International Journal on New Trends in Education and Their Implications
July 2024 Volume:15, Issue:1, ISSN 1309-6249

The Effect of Kahoot Supported Rebus Application on Gifted Students' Cognitive Structures and Views on Astronomy[1]

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Abstract

This study was planned to determine the effect of the rebus application developed on astronomy on the cognitive structures and views of gifted students. The research was designed according to phenomenological design, one of the qualitative research methods. In the research, firstly, using the canva programme, which is one of the web 2.0 tools, the rebuses for 25 different astronomy concepts were created and the created rebuses were integrated into the kahoot programme, which is also a web 2.0 tool. The developed application was applied for 8 weeks in the 2022-2023 academic year to 20 gifted students who were studying in a Science and Art Centre (SAC) in the east of Turkey and who were determined by the easily accessible case sampling method. The data of the study were collected with Word Association Test (WAT) and semi-structured interview form. The WAT was administered to all students in the study group before and after the application. The data obtained from the word association test were evaluated by creating frequency and percentage tables. Content analysis method was used to analyse the data collected through interviews. In the study, it was concluded that the application had a positive effect on the cognitive structures of gifted students on astronomy. In addition, the students stated that they learnt new and useful information with the application, enjoyed the process and found the application educational and instructive.

Keywords: Astronomy, gifted, mind and intelligence game, rebus, kahoot

Recommended Citation: Benek, İ. (2024). The Effect of Kahoot Supported Rebus Application on Gifted Students' Cognitive Structures and Views on Astronomy, *International Journal on New Trends in Education and Their Implications (IJONTE), 15* (1), 63-78.

Introduction

Astronomy and Astronomy Education

Astronomy is a branch of science that studies galaxies, stars, planets and other celestial bodies. It is a branch of science that investigates the structure and evolution of celestial bodies, the universe and utilises observational and theoretical studies (Ministry of National Education [MoNE], 2010). This science is one of the oldest branches of science. Humans have had a high level of curiosity about space since the earliest times. Since the earliest times, people have analysed the movements of celestial bodies using various observation tools. Space has always been a mystery to mankind. Thanks to the dizzying developments in science and technology in our age, this mystery is trying to be solved. In this process, many branches of science (physics, mathematics, astrophysics, etc.) have taken an active role in solving this mystery. Astronomy is one of the subjects of physics of the universe (Azizah et al., 2022). Scientists working not only in the field of physics but also in many other fields of science have conducted studies on astronomy. Thanks to the developing science, studies on astronomy have gained momentum. Developments in the field of astronomy have made positive contributions to humanity. The findings obtained have helped people in time determination, agricultural activities, direction finding, cartography, coordinate system, etc.

[1]A part of this study was presented at the 7th International Conference on Education, Technology, and Science (GLOBEST 2023) held on 8-11 September 2023.

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Astronomy is an interesting science subject (Susman & Pavlin, 2020). In fact, space and astronomy have attracted the attention of students at every school level from pre-school to graduate school and have been a source of curiosity for them. Countries have included astronomy in their school curricula and included astronomy-related courses. Many activities related to astronomy are carried out in schools. It is known that the majority of students develop positive attitudes towards activities related to space and astronomy. For example, according to a field study conducted by TUBITAK (The Scientific and Technological Research Council of Turkey) to measure the science literacy of young people between the ages of 15-24, "internet" and "astronomy" are the most interesting subjects for Turkish youth (MoNE, 2010). Recently, many studies have been conducted on astronomy for students (Azizah et al., 2022; Bartlett et al., 2018; Colantonio et al., 2021; Gali, 2021; Salimpour, 2019). Since students find the subject of astronomy interesting, they are eagerly involved in studies related to this field. They want to explore and understand the complexity of space. In fact, one of the early goals of many children and young people is to pursue a career in this field in the future. Countries need to light the way for people with career plans in this field.

Gifted Individuals

Gifted individuals are individuals who have superior abilities in many areas compared to their peers. In fact, the term gifted has been used for a long time despite scientific debates, including the National Association for Gifted Children (NAGC) experts, with the idea that purpose, context and multidimensionality are important (Rasheed, 2020). Gifted individuals are individuals who learn faster than their peers, are ahead of them in creativity, art and leadership, and act independently in their fields of interest (MoNE, 2023). Such individuals can exhibit high performance in subjects they are interested in and curious about. They develop a different perspective in interpreting an event, producing solutions and analysing problems. Generally, such individuals can show giftedness in fields such as science, mathematics, art, music and sports. In fact, there are debates on the definition of giftedness, identification of gifted students, and effective programming and implementation in gifted education (Rasheed, 2020). It is important to recognise gifted individuals from childhood and to identify their characteristics in terms of their development.

Early identification plays an important role in revealing the full potential of gifted students. As a result of the identification, a special education programme and guidance services should be offered to them. Education programmes prepared for gifted individuals should be aimed at accelerating their development. Education programmes should be able to respond to them sufficiently. These individuals are special individuals. They have intense interests. They think deeply about a problem situation and cope with the problem by using high level problem solving skills. These students transcend socioeconomic status, geography, religion, sexual orientation and barrier conditions (Castellano & Frazier, 2021). Many different groups live in a country in terms of religion, language, race and culture. Therefore, countries should take into account the characteristics of these different groups when designing education programmes. For example, while the population of culturally, linguistically and economically diverse students in the United States has increased in recent years, gifted talented (GT) programmes have failed to reflect this diversity (Mun et al., 2020).

Mind and Intelligence Games

Playing mind and intelligence games is one of the most practical ways to exercise the brain. Intelligence games offer a fun way to develop individuals' mental abilities and skills. The use of intelligence games in the learning-teaching process ensures that students have a good time and that the information is permanent and meaningful. It is of vital importance for the development of the individual to give intelligence games as a course. With the lessons to be given, students will gain a more systematic thinking structure. In the intelligence games course, it is aimed that students develop different and original strategies for problems, use a more systematic thinking structure and gain fast and accurate decision-making skills (MoNE, 2013). Intelligence games have educational contributions. It is obvious that these games have an important educational potential when used for educational

purposes (Ozdevecioglu & Hark Soylemez, 2021). In the learning-teaching process, students spend quality time when they play games they are interested in individually or in groups. When an individual who plays brain teasers faces a challenging problem, he/she focuses on the solution and makes the right decision as a result. There are many mind and intelligence games that will improve students' mental abilities. Some of these are reasoning and strategy games, verbal games, geometric-mechanical games, memory games, strategy games and intelligence questions (MoNE, 2013). One of the brain teasers that can be used in the education process of gifted students is rebuses.

Rebus appears as a mind-brain game or a type of puzzle. A word or word group is represented by visual clues such as various letters, writing, numbers, pictures, symbols, logos, signs. The person is asked to find the word or word group based on these visual clues. Recognisers basically constitute a pictorial system (Clark, 1981). Rebuses are examples of logo-graphic symbols that represent a word and do not require decoding into sub-units or phenomena (Sheehy, 2002). In addition, it means a code or reference with pictures, letters or symbols that represent certain words or sentences that are different from conventional words (Zegerek, 2019). According to another definition rebus, a word or syllable is represented by an image of an object that sounds similar to the represented word or syllable (Britannica, 2023). These cleverly encrypted visual puzzles help gifted students develop their affective and cognitive skills.

Purpose of the Study

The aim of this study is to reveal the effect of the rebus application developed for gifted students on the cognitive structures and opinions of the students. In line with this purpose, answers to the following questions were sought;

1. What is the effect of the rebus application on the cognitive structures of gifted students?
2. What are the opinions of gifted students about the rebus application?

sub-questions were searched for answers.

Method

Research Design

This study was designed according to the phenomenological design, which is one of the qualitative research methods. This design is used to reveal people's experiences, perceptions and interpretations of a phenomenon (Creswell, 2007). In this study, the cognitive structures and views of gifted students wre analysed.

Study Group

The study was conducted in the of the 2022-2023 academic year with a total of 20 gifted volunteer students, 12 girls and 8 boys, attending the Science and Art Centre located in the east of Turkey. In the selection of the participants, the "easily accessible case sampling" method was used. In the convenience sampling method, the researcher's selection of a close and easily accessible situation increases the speed and practicality of the research (Yildirim & Simsek, 2016). All of the participants took part in the individual skills recognition groups. Students in this group are those who are diagnosed with general intellectual ability and complete the support education program (Ministry of National Education [MoNE], 2022). The ages of the participants ranged between 10-13 years.

Implementation

The research was conducted in the 2022-2023 academic year. The studies were carried out within the scope of Science course. For the application, firstly, the Science and Art Centre Science Curriculum was examined. The learning outcomes in the "Planets, Solar System and Space", "Earth, Sun and Galaxy", "Celestial Bodies", "Space Research" and "Functioning of the Universe" modules of the curriculum were taken into consideration. The objectives taken into considerations are as follows:

1. Explains the properties of celestial bodies.

2. Questions the interactions between celestial bodies.

3. Prepares a model showing the relative positions of the Earth, the Sun and the Milky Way galaxy.

4. Relates the concepts of Earth, Sun and Galaxy.

5. Compares different celestial bodies according to their formation.

6. Predicts the possible results of the Earth's interaction with different celestial bodies.

7. Prepares models representing the satellites of the planets in the solar system.

8. Generates ideas to make the use of space technologies more effective.

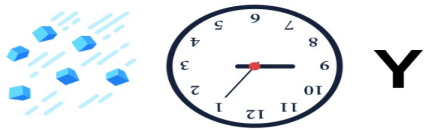
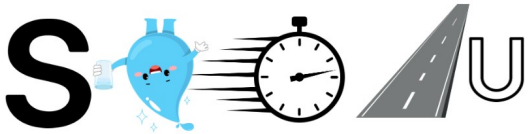
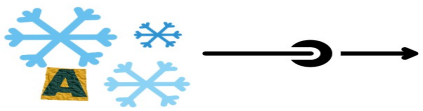
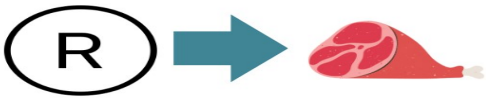
9. Summarises the existing ideas about the formation of the universe.

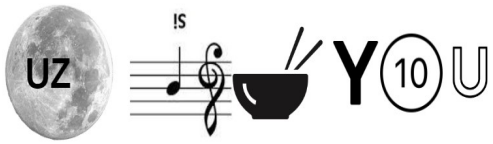
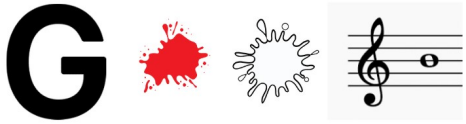
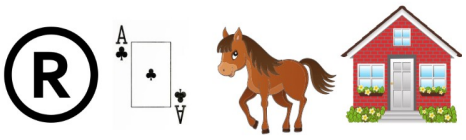
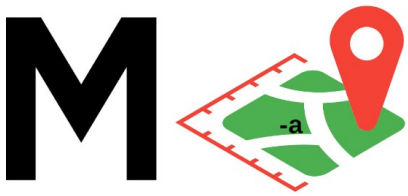
10. Compares the celestial bodies in the solar system in terms of their suitability for life (MoNE, 2021).

As a result of the examination of the learning outcomes in the curriculum, it was decided to develop a rebus test for astronomy concepts. For this purpose, first of all, 25 different rebus for astronomy concepts were developed. Some of the developed rebuses are shown in Table 1:

Table 1

Some Examples of Rebus Test Developed for Astronomy

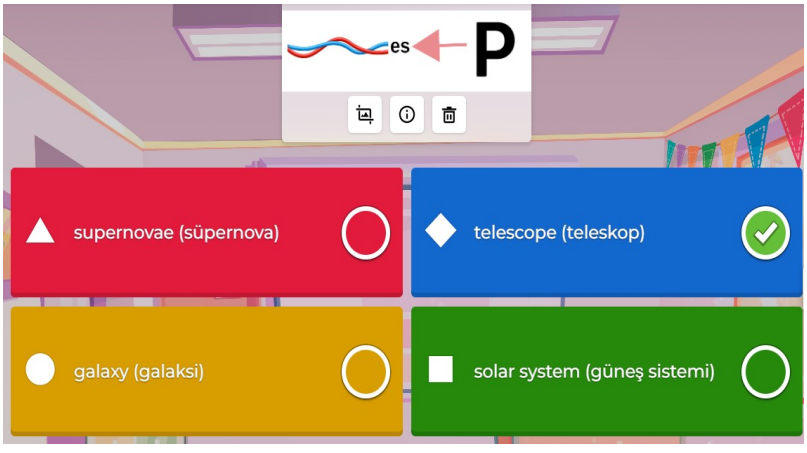
1. Sun (Güneş)	**2. Full Moon (Dolunay)**
	
3. Telescope (Teleskop)	**4. Evening Star (Akşam Yıldızı)**
	
5. Milky Way (Samanyolu)	**6. Supernovae (Süpernova)**
	
7. Blackhole (Karadelik)	**8. Rocket (Roket)**
	

9. Space Station (Uzay İstasyonu)	10. Galaxy (Galaksi)
	
11. Observatory (Rasathane)	**12. Sunspots (Güneş Lekeleri)**
	
13. Astronaut (Astronot)	**14. Mars (Mars)**
	

The rebuses developed within the scope of the subject were submitted to the examination of two academicians who are experts in the field and two teachers who are experts in intelligence games. In the light of the feedback from the experts, some rebuses were removed from the test and some were corrected. After the revision, the 25-question rebus test was finalised. While creating the rebuses, "canva" programme, a web 2.0 tool, was used. The developed rebuses were then integrated into the "kahoot" application, which is a web 2.0 tool and a digital-based educational test game. Pictures of the rebuses were placed on the "quiz" screen of the kahoot application and possible answers were placed in the options. According to the difficulty levels of the rebuses, "standard score" and "double score" options were used. Again, according to the difficulty levels of the rebuses, answering times were limited as "5 seconds", "10 seconds", "20 seconds", "30 seconds" and "1 minute". One of the rebuses integrated into the kahoot application is given in Figure 1:

Figure 1

The appearance of one of the developed rebuses in the kahoot application



Before the application, the participants were both trained on the use of the kahoot application and given information about the concept of rebus. After the introduction, a pilot application was carried out with the participant group for 1 lesson hour. After the pilot application, it was decided that it would be appropriate to carry out the studies in 2 lesson hours per week. The application lasted a total of 16 hours, 2 hours a week. Each student was given a tablet or computer during the application. The researcher used the smart board in the classroom as the main screen. After the researcher started the rebus test application, the kahoot system generated a pin code and the participants were included in the test by logging into the kahoot application with the given pin code. Participants who participated in the test using the pin code chose a nickname and a character. Then, the researcher teacher projected the rebus on the main screen, and after the students solved the rebus displayed on the main screen, they made marking within the given time via the tablet or computer in front of them. After each rebus was answered by all students, the students' rankings/ranks were displayed on the main screen. The ranking of the students depended on their ability to solve the rebus correctly and quickly. In the first and second week, the "classical mode" in the kahoot application mentioned above was used. In the third week "colour siege", in the fourth week "undersea team", in the fifth week "treasure chest" and in the sixth week "tallest tower" modes were used.

Data Collection Tools, Data Collection and Ethics

The data of the study were collected through Word Association Test (WAT) and semi-structured interviews. Word association test was used to determine the cognitive structures of the students. With the word association test, it is tried to determine the words that students associate in their minds about a concept. In this test, a list of words is created and the participant responds to each word according to the first word that comes to mind (Kostova & Radoynovska, 2008). Firstly, a table with two columns was created. One column contains the stimulus word list and the other column is left blank for student responses. The prepared form is given below:

Figure 2

Astronomy Word Association Test

Astronomy Word Association Test

	Word	Student Answer		Word	Student Answer
1	Astronomy		14	Astronomy	
2	Astronomy		15	Astronomy	
3	Astronomy		16	Astronomy	
4	Astronomy		17	Astronomy	
5	Astronomy		18	Astronomy	
6	Astronomy		19	Astronomy	
7	Astronomy		20	Astronomy	
8	Astronomy		21	Astronomy	
9	Astronomy		22	Astronomy	
10	Astronomy		23	Astronomy	
11	Astronomy		24	Astronomy	
12	Astronomy		25	Astronomy	
13	Astronomy		26	Astronomy	

The form in Figure 2 was distributed to the students and they were asked to quickly write the words that made associations in their minds about the word astronomy. There are differences in the literature regarding the completion time of WAT (Bostan Sarioglan & Celik, 2021; Ozyurt & Yalman, 2020; Yapici, 2022). In this study, it was found that 45-50 seconds was appropriate for gifted students to write the words associated with the concept of astronomy in their minds. WAT was applied to all students in the study group before and after the application.

In the study, the opinions of the students were also tried to be determined and a semi-structured interview form was used for this purpose. At the end of the application, semi-structured interviews were conducted with 10 volunteer students in the study group. For this, a draft form consisting of 10 questions was prepared first. The draft form was submitted to expert review to ensure validity and to

be analysed in terms of grammar, and some corrections were made in the questions within the framework of the feedback from the experts. After the necessary arrangements were made, a preliminary interview was conducted with a student and as a result, the 6-question interview form was finalised. In the interview form, there are questions aiming to reveal students' thoughts about the application in depth.

At the beginning of the implementation, the participants were informed about the purpose of the research and the purpose for which the data would be used. The consent of the students in the study group was obtained and they were informed that they could leave the study at any time they wanted. In addition, the confidentiality of the participants was taken as a basis within the framework of ethical principles and codes were used instead of the real names of the students.

Data Analysis

Frequency and percentage tables were created in the analysis of the data obtained from the Word Association Test. In the analysis of the data collected with the semi-structured interview form, content analysis method was used in accordance with the nature of qualitative research method. Firstly, the opinions of all students who participated in the interview were digitised. The data were deciphered by reading over the digitised data. A provisional code list was created after the readings. Then, related and similar codes were combined under certain themes. The themes and codes obtained were interpreted and presented to the reader. Two independent experts took an active role in the process of analysing the data simultaneously and each of them created a separate code list. In order to ensure the reliability of the codings created by two different experts, Miles and Huberman's (1994) reliability calculation formula was used and the agreement between the coders was calculated as 88%.

Findings

The findings obtained as a result of analysing the collected data are presented in the following order in accordance with the sub-questions of the research.

Cognitive Structures of Students

In this section, the findings obtained from the word association test to determine the cognitive structures of the students about astronomy are presented. The answers given by the students about the concept of astronomy before the application are given in Table 2:

Table 2
The answers produced by the students in the pre-test and their frequency/percentage values

Word	f	%	Word	f	%
Space	8	7.2	Space shuttle	2	1.8
Earth	7	6.3	Andromeda	2	1.8
Sun	7	6.3	Milky Way	2	1.8
Star	6	5.4	Rocket	2	1.8
Planet	6	5.4	Meteorite	2	1.8
Spacecraft	5	4.5	Living	2	1.8
Astronaut	5	4.5	Moving object	1	0.9
Moon	5	4.5	Exoplanet	1	0.9
Telescope	4	3.6	Black hole	1	0.9
Mars	4	3.6	Venus	1	0.9

Neptune	4	3.6	Uranus	1	0.9
Universe	4	3.6	Satellite	1	0.9
Galaxy	4	3.6	Jupiter	1	0.9
Infinity	3	2.7	Crater	1	0.9
NASA	3	2.7	Space junk	1	0.9
Asteroid	3	2.7	Pole Star	1	0.9
Saturn	3	2.7	Big Dipper	1	0.9
White dwarf	3	2.7	Solar system	1	0.9
Meteor	3	2.7			
Total			**37**	**111**	**100**

When Table 2 is examined, it is seen that the students produced the concepts of "space" (8), "earth" (7), "sun" (7), "star" (6), "planet" (6), "spacecraft" (5), "astronaut" (5), "moon" (5), "telescope" (4), "mars" (4), "neptune" (4), "universe" (4) and "galaxy" (4). Students produced 37 different words in the pre-test and 111 words in total. After the end of the application, the same test was reapplied as a posttest to determine the change in students' cognitive structures. The answers given by the students about the concept of astronomy after the application are given in Table 3:

Table 3
The answers produced by the students in the post-test and their frequency/percentage values

Word	**f**	**%**	**Word**	**f**	**%**
Space	13	6.2	Last Fourth	2	0.9
Moon	11	5.2	Big Dipper	2	0.9
Earth	9	4.3	Space station	2	0.9
Astronaut	8	3.8	Pole star	2	0.9
Universe	7	3.3	Artificial satellite	1	0.4
Mars	7	3.3	Natural satellite	1	0.4
Sun	7	3.3	Exoplanet	1	0.4
Black hole	7	3.3	White dwarf	1	0.4
Saturn	7	3.3	Comet	1	0.4
Star	7	3.3	Celestial body	1	0.4
Jupiter	6	2.8	Neutron stars	1	0.4
Celestial island	6	2.8	Red planet	1	0.4
Planet	6	2.8	Brown dwarf	1	0.4
Venus	6	2.8	Asteroid belt	1	0.4
Spacecraft	6	2.8	Ozone	1	0.4
Bulging moon	5	2.4	Astronomy	1	0.4
Galaxy	4	1.9	Rocket	1	0.4
Meteor	4	1.9	Nebula	1	0.4

Dwarf planet	4	1.9	Celestial bodies	1	0.4
Meteorites	3	1.4	Space pollution	1	0.4
Galileo satellites	3	1.4	Titan	1	0.4
Milky Way	3	1.4	NASA	1	0.4
Mercury	3	1.4	Wormhole	1	0.4
The vacuum of space	3	1.4	Observatory	1	0.4
Sunspots	3	1.4	Little Dipper	1	0.4
Supernova	3	1.4	Orion	1	0.4
Full Moon	3	1.4	Phases of the Moon	1	0.4
Neptune	3	1.4	Constellation	1	0.4
Pluto	3	1.4	Astronomy	1	0.4
Telescope	3	1.4	Andromeda	1	0.4
Uranus	2	0.9	Light	1	0.4
Crater	2	0.9	Solar system	1	0.4
Light year	2	0.9	Science	1	0.4
First quadrature	2	0.9			
Total			**67**	**208**	**100**

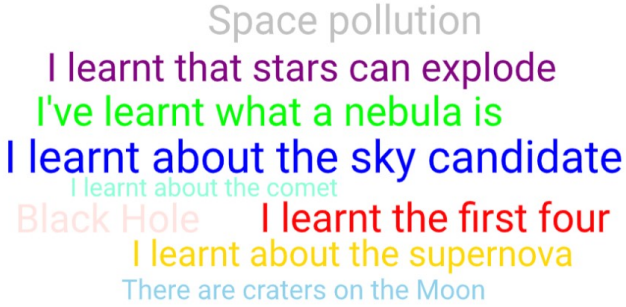
When Table 3 was analysed, it was seen that the participant students produced the concepts of "space" (13), "moon" (11), "earth" (9), "astronaut" (8), "universe" (7), "mars" (7), "sun" (7), "black hole" (7), "saturn" (7) and "star" (7). In addition, the students produced 67 different words and 208 words in total in the post-test. As a result, it was observed that the number and types of words in the post-test were higher than the number and types of words in the pre-test. From this point of view, it was concluded that the application of the rebus application positively affected the cognitive structures of the students towards the concept of astronomy.

Students' Opinions

Opinions of Gifted Students on Learning New Knowledge

Participants stated that they learnt new information with the application. The responses of the participants on this subject are given in Figure 3 as a word cloud:

Figure 3
Learning new information



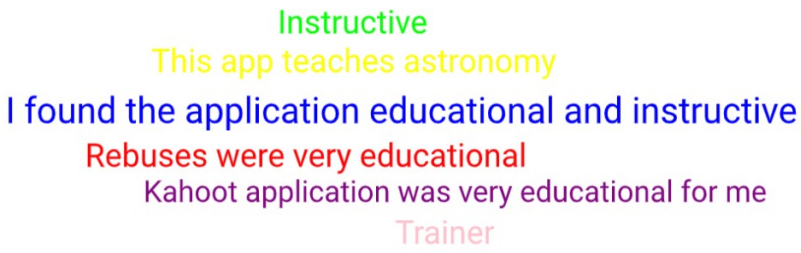
When Figure 3 is analysed, 9 codes were formed based on the students' views on learning new information. Four of the students were celestial candidates (S1, S5, S12, S17), three of them learnt the concept of nebula (S12, S15, S17) and the first four phases of the Moon (S2, S9, S15), two of them learnt that stars explode (S1, S15) and supernova is a star explosion (S1, S5), one of them stated that he learnt space pollution (S15), that there are craters on the surface of the Moon (S9), what a comet is (S2) and what a black hole is (S6). Some student opinions about these codes are as follows:

> S1: *I heard the concept of galaxy for the first time. Besides, it was surprising to learn that stars that run out of energy go supernova.*
> S5: *It was interesting to learn that the system formed by millions of stars and planets revolving around these stars is a galaxy.*
> S17: *During this process, I learnt the concept of galaxies, the first four phases of the Moon and that there are deep pits called craters on the surface of the Moon.*

Students' Opinions on Finding the Practice Educational and Instructional

The participants stated that they found the application educational and instructive. The responses of the participants on this subject are given in Figure 4 as a word cloud:

Figure 4
Educational-educative nature of the application



When Figure 4 is analysed, 6 codes were formed based on the opinions of the students about finding the application educational and instructive. Five of the participants said that they found the application educational and instructive (S2, S4, S15, S17, S19), four of them said that the rebuses were very educational (S1, S2, S6, S15) and that this application taught astronomy concepts (S5, S12, S17, S19), three of them stated that the application had educational (S1, S9, S12) and instructive (S2, S9, S15) aspects and two of them stated that kahoot application was very educational for them (S9, S19). Some student opinions about these codes are as follows:

> S2: *I think this application is very educational and instructive. In fact, I think that the rebuses are educational about space related subjects.*
> S15: *I think teachers should use this application in teaching subjects. If I were a teacher, I would use it because it is an instructive application.*
> S19: *I am aware that Kahoot application taught me some concepts about astronomy. I found this application very educational and instructive*.

Students' Opinions on the Useful/Benefical of the Implementation

Participants thought that the application was useful/benefical. The answers given by the participants on this subject are given in Figure 5 as a word cloud:

Figure 5

Useful/beneficial aspects of the implementation

When Figure 5 is analysed, 7 codes were created based on the students' opinions about whether they found the application useful/benefical. Eight of the participants said that they found the application very useful (S2, S4, S5, S6, S9, S12, S15, S17), six said that it was a useful application (S2, S4, S9, S12, S15, S17), five said that the application added a lot to them (S4, S9, S12, S15, S17), four of them stated that the application added different information to them (S1, S4, S9, S17), three of them stated that the application developed their minds (S6, S9, S12), two of them stated that the application developed their horizons (S5, S9) and one of them stated that they could establish a relationship between life and space thanks to the application (S5). Some student opinions about these codes are as follows:

S1: *The games we played in kahoot application added different information to me.*
S2: *I think this application is a very useful application.*
S5: *My horizons about space have expanded thanks to the word problems we solved about space. Space is a very interesting place. I now relate life and the existence of space.*
S12: *This process contributed a lot to me. For example, it improved my mind. Therefore, I find the application useful and beneficial.*

Students' Opinions on the Use of the Implementation in Repetition, Reinforcement and Recall of Subjects

The participants stated that they repeated the concepts and subjects they knew about astronomy and reinforced these subjects with the application. Some of the student opinions within the scope of this theme are given below:

S5: *I reinforced the subjects I already knew.*
S6: *It was very good to repeat these topics.*
S9: *I had learnt some of these concepts before but I had forgotten them. It was good to repeat them with kahoot.*
S12: *I knew some of these concepts before. It was a good repetition.*
S15: *I had read and learnt most of these concepts before. Because I am curious about space. But I had forgotten some of them. I remembered most of them again when I was solving these word searches.*

Students' Emotions towards the Practice

Participants expressed their feelings about the application of rebus. The feelings of the participants on this subject are given as a word cloud in Figure 6:

Figure 6
Students' feelings towards the implementation

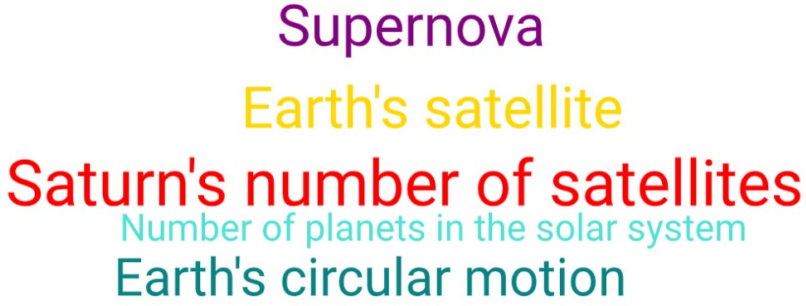
When Figure 6 is analysed, 8 codes were formed based on the feelings of the students towards the application. Seven of the students stated that they enjoyed the application (S1, S2, S4, S5, S12, S15, S17), five of them stated that they were happy in this process (S2, S4, S5, S6, S9) and their interest in astronomy increased during this process (S5, S6, S9, S15, S17), four of them stated that the application was exciting and they were very excited while playing games (S1, S5, S9, S12), four of them stated that their curiosity towards astronomy was activated (S1, S5, S15, S17), three of them stated that their motivation towards the lesson and space increased (S6, S9, S15), two of them stated that their belief that they could do astronomy increased (S12, S17) and they enjoyed the application (S2, S9). Some student opinions related to these codes are as follows:

> S1: *The games we played were very enjoyable. When I heard things like supernova, Saturn's number of satellites, galaxy, my curiosity about space increased.*
> S5: *I was curious about space before and I liked to be interested in space, but after the games we played, my interest in space increased. I started to read and watch more things about space, especially starburst is a great thing.*
> S15: *I had a very pleasant and enjoyable time during the applications. It was a very high quality time for me. I am curious about everything about space now.*

Students' Opinions that the Implementation Eliminates Misconceptions

The participants expressed opinions about the fact that the rebus application eliminated the misconceptions that existed in them. The opinions of the participants on this subject are given in Figure 7 as a word cloud:

Figure 7
Misconceptions



When Figure 7 is analysed, 5 codes were formed based on the students' opinions that the application eliminated some misconceptions they had about astronomy. One of the students (S12) stated that he misunderstood the concept of supernova and corrected this misconception, one (S5) stated that he confused the rotation and circulation movements of the Earth, one (S6) stated that he misunderstood the information that the Earth has only one satellite, one (S9) stated that he misunderstood the number of satellites of the planet Saturn but now he learnt the correct information and one (S15) stated that he previously misunderstood how many planets there are in the solar system. Some student opinions about these codes are as follows:

> S5: *I didn't know exactly how many movements the Earth has, but now I know. It moves round itself and round the sun.*
> S9: *I knew that the planet with the most moons was Jupiter. It turns out that the planet with the most moons is Saturn.*
> S12*: I had heard about the supernova event before, but I did not know that it was a star explosion.*

Discussion, Conclusion and Recommendations

In this study, the effect of rebus application on gifted students' cognitive structures and views on astronomy was examined. In this context, the study was conducted with students studying at a Science and Art Centre located in the east of Turkey. With this study, the educational-teaching aspects of the application were examined and the contributions of the application to the cognitive structures and views of the students were revealed. Rebus is an educational game that improves students' logical thinking and connection skills between concepts (Andic et al., 2018). Rebus is a fun combination of word and symbol games. Students are expected to solve the puzzle based on the symbol representing the word or word group. Rebus puzzles consist of a series of pictures and letters in a computational format that form a word or sentence (Morrell & Eukel, 2021). In line with the findings obtained in the study, it is seen that the rebus application has positive effects on the cognitive structures and opinions of gifted students. In the study, word association test was used to examine the change in the cognitive structures of the participants. It was observed that the students produced 37 different words for the concept of astronomy in the pre-test and 67 different words in the post-test. In addition, it was concluded that they produced a total of 111 words in the pre-test and 208 words in the post-test. In the light of these findings, it was seen that the kahoot-supported rebus application had positive reflections on the cognitive structures of the students. Yesilbursa and Işiksal (2022) concluded in their research on the fifth grades that rebus activities increased students' academic achievement. Ozdevecioglu and Hark Soylemez (2021) concluded in their descriptive content study that intelligence games contribute to the cognitive development of students. Similarly, Marangoz and Demirtas (2017) stated that mechanical intelligence games improve students' mental skill levels in their research with second grade primary school students. In addition, Demirci (2022) concluded in his thesis study that game-based activities have positive contributions to the learning of astronomy concepts of students in early childhood. It can be said that the results of these studies are parallel to the results we reached in our study.

As a result of the interviews with the students, it can be said that the application has positive reflections on the opinions of the students. In this regard, the most frequently mentioned positive features of the students were that the application provided new information and was educational and instructive. Students think that they learnt concepts such as celestial island, nebula, first four, supernova, craters of the Moon, space pollution, comet and black hole thanks to the application. According to the participants, the application of the word search has a supportive role in the teaching of astronomy concepts. The gifted students think that the rebus are useful/beneficial for them. Similarly, Ozpinar (2020) concluded in his study with pre-service teachers that the participants thought that the use of rebus in science education could be useful. In addition, in the light of the results obtained, it was concluded that students repeated the information, reinforced it and learnt it permanently with the help of a brain teaser game. In their study, Yesilbursa and Işiksal (2022) also stated that the rebuses provided permanent learning and visual learning and facilitated understanding.

In addition, it was determined that some of the students in the participant group had some misconceptions about astronomy before the application and that they eliminated their misconceptions with the application.

As a result of the interviews with the students, it was concluded that the students spent quality time during the process, enjoyed the participation and liked the application. Based on this, it is thought that the application has positive effects on students' emotions. Yesilbursa and Işiksal (2022) reported that the students found the use of the game fun, enjoyable and enjoyable, interesting, instructive and motivating. Ozdevecioglu and Hark Soylemez (2021) also stated in their study that students enjoyed intelligence games. Soylemez et al. (2022) concluded that students had a fun time during the application of rebus, which they used in teaching values.

Rebus is a fun mind and intelligence game. In this study, the effect of rebus used in science education was investigated. In the light of the data obtained from the research, it can be said that the use of the game positively affects both the cognitive structures and opinions of the students. The participants of this study consisted of students diagnosed with special ability. In future researches, the effects of the rebuses on other students outside this group can be investigated. This study was conducted in science course and it was concluded that the use in this course was positive. From this point of view, we think that it would be useful to use it in other courses as well.

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