ratio was calculated for each item. Veneziano and Hooper (1997) considering the expert count reported that the content statically $\alpha=.05$ significance level validity ratio must be at least .78. Content validity for each of the items were identified by content validity number which was developed by Hooper and Veneziano (1997). Content Validity Ratio is a method which depending on expert opinions turns the qualitative values into statistical quantitative values. Content Validity Ratio is calculated by the ratio of the number of the experts who responded positively for an item with the total number of the experts. According to expert evaluation forms -as a feedback which were got from the 8 people, all the items were used in the 42 items achievement test because of the fact that none of their Content Validity Ratio value was

under .78. In addition to this, content validity index is calculated by getting the arithmetic mean of the all items' Content Validity Ratio. According to this Content Validity Index was calculated .94. Since the Content Validity Index is higher than the Content Validity Ratio it is seen that the all items which are kept on the scale, statistically meaningful (Lawshe, 1975). On the other hand, for the face validity of the academic achievement test belonging to solar system and beyond it is consulted with an academician from science teaching department, a science teacher and a language expert. And according to their feedbacks, after making corrections, pilot scheme section has begun. In addition to this, table of specifications which had been prepared for specifying the content validity and a dashboard including at list three items for each objective are demonstrated on Table 5.

Table 5. Distrubition of tests items according to the "solar system and beyond unit" topics and objectives

Topic	Objective	Question Number	Total question
Research about the Space	Students will be able to explain the space technologies	1, 2, 3, 4, 5, 6, 7	26
	Students will be able to guess the probable implications and states the reason of space pollutions	8, 9, 10, 11, 12*	
	Students will be able to explain the relationship between technology and space researches	13, 14, 15*, 16*	
	Students will be able to explain the shape and the functions of telescope	17, 18, 19, 20*	
	Students will be able to make inferences about the importance of a telescope in astronomy	21, 22, 23*	
	Students will be able to create a simple telescope and present it	24, 25, 26	
	Beyond the solar system: Celestial bodies	Students will be able to realize the process of a star formation	
Students will be able to explain star concept		31, 32, 33, 34, 35	
Students will be able to explain forms of galaxies		36, 37, 38, 39	
Students will be able to explain universe concept		40, 41*, 42*	
Total			42

* According to pilot study, excluded items from the solar system and beyond academic achievement test

The achievements of the prepared test and each item in the test were prepared according to the processes of Haladyna (1997) Taxonomy. Attention was paid to preparing a question from each achievement. A wide variety of sources were used when preparing test questions. Accordingly, in the application of the pilot study solar system and beyond unit

there are 2 subtopics which are research about the space (26 items) and beyond the solar system: celestial bodies (16 items). Results of the pilot study have given on Table 6.

Results of the Normality Test

The data on the sketch form of academic achievement test of solar system and beyond unit's arithmetic mean was calculated as 26.0 (65.5%) and median was calculated as 25.28 (58.8%) where the maximum score is 42 for this achievement test. Based on mean and median score, it can be referred that the distribution is normal (not skewed to right or left side) on the horizontal axis. In addition to this Skewness and Kurtosis values of the properness of academic achievement test of solar system and beyond unit's form was were identified. To calculate the skewness and kurtosis values as $-.320 \pm .163$ and $-.743 \pm .304$ was interpreted that the points do not demonstrate a meaningful deviation between $[-1, +1]$ (Clements, 1999). Consequently, the result of kurtosis and skewness demonstrated that the achievement test scores of the students did not get significantly different. Moreover, coefficient of skewness for sketch form of the academic achievement test of solar system and beyond unit $-.320$ indicates that the distribution is right skewed (positive skewness). To be coefficient of kurtosis $-.743$ indicates the distribution is under the Gaussian distribution. Similarly, the point of median under the arithmetic mean has supported all of these results.

Item Difficulty and Item Discrimination Score

While the data were being analyzed from the sketch form of academic achievement test of solar system and beyond unit students who answered correctly were given 1 point. Furthermore, students who answered wrong, or the students who didn't answer, or students who answered the two choices for the same question were given 0 point. Since there are 42 questions, the maximum point is 42. And the total score was calculated for each student. The scores were put in an order as from the high to low via TAB program. The first 27% part was identified as upper group and the last 27% part was identified as lower group. Item statistic was realized depending on upper group and lower group statistics. Item analyses was given on table 6 for the sketch form of academic achievement test of solar system and beyond unit according to the lower group and upper group correct answer scores.

Table 6. The item analysis of the data which was gained from the pilot test for the sketch form of “solar system and beyond unit academic achievement test” according to upper group and lower group scores (Pilot study, N:254)

Item No	N	p_j	Item difficulty	r_{jx}	Item discrimination	Upper group correct answer	Lower group correct answer	AdjBi Correl	Result
1	191	.75	easy	.35	good	68 (.89)	38 (.54)	.404	proper to use
2	127	.50	average	.59	very good	58 (.76)	12 (.17)	.504	proper to use
3	146	.57	average	.37	good	56 (.74)	26 (.37)	.343	proper to use
4	133	.52	average	.54	very good	62 (.82)	19 (.27)	.525	proper to use
5	132	.52	average	.55	very good	61 (.80)	18 (.26)	.460	proper to use
6	111	.44	average	.44	very good	54 (.71)	19 (.27)	.390	proper to use
7	151	.59	average	.40	very good	63 (.83)	30 (.43)	.410	proper to use
8	183	.72	easy	.56	very good	70 (.92)	25 (.36)	.617	proper to use
9	180	.71	easy	.55	very good	73 (.96)	29 (.41)	.624	proper to use
10	122	.48	average	.36	good	50 (.66)	21 (.30)	.316	proper to use
11	149	.59	average	.63	very good	66 (.87)	17 (.24)	.598	proper to use
12	160	.53	average	.16	weak	59 (.78)	36 (.51)	.200	have to be excluded
13	112	.44	average	.54	very good	52 (.68)	10 (.14)	.464	proper to use
14	143	.56	average	.62	very good	62 (.82)	14 (.20)	.580	proper to use
15	86	.34	hard	.01	weak	31 (.41)	28 (.40)	.004	have to be excluded
16	58	.23	hard	.15	weak	23 (.30)	11 (.16)	.106	have to be excluded
17	110	.43	average	.32	good	45 (.59)	19 (.27)	.282	proper to use
18	166	.65	easy	.66	very good	70 (.92)	18 (.26)	.655	proper to use
19	183	.72	easy	.63	very good	73 (.96)	23 (.33)	.657	proper to use
20	68	.27	hard	.03	weak	16 (.21)	17 (.24)	-.068	have to be excluded
21	149	.59	average	.35	good	58 (.76)	29 (.41)	.315	proper to use
22	191	.75	easy	.38	good	69 (.91)	37 (.53)	.469	proper to use
23	49	.18	hard	.11	weak	24 (.14)	21 (.21)	.197	have to be excluded
24	150	.59	average	.45	very good	60 (.79)	24 (.34)	.415	proper to use
25	200	.79	easy	.39	good	72 (.95)	39 (.56)	.467	proper to use
26	194	.76	easy	.45	very good	73 (.96)	36 (.51)	.537	proper to use
27	129	.51	average	.45	very good	58 (.76)	22 (.31)	.372	proper to use
28	199	.78	easy	.52	very good	74 (.97)	32 (.46)	.643	proper to use
29	109	.43	average	.53	very good	53 (.70)	12 (.17)	.439	proper to use
30	137	.54	average	.43	very good	58 (.76)	23 (.33)	.327	proper to use
31	202	.80	very easy	.52	very good	75 (.99)	33 (.47)	.591	proper to use
32	116	.46	average	.35	good	47 (.62)	19 (.27)	.303	proper to use
33	171	.67	easy	.48	very good	66 (.87)	27 (.39)	.482	proper to use
34	218	.86	very easy	.33	good	74 (.97)	45 (.64)	.561	proper to use
35	169	.67	easy	.70	very good	74 (.97)	19 (.27)	.680	proper to use
36	146	.57	average	.55	very good	67 (.88)	23 (.33)	.490	proper to use
37	201	.79	easy	.39	good	73 (.96)	40 (.57)	.467	proper to use
38	109	.43	average	.58	very good	59 (.78)	14 (.20)	.502	proper to use
39	212	.83	very easy	.42	very good	73 (.96)	38 (.54)	.676	proper to use
40	148	.58	average	.50	very good	65 (.86)	25 (.36)	.432	proper to use
41	39	.15	hard	.07	weak	11 (.14)	15 (.21)	-.155	have to be excluded
42	58	.12	hard	.08	weak	31 (.14)	25 (.21)	-.166	have to be excluded

p_j : Item difficulty; r_{jx} : Item discrimination; N: Total number of students who answered the question correctly; AdjBisCorrel: Adjusted Biserial Correlation

Bayrakçeken (2007) stated that the quality of test items can be analyzed by using the item statistic via the answers of the test. The item difficulty is identified as the rate of the number of students who correctly answered the item to the number of the whole students

who answered (Tan, 2005). Item difficulty index can be the various numeric values between 0-1. Item difficulty demonstrates the ratio of correct answers for the item (Gajjar, Sharma, Kumar & Rana, 2014). Bayrakçeken (2007) stated that the item difficulty index could be proper if it is around .50. Sözbilir (2010) reported that that an item difficulty level (p_i) of an item was between .00-.19, means that item was a very difficult item, an item difficulty level (p_i) of an item was between .0.20-0.34 means that item was a difficult item, an item difficulty level (p_i) of an item was between .34-.64 means that item was an average difficulty level item, an item difficulty level (p_i) of an item was between .65-.79, means that item was an easy item, an item difficulty level (p_i) of an item was between .80-1.00, means that item was a very easy item (Sözbilir, 2010). Therefore, the level of the item difficulty increases as much as the difficulty level of an item approaches to 0 and, the level of the item difficulty decreases as much as the difficulty level of an item approaches to 1. According to table 6, item difficulty level can be a value between .12-.86. Item discrimination index defines the power of distinguishing the students in upper group and in lower group of an item. To keep or not an item on an achievement test is decided depending on the item discrimination index. According to Tan (2005) item discrimination level can be a value between -1 and +1 so that the values which are close to 1 demonstrate the item discrimination level of the item is high. Özcelik (2011) states that the items whose item difficulty index (r_{ix}) is negative or zero should not be in the test, and in the event that lower than .20 that should not use or should prepare again. Also Özcelik (2011) stated that the item discrimination index between .20-.29 item had to be revised; or that the item discrimination index between .30-.39 item's discrimination was acceptable level; and the item discrimination index between .4 or higher than .4, the item's discrimination was a very high level. According to Table 6, sketch form of the academic achievement test of solar system and beyond unit's discrimination level is between .01 and .70. At the end of the item analysis, item discrimination was evaluated depending on the canons which were stated above. Therefore, number 12, 15, 16, 20, 23, 41, 42 items were decided to be excluded from the test. After these items had been excluded, the skewness and kurtosis values of whole test calculated as (from beginning to end) -.310 and -.830.

Item Analysis Predicated on Correlation

Adjusted biserial correlation is used in order to identify the total item correlation in item analysis predicated on correlation. Adjusted biserial correlation is used to identify the

relation between a continuous variable and a real discontinuous variable having 2 categories (Büyüköztürk, 2010). According to this, there is a statistically significant relationship between the scale score which is got from the total value of the data which are got from the form of academic achievement test of solar system and beyond unit and the score which is got from each of the items of the test. For each item on the test, biserial correlation was calculated by giving 0 points for the wrong answers or the questions which wasn't answered and giving 1 point for the correct answers. Total item correlation explains the relation between the total score that the participants get from the achievement test and the score between the participants get from each item. Büyüköztürk (2010) stated that, scale items could be in similar behaviors or the internal consistency could be high in the event that the total item correlation was high. For this reason, it is predicted that the correlation values could be the values between .20 and .80 to exclude the items having negative value, low or very high coefficient of correlations from the scale was suggested. Being the correlation values in this gap means that the items are enough to be a homogenous and include unique variance. In this context after the items which were marked above from the form of academic achievement test of solar system and beyond unit the distribution of the test items depending on the topics and objectives of the unit is demonstrated on Table 7.

Table 7. Distrubition of test items according to the topics and objectives

Topic	Objective	Question number	Total question
Space Researches	Students will be able to explain the space Technologies	1, 2, 3, 4, 5, 6, 7	21
	Students will be able to guess the probable implications and states the reason of space pollutions	8*, 9, 10, 11*	
	Students will be able to explain the relationship between technology and space researches	13, 14*	
	Students will be able to explain the shape and the functions of telescope	17, 18, 19	
	Students will be able to make inferences about the importance of a telescope for astronomy	21, 22	
	Students will be able to create a simple telescope and present it	24, 25, 26*	
	Beyond the solar system: Celestial bodies	Students will be able to realize the process of a star formation	
Students will be able to explain star concept		31*, 32, 33, 34, 35*	
Students will be able to explain forms of galaxies		36*, 37, 38, 39*	
Students will be able to explain universe concept		40	
		Total	35

*Test items for multiple objectives

The final form of the academic achievement test of solar system and beyond unit including 35 multiple choices test items is created. The final form of academic achievement test of solar system and beyond unit has 35 multiple choice items. 14 items of 31 items are in the subtopic of solar system and beyond: celestial bodies and 21 items of 31 items are in the subtopic of space researches. The final form of academic achievement test of solar system and beyond unit's item statistic results are demonstrated on Table 8. Also, arithmetic mean, standard deviation, variance, reliability were calculated again according to remaining 35 questions. The statistic values of the final form of academic achievement test of solar system and beyond unit's were presented on Table 8.

Table 8. Item statistic values of the final form of "solar system and beyond unit academic achievement test" (Pilot test, N:254)

Item No*	Item No**	N	p_j	Item difficulty	r_{jx}	Item discrimination	Upper group correct answer	Lower group correct answer	AdjBi Correl	Result
1	1	191	.75	easy	.33	good	65 (.89)	42 (.56)	.417	proper to use
2	2	127	.50	average	.58	very good	57 (.78)	15 (.20)	.505	proper to use
3	3	146	.57	average	.38	good	55 (.75)	28 (.37)	.346	proper to use
4	4	133	.52	average	.58	very good	61 (.84)	19 (.25)	.541	proper to use
5	5	132	.52	average	.60	very good	61 (.84)	18 (.24)	.467	proper to use
6	6	111	.44	average	.50	very good	54 (.74)	18 (.24)	.402	proper to use
7	7	151	.59	average	.45	very good	62 (.85)	30 (.40)	.404	proper to use
8	8	183	.72	easy	.50	very good	67 (.92)	31 (.41)	.599	proper to use
9	9	180	.71	easy	.59	very good	71 (.97)	29 (.39)	.657	proper to use
10	10	122	.48	average	.37	good	51 (.70)	25 (.33)	.305	proper to use
11	11	149	.59	average	.37	good	54 (.74)	28 (.37)	.616	proper to use
13	12	112	.44	average	.54	very good	51 (.70)	12 (.16)	.456	proper to use
14	13	143	.56	average	.61	very good	61 (.84)	17 (.23)	.584	proper to use
17	14	110	.43	average	.30	good	43 (.59)	22 (.29)	.277	proper to use
18	15	166	.65	easy	.64	very good	66 (.90)	20 (.27)	.674	proper to use
19	16	183	.72	easy	.63	very good	70 (.96)	25 (.33)	.676	proper to use
21	17	149	.59	average	.64	very good	65 (.89)	19 (.25)	.323	proper to use
22	18	191	.75	easy	.36	good	66 (.90)	41 (.55)	.473	proper to use
24	19	150	.59	average	.45	very good	57 (.78)	25 (.33)	.422	proper to use
25	20	200	.79	easy	.37	good	69 (.95)	43 (.57)	.463	proper to use
26	21	194	.76	easy	.48	very good	71 (.97)	37 (.49)	.541	proper to use
27	22	129	.51	average	.46	very good	58 (.79)	25 (.33)	.360	proper to use
28	23	199	.78	easy	.52	very good	71 (.97)	34 (.45)	.667	proper to use
29	24	109	.43	average	.62	very good	58 (.79)	13 (.17)	.440	proper to use
30	25	137	.54	average	.46	very good	58 (.79)	25 (.33)	.351	proper to use
31	26	202	.80	very easy	.44	very good	70 (.96)	39 (.52)	.580	proper to use
32	27	116	.46	average	.35	good	46 (.63)	21 (.28)	.304	proper to use
33	28	171	.67	easy	.48	very good	63 (.86)	29 (.39)	.479	proper to use
34	29	218	.86	very easy	.33	good	71 (.97)	48 (.64)	.569	proper to use
35	30	169	.67	easy	.72	very good	72 (.99)	20 (.27)	.698	proper to use
36	31	146	.57	average	.56	very good	64 (.88)	24 (.32)	.486	proper to use
37	32	201	.79	easy	.35	good	69 (.95)	45 (.60)	.458	proper to use
38	33	109	.43	average	.53	very good	51 (.70)	13 (.17)	.507	proper to use
39	34	212	.83	very easy	.41	very good	70 (.96)	41 (.55)	.696	proper to use
40	35	148	.58	average	.46	very good	63 (.86)	30 (.40)	.422	proper to use

p_j : Item difficulty; r_{jx} : Item discrimination; N: Total number of students who answered the question correctly; AdjBisCorrel: Adjusted Biserial Correlation

It can be referred from the table 8 that all the difficulty and distinctiveness of each test item in the form of academic achievement test of solar system and beyond unit were in the identified limitations. Because of the fact that all the difficulty levels are $r_{jx} > .2$ it did not need to exclude any item from the test. In this way, all items statistical validity was provided. On the results of item statistics of the final form of form of academic achievement test of solar system and beyond unit, it was determined that 26th item (p: .80), 29th item (p: .86), and 34th item (p: .83) were the easiest items and the other items were the average items. Also, it stated that, 15th (r_{jx} : .64), 17th (r_{jx} : .64), and 35th (r_{jx} : .72) items' item discrimination levels were very well. According to item statistics of the final form of the academic achievement test of solar system and beyond unit average item difficulty index was determined .61 and discrimination index was determined .48. in addition to this, it was understood by the domain experts that 8 questions which were excluded from the sketch form of academic achievement test of solar system and beyond unit did not have a negative effect for the content validity. Tekin (2010) stated that if the item discrimination index of an achievement test is .40 or above, the discrimination power is of that item is "high". According to this, being the average item discrimination index 48 means that the discrimination level of the form of academic achievement test of solar system and beyond unit is high. As a conclusion it can be said that the item difficulty level and item discrimination level are in a good level. In addition to this, besides the statistical values, arithmetic mean, standard deviation, variance, and reliability are calculations were repeated for both the sketch and final forms of the form of academic achievement test of solar system and beyond unit.

Table 9. The statistics of the achievement test which were gained from item analysis

Achievem ent Test	Number of items	Number of participa nts	Average	variance	SD	Average difficulty	Average item discrimination	KR-20
Pilot Test	43	254	25.28	54.57	7.3	.58	.41	.85
Final Test	35	254	21.61	48.68	6.9	.61	.48	.87

SD: standart deviation; IDI: Item difficulty index; KR-20: Kuder Richardson coefficient

Reliability Test

For the reliability analysis the sketch and the final forms of the form of academic achievement test of solar system and beyond unit KR-20, Pearson Product Moment Correlation Coefficient and Sperman-Brown coefficient were calculated. How the

consistency of all the items in a test is strict can be predictable via KR-20 method. Hence, it is proper to determine the reliability coefficient of the tests which have the questions having 1 point for each correct answer. Reliability coefficient value was calculated for KR-20 pilot and also final form of the form of academic achievement test of solar system and beyond unit and the results are successively .85 and .87. Can, (2014) reported that the reliability coefficient value had to be between .60 and .90 for the reliability of the scores that the students got from a test. Saipanish, Hiranyatheeb and Lotrakul, (2015) reported that KR-20 reliability coefficient had to be higher than .70. According to this, it can be claimed that the final form of academic achievement test of solar system and beyond unit is reliable. Because of the fact that it's KR-20 value is higher than .70. Also, the Pearson Product Moment Correlation Coefficient, and Sperman-Brown coefficient of the pilot and final forms of the form of academic achievement test of solar system and beyond unit were calculated. According to this, the Pearson Product Moment Correlation Coefficient and Sperman-Brown Coefficient of the pilot and final forms of the form of academic achievement test of solar system and beyond unit have found .78 and .85; .79 and .87 respectively. These coefficients show high correlation and strong relationship according to an informal interpretation of Guilford (1956).

Discussion and Conclusions

Besides the evaluation is an integral part of the process of education, it is also important to determine how the teaching-learning process occurs. The most important outcomes in this process are the ones about students. While evaluating the students' knowledge and skills mostly multiple-choice tests are used. Multiple choice tests are one of the most preferable instruments in our education system. Some of the reasons of this are objectivity and easy grade taking process, high content validity level, and opportunity to ask questions in different levels (Burton, Sudweeks, Merrill & Wood, 1991). The achievement tests which evaluate the academic success are not only practiced for the knowledge level of students in the things they learnt but also, they are instruments for teaching. Students can learn the terms and subjects which they couldn't learn in the classes, via multiple choice achievement tests. The developed item samples instigate the students think on the questions. For this reason, the developed item samples will be strengthening their being in use characteristics. In the literature, when multiple choice tests about Earth and Universe are examined, it is seen that most of the tests examine the concepts of meteor, meteorite, stars,

star drift, comet, sun, planet, space and universe. Most of these studies aimed to reveal the knowledge levels or misconceptions of students in various education levels with multiple choice tests (Slater, Schleigh, & Stork, 2015; Wallace, 2011). However, among these studies, it has been determined that the success tests developed for the acquisitions of the "Solar System and Beyond" unit are quite limited within the framework of the studies given in Table 1. Therefore, the aim of this research was to develop a reliable and valid evaluation material to evaluate the students' success about 7th grade science lesson solar system and beyond unit. In the process of development of the form of academic achievement test of solar system and beyond unit at first its pilot scheme and after that its item analysis were applied. In the direction of the objectives which are in education ministry science program, 8 items were excluded from the achievement test with 42 items as a conclusion of item analysis; and the final form of the form of academic achievement test of solar system and beyond unit which includes 35 items was created. As a result of the item analyses of the final form of the academic achievement test of solar system and beyond unit; item difficulty was calculated between .43-.83, item discrimination index was calculated between .3-.72 and total item biserial correlation coefficient was calculated between .27-.69. Also average of the item difficulty index and item discrimination index of the final forms of the form of academic achievement test of solar system and beyond unit were successively calculated as .61 and .41. Tekin (2010) states that if the item discrimination level is .40 or above, the item discrimination is high. According to this, while calculating KR-20 reliability coefficient the average difficulty of test was found "average" and average item discrimination found "very good". KR-20 was identified .87. Can (2014) reported that the reliability of an evaluation instrument had to be between .60-.90 if students' scores needed to be reliable. In this case the scores of the students' reliability can be identified as high. The results demonstrated the form of academic achievement test of solar system and beyond unit is a valid and reliable test to evaluate the 7th graders' academic achievements about solar system and beyond unit. Thereby it is believed that the form of academic achievement test of solar system and beyond unit will be useful to determine the readiness and knowledge deficiency of 7th graders. Also the final form of academic achievement test of solar system and beyond unit can be contribute the suggested fields below:

-Organizing the learning activities of students by the developed test, as regards the identified deficiencies.

- Using the developed achievement test for process evaluation.
- Determining the misconceptions of students via the choices which belongs to the developed multiple-choice test.
- To make permanent teaching, presenting beneficial knowledges via developed achievement test.
- In using the developed achievement test as a data collector for the other researches in the field of science education.

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The data used in this study was confirmed by the researchers that it belongs to the years before 2020.

Authorship Contribution Statement

Fatih DOĞAN: *Conceptualization, design of the work, literature search, data analysis, data interpretation, writing - review and editing.*

Burcu ÖZDEMİR: *Conceptualization, data collection, preliminary analyses, manuscript draft, writing, manuscript revision*

Appendix: Solar System and Beyond Academic Achievement Test
Ek: Güneş Sistemi ve Ötesi Ünitesi Akademik Başarı Testi

1) P, R, S uzay araçlarıyla ilgili bilgiler aşağıdaki gibidir.

P-İçinde insanların yaşayabileceği şekilde tasarlanan uzay yaşam birimleridir.

R-Meteorolojik bilgi edinme, haberleşme vb. amaçlarla Dünya yörüngesine yerleştirilir.

S-Bir gezegen veya gök cismini incelemek için gönderilen insansız uzay aracıdır.

Aşağıdakilerden hangisi özellikleri verilen uzay araçları için doğrudur?

P	R	S
A)Uzay mekiği	Uzay istasyonu	Yapay uydu
B) Yapay uydu	Uzay sondası	Uzay istasyonu
C)Uzay istasyonu	Yapay uydu	Uzay sondası
D)Uzay sondası	Uzay Mekiği	Yapay uydu

2)

Samanyolu	Yıldız
Güneş	Galaksi
Mars	Takımyıldız
Hubble	Gezegen

Yukarıda verilen gök cisimleri ve adları doğru eşleştirildiğinde hangi kavramlar boşta kalır?

- A) Güneş -Gezegen B) Mars- Galaksi
C) Samanyolu- Yıldız D) Hubble- Takımyıldız

3)



Yukarıda bir bulutsu görseli görülmektedir. Aşağıdakilerden hangisi bulutsular için doğrudur?

- A) Bulutsular sadece yıldız ölümü sonucu oluşurlar.
B) Karanlık bulutsular, parlak bulutsulara göre daha çok ışık yayar.
C) Halka bulutsusu bir yansıma bulutsusudur.
D) Parlak bulutsuların içinde genellikle yeni oluşmuş yıldızlar bulunur.

4)



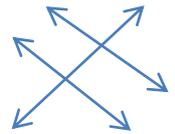
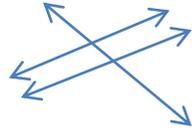
Yukarıdaki ifadeler doğru ise 'D', yanlış ise 'Y' yönüyle ilerleyen Cansu hangi takımyıldızına ulaşır?

- A) Orion B) Büyük ayı
C) Çoban D) Küçük ayı

5)

Galileo	•Teleskobu ilk bulan kişidir.
Hans Lippershey	•Güneş saatini yapmıştır. •Ay'ın ilk haritasını çıkarmış.
Ali Kuşçu	•Teleskopla yaptığı gözlemlerle Ay'ın dağ ve çukurlarını görmüş. •Jüpiter'in uydularını keşfetmiş.

Hangi seçenekte bilim insanları ile çalışmaları doğru eşleştirilmiştir?

- A)  B) 
- C)  D) 

6) Vega, Polaris, Sirius, Rigel aşağıdakilerden hangisine örnek olarak gösterilebilir?

- A) Yıldız B) Gezegen
C) Galaksi D) Takımyıldız

7) Aşağıdakilerden hangisi galaksi türü değildir?

- A) Düzensiz B) Sarmal
C) Yörüngesel D) Eliptik

8)

Güneş Sistemi, Samanyolu galaksisinin Orion kolu üzerinde bulunur.	Samanyolu galaksisi düzensiz şekilli galaksidir.
Samanyolu galaksisine en yakın galaksi Andromeda galaksisidir.	Samanyolu galaksisinde bulunan en parlak yıldız Güneş'tir.

Tabloda Samanyolu galaksisine ait bilgiler verilmiştir. Bu bilgilerden doğru olanlar taranırsa tablonun son görünümü nasıl olur?



9) Uzay araştırmaları sayesinde çıkan ve günlük hayatta da ihtiyaçlarımızı karşılayan bazı teknolojik ürünler geliştirilmiştir.

Yukarıdaki açıklamaya uygun olmayan örnek hangisidir?

- A) Kulak termometreleri B) Alüminyum Folyo
C) Duman Dedektörü D) Dürbün

10)



Türkiye'nin çeşitli amaçlarla uzaya gönderdiği uydular bulunmaktadır. Aşağıdakilerden hangisi günümüzde görevini tamamlamış bir uydudur?

- A) Rasat B) Göktürk1
C) Türksat3A D) Türksat1C

11) Aşağıda Türkiye'nin sahip olduğu yapay uydular listelenmiştir.

1. Bilsat 2. Rasat 3. Göktürk
4. Türksat 1A 5. Türksat 3A 6. Türksat 4A

Buna göre hangi seçenekte aktif haberleşme uyduları vardır?

- A) 1,4 B) 2,3 C) 5,6 D) 4,5

12)

Dünya'nın yörüngesinde işlevini yitirmiş yapay uydular, roket parçaları vb. insan yapımı cisimlerin oluşturduğu kirlilik uzay kirliliği olarak bilinir.

D	Y
Uzay araştırmaları sonucu Üretilen araçlardan bazıları MR cihazı, diş teli ve tükenmez kalemdir.	Rasat ve Göktürk2 adlı uydular Türkiye'nin gözlem keşif uydularıdır.



Yukarıdaki ifadeler doğru ise 'D' yanlış ise 'Y' okları yönünde ilerleyen Bahadır hangi çıkışa ulaşır?

- A) 1. Çıkış B) 2. Çıkış C) 3. Çıkış D) 4. Çıkış

13)

1. Küresel yapıda olma.
2. Gaz ve toz yığını olma.
3. Tüm yıldızların parlaklığının aynı olması.
4. Isı ve ışık kaynağı olması.

Yukarıdaki özelliklerden hangisi ya da hangileri yıldızlara ait değildir?

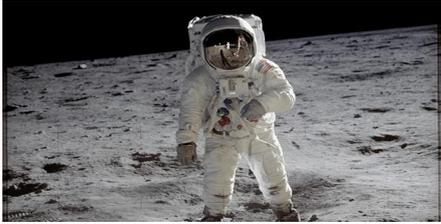
A) 1 ve 2 B) 3 ve 4 C) Yalnız 3 D) Yalnız 4

14) Yıldızlar, Uydular, Kuyruklu yıldızlar, Gezegenler

Yandaki gök cisimleri bir araya gelerek hangisini oluşturur?

A) Takım yıldız B) Galaksi
C) Kara Delik D) Nebula

15)



Ay'a ilk giden astronot hangisidir?

A) Yuri Gagarin B) Neil Armstrong
C) Galileo Galilei D) Hans Lippershey

16)



Andromeda galaksisine en yakın galaksi güneş sistemimizin de içinde bulunduğu Samanyolu galaksisidir. Bu iki galaksinin arasındaki uzaklığı ölçmek için hangi uzaklık birimi kullanılır?

A) Metre B) Kilometre
C) Işık Yılı D) Astronomik Birim

17)

- Yıldızlar arası ortamda bulunan gaz ya da tozlardan oluşan bulutlara.....denir.
- Uzayda bulunan ve ışığın bile kaçamadığı çok güçlü bir çekim kuvvetine sahip olan bölgeye denir.
- Avcı, Küçük Ayı , Büyük Ayı, Ejderha, Çoban ve Kuzey Tacı Örnekleridir.

Boşluklar uygun terimlerle doldurulduğunda aşağıdakilerden hangisi kullanılmaz?

A) Takımyıldız B) Galaksi
C) Kara Delik D) Bulutsu

18)

1. Kartonda oluşan fazlalıkları makas ile kesmiştir.
2. İki adet merceğin arkalarından bakıldığında net görüntünün elde edildiği uzaklığı cetvel ile ölçmüştür.
3. Mercekleri , cetvelle ölçülen uzaklıktayken boru şeklindeki karton kağıda sarmıştır.
4. Merceklerin etrafına yapıştırıcı sürmüştür.

Yukarıda basit bir teleskobun yapım aşamaları verilmiştir. Aşağıdaki seçeneklerden hangisi basit bir teleskop yapımının aşamalarını doğru şekilde sıralamıştır?

A) 1,2,3,4 B) 4,2,1,3
C) 3,2,4,1 D) 2,4,3,1

19) Günümüzde evrenin oluşumuyla ilgili en çok kabul gören teori Big Bang Teorisidir. Bu teoriye göre yanlış olan bilgi hangisidir?

- A) Evren büyük patlamayla oluşmuştur.
- B) Evren devamlı genişlemektedir.
- C) Evrenin bir başlangıcı vardır.
- D) Büyük patlamadan önce evren daralmaktaydı.

20) 1. Kalp, 2. Atbaşı, 3. İris, 4. Başak, 5. Çoban

Yukarıda numaralandırılarak verilen gök cisimlerinden hangileri bulutsudur?

A) 1,2,3 B) 2,4,5 C) 1,3,5 D) 2,3,4

21)



Yukarıda bir görseli verilen teleskopla ilgili hangi bilgi yanlıştır?

- A) Mercekleli teleskoba ışığı kırma özelliğinden ötürü kırıcı teleskop da denir.
 B) Aynalı teleskoba, ışığı yansıtma özelliğinden ötürü yansıtıcı teleskop da denir.
 C) Gökyüzü gözlemlerinde teleskobu ilk kullanan bilim insanı Galileo Galilei'dir.
 D) Teleskop yalnızca gökyüzü gözlemlerinde kullanılır.

22)



"Işık Kirliliğinin canlılar üzerindeki olumsuz etkileri nelerdir?" Buna göre Selman öğretmenin sorusunu hangi öğrenci doğru yanıtlayamamıştır?

- A) Ömer: Karanlıktan korkan insanlar cadde ve sokaklarda güvenli bir şekilde yürüyebilirler.
 B) Yusuf: Caretta Carettaların neslinin tükenmesine sebep olur.
 C) Osman: Göçmen kuşların yönlerini şaşırmasına sebep olur.
 D) Orhan: İnsanlarda göz hastalıklarına sebep olur.

23) İstihbarat sağlama, Haberleşme, Gök cisimlerini inceleme, Meteorolojik tahmin, Harita çizme, Konum belirleme
 Yukarıdaki olayları gerçekleştirmek için kullanılan uzay aracı hangisidir?

A) Uzay istasyonu B) uzay roketi
 C) Yapay uydu D) Uzay sondası

24) Merve : Uzay kirliliği temizlenmesi çok zor bir kirliliktir.

Pelin: Uzay kirliliği gün geçtikçe azalmaktadır.

Oya: Dünya yörüngesindeki ömrünü tamamlamış uydu parçaları uzay kirliliğini oluşturur.

Uzay kirliliği ile ilgili hangi öğrencilerin yorumu doğrudur?

A) Merve- Pelin B) Merve- Oya
 C) Pelin -Oya D) Merve - Pelin- Oya

25)



Uzayla ilgili araştırmalar yapılması için teleskop ve diğer araçların kullanıldığı yerlere gözlemevi (Rasathane) denir. Bir yerde gözlemevi kurulması için bazı özellikler olmalıdır.

Buna göre aşağıdakilerden hangisi gözlemevi kurulacak yerin sahip olması gereken bir özellik değildir?

- A) Yüksek yerlere kurulmalı
 B) Işık kirliliğinin olmadığı yerlere kurulmalı
 C) Deniz seviyesinde bir yere kurulmalı
 D) Havanın bulutsuz olduğu yerlere kurulmalı

26) Aktif olarak kullanılmayan ve Dünya çevresinde dolanan uzay araçları ve parçalarının uzay kirliliğine yol açtığı bilinmektedir.

Aşağıdakilerden hangisi uzay kirliliğinin zararlarından değildir?

- A)Uzay yürüyüşü yapan astronotlara çarpabilir.
 B)Uzay araçlarının rotalarının değişmesine sebep olur.
 C)Yansıtıcı yüzeylerinden ötürü Dünya’da küresel ısınmaya sebep olur.
 D)Aktif uyduların çalışmasını engelleyebilir.

27) Bilgi: Uzaya astronot gönderirken uzay aracında yiyeceklerin az yer kaplaması oldukça önemlidir.bu yüzden yiyecekler dondurularak toz halinde saklanır. Bu da günümüzde toz şeklindeki bebek mamalarına öncülük eden bir teknolojidir.

Bilgi: Astronotların hareketlerini gözlemlemek amacıyla üretilen akıllı kumaşın bebeklerin uyurken ani ölümlerinin önüne geçilmesi için pijama yapımında kullanılması fikri ortaya atıldı.

Bu bilgiler göz önüne alındığında :

- I. Uzay arařtırmalarındaki gelişmeler teknolojik gelişmelerle paralel gerçekleşmiştir.
 II. Uzay arařtırması için geliştirilen ürünler, gündelik ihtiyaçlar için de kullanılabilir.
 III. Uzay arařtırmaları olmasa teknoloji gelişmezdi.

Yorumlarından hangileri yapılabilir?

- A) I ve II B) I ve III
 C) II ve III D) I, II ve III

28) Makas, Cetvel, Karton Yapıştırıcı, PİL Büyüteç ve Lazer Işık

Fen Bilimleri Öğretmenin yaptıracığı ‘ Basit Bir Teleskop Yapalım’ Etkinliği için alışverişe çıkan Duygu’nun yukarıdaki malzeme listesindeki hangi malzemelere ihtiyacı yoktur?

- A) Makas ve Yapıştırıcı B) Lazer ışık, PİL
 C) Büyüteç, Karton D) Cetvel , Yapıştırıcı

29) Fen Bilimleri Doğru- Yanlış etkinliği aşağıda verilmiştir.

- Yapay uyduların uzay kirliliğini arttırıcı etkisi vardır.
- Uzay kirliliği, uzay arařtırmaları için sorun teşkil etmez.
- Uzayda görevini tamamlayan uydular ve uzay aracı parçaları uzay kirliliğine sebep olur.
- Gezegenlerin çevresinde dolanan doğal uydular uzay kirliliği yaratır.

Aşağıdaki seçeneklerden hangisinde doğru cevaplar yer almaktadır?

- A) D,Y,Y, D B) Y,Y,D,Y
 C) D,D,Y,D D) D,Y,D,Y

30) Zeynep’in Fen Bilimleri kitabındaki sorulara verdiği yanıtlar aşağıdaki gibidir.

1. Galaksiler şekillerine göre nasıl sınıflandırılır?
 - Eliptik,sarmal ,düzensiz.
2. Samanyolu galaksimize komşu galaksi hangisidir?
 - Andromeda
3. Çıplak gözle gökyüzüne baktığımızda hangi gök cisimlerini görebiliriz?
 - Kara Delik
4. Toz ve gaz bulutlarından oluşmuş gök cismi nedir?
 - Bulutsu

Buna göre Zeynep hangi sorulara doğru yanıt vermiştir?

- A) 1,2 B) 1,3 C) 1,2,4 D) 2,3,4

31) Yapay uydular çok değişik amaçlarla kullanılmaktadır.

- I) Haberleşme II) Meteoroloji
III) Askeri IV) Enerji Üretimi

Yukarıdakilerden hangileri uzaya uydu gönderme amaçlarındandır?

- A) I,III,IV B) II,III ve IV
C) I, II ve III D) I,II,III ve IV

32) Orion, Samanyolu, Halley ve Sirius Yukarıdaki kavramlar örnekleriyle eşleştirildiğinde hangisi eşleşmeden kalır?

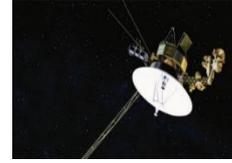
- A) Orion B) Samanyolu
C) Sirius D) Halley

33) Işığın bir yılda aldığı yola denir. Her türlü kütle ve enerjiyi yutan uzay cismine denir.

Yukarıdaki boş bırakılan yerlere sırasıyla hangileri gelmelidir?

- A) Işık yolu, Gökada B) Işık yılı, Kara Delik
C)Nebula, KaraDelik D)Gökada, Yıldız

34) Astronotların uzun süre uzayda kalıp araştırmalarını sürdürebilmeleri için bazı uzay araçları geliştirilmiştir.



1)Uzay sondası



2) Haberleşme uydu aracı



3) Uzay İstasyonu

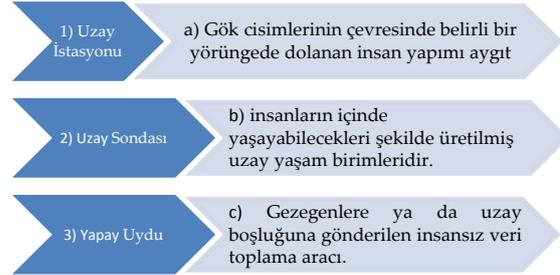


4) Uzay Roketi

Yukarıdaki uzay araçlarından hangileri bu amaçla üretilmemiştir?

- A) 1,2,ve 3 B) 1,2,ve 4 C) 2,3 ve 4 D) 1,3 ve 4

35)



Aşağıdaki eşleştirmelerden hangisi doğrudur?

- A) 1-b, 2-c, 3-a B) 1-b, 2-a, 3-c
C) 1-c, 2-b, 3-a D) 1-a, 2-b, 3-c

Cevap Anahtarı

1. C, 2. D, 3. D, 4. C, 5. C, 6. A, 7. C, 8. D, 9. D, 10. D, 11. C, 12. A, 13. C, 14. B, 15. B, 16. C, 17. B, 18. D, 19. D, 20. A, 21. D, 22. A, 23. C, 24. B, 25. C, 26. C, 27. A, 28. B, 29. D, 30. C, 31. C, 32. B, 33. B,34. B, 35. A

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