Social Scientific Centered Issues Journal

2024-6(1)
http://dergipark.org.tr/ssci

Received: 30.05.2024
Accepted: 28.06.2024

EXAMINATION OF 3D DESIGNS PREPARED IN TİNCERCAD PROGRAM IN TERMS OF SUSTAINABILITY AND ITS RELATION WITH CREATIVE THINKING

[1.] Zeynep ERGÜN, [2.] Büşra Nur ÇAKAN AKKAŞ, [3.] Dilara ŞAHİN, [4.] Esra KABATAŞ MEMİŞ

Abstract

This study examines the perceptions of 8th grade middle school students towards the concept of sustainability in the context of their 3D designs and how the creativity of students who make 3D designs is related to 3D design making. In the study in which exploratory sequential design, one of the mixed method designs, was used, 24 students studying in the 8th grade represented the study group. The data collection tools were the 3D designs made by the students for sustainability, the Scientific Creativity Scale and semi-structured interviews to determine the students' views on sustainability and the process. When the designs of the students are analyzed; renewable energy sources, recycling, clean environment and green space are emphasized. It is seen that there is a moderate, positive and significant relationship between the students' creative thinking test scores and their average scores from 3D designs.

Key words: 3D design, creativity, sustainability, sustainable development.

Introduction

In the current century, many new concepts are being constructed as well as re-evaluating existing concepts (Ülker & Yalçın, 2024). Sustainability is one of these concepts. The concepts of sustainability and sustainable development emerged with the realization of the deterioration of the natural balance in the face of human needs (Suna, 2023). The use of the concept of sustainability in the literature dates back to the 18th century. It gained its current recognition with the "Our Common Future" report

1. PhD. Students, Kastamonu Universty, zynpclgl57@gmail.com
2. Phd. Graduate, bnurcakanakkas@outlook.com
3. PhD. Students, Kastamonu Universty, dilaratemursahin@gmail.com
4. Prof. Dr., Kastamonu Universty, ekmemis@kastamonu.edu.tr

Citation: Ergün, Z., Çakan Akkaş, B., Şahin, D., & Kabataş Memiş, E. (2024). Examination of 3d designs prepared in tincercad program in terms of sustainability and its relation with creative thinking, *Social Scientific Centered Issues*, 6(1), 54-83.

published by the United Nations' World Commission on Environment and Development in 1987 (Wiersum, 1995). In this report, sustainability is defined as "meeting the needs of the present generation without compromising the ability of future generations to meet their needs" (WCED, 1987, p.27). In addition to ensuring continuity, sustainability aims to ensure the longevity of limited natural resources used to meet human needs (Özgen, 2019). While ensuring the continuity of resources in a sustainable life, it is also aimed to achieve prosperity in human life (Gökmen, Solak, & Ekici, 2017). Sustainable development is a result/product, while sustainability is a process (Akgül, 2020). The idea of sustainability is a multifaceted concept that includes economic, environmental and social dimensions (Kılıç, 2012).

For the existence of sustainable life and the realization of sustainable development, this issue is addressed in many different fields, especially in the field of education (Suna, 2023). The concept of "sustainable development education", which is frequently encountered today, offers solutions to the damage to nature and the environment through education (Korkut Demir, 2023). Today, one of the most important duties of individuals is to carry out nature-human interaction without negatively affecting the natural balance and to leave a more livable world to future generations. Raising individuals who have undertaken these duties is only possible through education (Engin, 2010). Individuals, institutions, societies and countries acting in line with common goals for sustainable development, protecting and developing our environment and preventing problems that may occur in the future will be provided by sustainable environmental education (Akgün, 2021).

Education for sustainable development can provide opportunities for critical thinking, greater awareness and greater empowerment, which are necessary for exploring new visions and concepts and developing new methods and tools (UNECE, 2004). Recognition of the importance of education for sustainable development came in 2002 when the UN declared the period 2005-2014 as the "Decade of Education for Sustainable Development". Today, many educational organizations all over the world are working on the direction of education programs to include sustainability (UNESCO, 2005). In our country, sustainability is among the concepts that individuals should acquire in the 2013 Science curriculum (MoNE, 2013). The Ministry of National Education Science Curriculum was updated in 2018 and 10 objectives were determined. When these 10 objectives are examined, there are four objectives

emphasizing sustainable development education and these objectives are given below.

1. To recognize the interaction between the individual, the environment and society; to develop awareness of sustainable development of society, economy and natural resources,
2. To adopt scientific process skills and scientific research approach in the process of exploring nature and understanding the relationship between human and environment, and to produce solutions to the problems encountered in these areas.
3. To take responsibility for daily life problems and to use science knowledge, scientific process skills and other life skills to solve these problems,
4. To arouse interest and curiosity about the events occurring in nature and its immediate surroundings and to develop attitudes (MoNE, 2018, p.9).

Sustainable development is also the basis for the development of information technology in the transition to a knowledge economy. In this context, information technologies are used as a resource to facilitate the learning process and provide efficiency, as well as in evaluation processes in terms of sustainable development (Öztopçu, 2018). It is important to integrate technology into education and to realize educational practices in accordance with the requirements of the age. The increasing prevalence of computers in social life shows that the future will be more complex and advanced than today. The fact that individuals have the skills to recognize and use computers helps them keep up with the world (Yüksel, 2015).

It is important to prepare environments that will focus on providing students with design and production skills and to create processes for the development of these skills (Çetin, Berikan, & Yüksel, 2018). In recent years, researchers in the field of education have been working on fun environments and activities that emphasize design and production processes in order to gain these skills (Selena & Neil, 2017; Somyürek, 2015). 3D design environments are one of these environments. Three-dimensional modeling of objects using computer graphics through special programs is defined as 3D design (Dizman, 2018). 3D design is also defined as 3D modeling of objects using realistic dimensions and depths in a virtual environment (Pakman, 2018). Tinkercad is a free online 3D modeling and design tool that is web-based and can be accessed through an internet browser. A three-dimensional design platform established in 2011, millions of designs have been made so far and this number is increasing over time. Individuals such as teachers, students, designers, adults, and children can use the

software to create prototypes, houses, toys, home decorations, Minecraft models, jewelry and jewelry designs, and any other design they want easily and simply. The Tinkercad program used in the research is an easy-to-use and enjoyable tool among the programs used to create 3D designs (Dere, 2017).

Students can make 3D design to produce a solution to a problem in their environment. 3D design can develop students' creativity and make learning in education concrete and permanent (Dizman, 2018). In addition, 3D design efforts develop analytical thinking methods and decision-making power in individuals (Allen, 1978). The design process has parts such as situation determination, analysis, definition, elimination, implementation and evaluation. Since the perception styles of individuals who watch and use the design are different, there is an interaction between design, designer and user (Gümüş. 2015). From this point of view, one of the aims of this study is to examine the perceptions of middle school 8th grade students towards the concept of sustainability in the context of 3D designs.

Creativity, which has been a subject of curiosity for many years and the subject of many researches, has an impact on educational policies today (Gençer, 2023). Creative thinking is defined by OECD (2019, p.8) as "the ability to participate productively in the generation, evaluation and improvement of ideas that can lead to original and effective solutions, advances in knowledge and effective expressions of imagination" (Caynak, 2024). Creative thinking skills are very important for individuals to produce solutions to new situations, to communicate effectively, and to produce useful ideas, ways or alternatives to improve themselves (Karlıdağ, 2018). Creative thinking skills enable individuals to produce solutions to problems that they have encountered before or have never encountered in their lives (Doğanay, 2000).

Creative thinking is a way of thinking that seeks innovation, can bring new solutions to problems, is inventive and unique to the individual (Özben & Argun, 2005). Individuals who think creatively are able to predict the events they experience and show a systematic approach to the problems they face (Aslan, 2016). Creative thinking, as an important quality unique to human beings, is of interest to many branches of science (Dikici, 2006; Erten-Tatlı, 2017; Katılmış, 2024). Torrance (1974), one of the pioneers of creative thinking skills in the literature, defines creativity as "Being sensitive to problems, inadequacies, lack of knowledge, unavailable elements, incompatibilities; identifying difficulties, searching for solutions, making predictions and hypothesizing about deficiencies or changing hypotheses, choosing one of the solutions and trying,

retrying, and then revealing the results." When the literature is examined, it is seen that scientific creativity has four main dimensions (Chien & Hui, 2010). These dimensions are: fluency, flexibility, originality and elaboration.

Fluency

According to Torrence (1980), fluency is the ability to find the maximum number of thoughts, ideas, alternatives or solutions on a concept or topic within a certain period of time (Torrence and Horng 1980). When another definition is examined, the fluency dimension is the individual's ability to successively list the alternatives that can solve the problem when faced with a problem. In this case, the more the number of solution alternatives produced, the more fluency the individual is considered to have (Önder, 2017). Activities such as brainstorming are used to develop the fluency dimension of creativity, and the use of such activities, especially in childhood, is very important for the development of creativity (Kandemir, 2006).

Flexibility

Flexibility dimension refers to the ability to think in a multidimensional way away from uniformity by adapting to changing situations (Öncü, 1989). In other words, flexibility is defined as the ability to generate ideas that can be categorized in different fields or the ability to change ideas and approaches (Yenilmez & Yolcu, 2007). A person with developed flexibility can adapt to new situations without difficulty and can easily switch from one behavior or approach to another (Oğuzkan, Demiral, & Tür, 1999).

Originality

This dimension of creativity is defined as the ability to produce ideas or solutions to a problem or issue that have not been tried before and can be called different (Öncü, 1989). Looking at another definition, Üstündağ (2014) associates originality with "making an invention" unlike other definitions. According to Üstündağ, originality is the ability to produce new and different ideas and, as a result, invaluable products and ideas (Üstündağ, 2014).

Elaboration

The elaboration dimension of creativity also appears in the literature with titles such as capacity to deepen, enrichment and elaboration (Gençer, 2023). The elaboration dimension includes many skills that affect each other, such as the ability to think in multiple ways, to look from different angles, to empathize, and to think in reverse (Kuru Turaşlı, 2020). Elaboration, in its most general definition, is the capacity

to change, develop and beautify an idea or thought by adding details to it (Kontaş, 2015). The extent to which a person's elaboration dimension is developed is related to the extent to which he/she can enrich and elaborate the answers he/she gives about a subject or the solutions and alternatives he/she produces in the face of problems (Yenilmez & Yolcu, 2007).

Creativity is considered a universal ability and it is stated that this ability, which is basically present in everyone, can be developed through education (Yavuzer, 1996; Kılıç ve Yalım,2023). Programs at all levels of formal education, from primary school to university, aim to develop creativity and creative thinking skills of individuals (Akan, 2022). It is very important to implement activities that contribute to the development of creative thinking skills, which are part of the existing potential of human beings, in learning and teaching environments (Katılmış, 2024). For this reason, creativity and creative thinking skills that can be developed through education are considered important outcomes of educational systems (Akan, 2022).

The relationship between 3D design and creativity is often emphasized in the literature. In this study, this relationship is discussed in the context of the concept of sustainability. The reason why sustainability is preferred is because it is a concept that should be acquired by individuals, it concerns future generations, and it has characteristics such as finding creative solutions to existing environmental problems. Within the scope of this study, another aim of the study is to examine how the creativity of students who make 3D designs for the concept of sustainability is related to 3D design making. It is believed that this study will contribute to the related literature as it deals with the mentioned concepts together.

Methods

Research Model

In this study, in which both quantitative and qualitative data are handled together, the research model is mixed method. Mixed methods research is an approach in which researchers integrate quantitative and qualitative data sets to better understand research problems and make inferences using the benefits of this integration (Creswell, 2021, p.2). In this study, exploratory sequential design, one of the mixed method designs, was used. The purpose of using the exploratory sequential design is to collect qualitative data after quantitative data and to provide the opportunity

to examine the research problem in more detail (Creswell & Plano Clark, 2020). Mixed research method can also be defined as the analysis and integration of data obtained by using quantitative and qualitative data collection methods (Creswell & Plano Clark, 2020, p.5).

Working Group

24 8th grade students represent the study group. Easy accessibility of the study group was prioritized. The study group consisted of 24 students, 17 girls and 7 boys.

Application

Within the scope of the research, the 3D design program was first introduced to the students and how to use the program was explained through sample applications. After the introductory lessons, the students were asked to make three designs: 'a sustainable house design', 'a sustainable shelter design' and 'a free design addressing sustainability'. Students realized their designs in the coding classroom at the school. They were given 2 class hours for each design task. During the design process, each student made their designs separately and it was tried to prevent them from being influenced by each other. During the design process, the teacher supported the students in case of difficulties caused by the program or the computer. However, no intervention was made during the design process. After these three applications, a creative thinking test was applied to examine students' creative thinking skills. Then, semi-structured interviews were conducted with six students to get their thoughts on both the concept of sustainability and the design process.

Data collection tools

3D designs

The 3D designs made by the students for sustainability constitute one of the quantitative data collection sources of this research. The elements used by the students in their designs, themes, the living and non-living figures they chose, the dimensions they emphasized on sustainability and the details they revealed their perceptions towards sustainability were discussed.

Scientific Creativity Scale

Another quantitative data collection tool, the scientific creativity scale test, was developed by Hu and Adey (2002) and adapted into Turkish by Kadayıfçı (2008). In this study, it was applied to determine students' creative thinking skills.

In the scale, fluency, flexibility and originality scores are collected in the first four questions. The fluency score is obtained by calculating the separate answers given by students regardless of their quality. The flexibility score is obtained by calculating the number of each domain or approach used in the answer. The originality score is developed by tabulating the frequencies of all the answers obtained. Students who score in the top 5% of all correct answers receive 2 points; students who score between 5% and 10% receive 1 point. Zero points are given for the other correct answers. In the fifth question, students in the top 5% of all correct answers receive 3 points, students between 5% and 10% receive 2 points, and the others receive 1 point each. The sixth question is the sum of flexibility and originality scores. The maximum score for flexibility is 9 for each correct method. 3 points can be taken from the tool, 3 points from the principles and 3 points from the way followed. As before, the originality score is calculated as 4 points if the percentage is less than 5% of the answers given, 2 points if the percentage is between 5% and 10%, and 0 points if the percentage is greater than 10%. Scoring of the seventh question apple picking machine.

Semi-structured interview

Semi-structured interviews were conducted to determine students' views on sustainability and the process. While preparing the interview questions, the developmental levels of the students were taken into consideration and the necessary corrections were made by presenting them to the expert opinion. After finalizing the interview questions, care was taken to ensure that the interview questions were appropriate, clear and understandable for the level of the students. The interviews with the identified students were recorded with a voice recorder.

Data analysis

Analysis of quantitative data

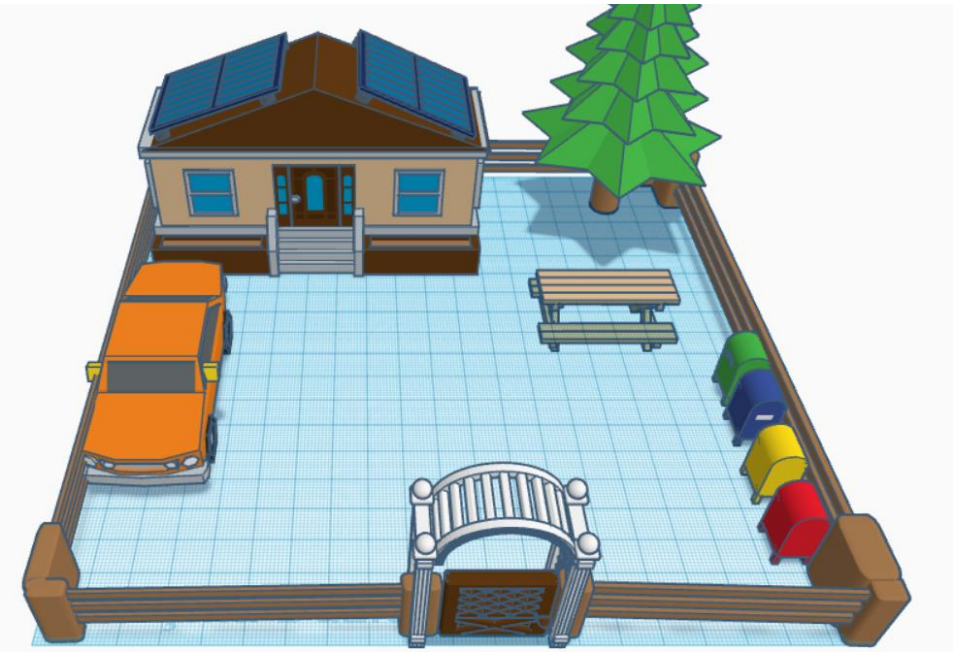
Analysis of Data Obtained from 3D Designs

3D designs were subjected to descriptive analysis. Descriptive analysis is a type of qualitative data analysis that involves summarizing and interpreting the data obtained through various data collection techniques according to predetermined themes (Yıldırım & Şimşek, 2003). General evaluations were made by looking at the suitability of the design for the purpose, detailing, composition and color emphasis. In addition, the emphasis on sustainability in the designs and the themes used for sustainability were examined. Finally, it was evaluated according to criteria such as the appropriate use of the figures used for the use of technology, the absence of unnecessary figure use, and the effective use of technology. Designs that were not suitable for the purpose of the study were excluded from the scoring. The designs were scored in the context of the determined criteria. The scoring was done separately by three researchers. Then, the researchers came together and conducted detailed studies on the designs and scoring. The scoring key created by the researchers is given in Table 1.

Table 1. 3D designs rubric

General assessment				Emphasis on sustainability	Sustainability dimension	Sustainability	Using Technology	Total points
Fit for purpose	**Elaboration**	**Composition inclusion**	**Emphasis on color**					
In this section, it is evaluated whether the student's design is made for sustainability. Scoring is done with a minimum of 0 and a maximum of 5.	In this section, it is evaluated whether elaborations such as detailing the design and explaining the design using notes are made. Scoring is done with a minimum of 0 and a maximum of 5	In this section, it is checked whether the combination of the elements in the design is random or not, whether the design elements are used in a way to form a whole or not. Scoring is done with a minimum of 0 and a maximum of 5	In this section, it is checked whether color emphasis is made while making designs. For example, using green color when designing the environment, using black or dark color tones when depicting a dirty environment, etc. Scoring is done with a minimum of 0 and a maximum of 5.	In this section, it is determined how many emphasis is placed on sustainability. And 1 point is scored for each emphasis.	In this section, it is determined which dimension of sustainability is emphasized. Environmental, cultural and economic sustainability are scored as 1 point for each emphasis.	In this section, the themes of recycling, energy saving, sustainable energy, green space, clean environment and saving are given 1 point for each theme.	In this section, it is examined whether the students use the program effectively while making their 3D designs. Their competencies in the use of the program such as using the same objects, designing unique objects are examined. Scoring is done with a minimum score of 0 and a maximum score of 5.	All the scores obtained are summed to form a total score.

How the scoring of a 3D design is made within the scope of the specified criteria is explained below through an example design.



In the design given for sustainable house design, firstly, general evaluation criteria are examined. The suitability of the design for the purpose was evaluated and it was determined that it was a suitable design for the purpose. The score for fitness for purpose is scored as 5. For the detailing of the design, it was determined as 4 because the elements in the design were designed in detail (parts of the house such as doors, windows, stairs, benches placed to show that there is a garden, etc.). At this stage, 1 point was deducted due to the fact that the student did not use the explanatory notes in the program, as it was stated that they should also use them. The composition score was scored as 5 because the elements in the design were in integrity and the design reflected a sustainable home environment and its surroundings. In addition, the color emphasis score was scored as 5 because the elements in the design were colored and the color emphasis in the recycling bins was made. It is seen that the design emphasizes recycling, clean environment, green space and renewable energy by using solar panels. Although 1 point was scored for each emphasis, the total sustainability emphasis score was scored as 4. All of the emphases made in the elements in the design were designed for environmental sustainability and received 5 points from the sustainability dimension criterion. In terms of the degree to which each of the sustainability themes is emphasized, recycling, clean environment, green space, sustainable energy themes received 5 points each. Finally, in the context of the

criterion of using technology, it was determined that each figure was used in accordance with the purpose and that no unnecessary figures were used, and it was specified as 5 points. Thus, the total score of the student who realized this design was calculated. The scores obtained for this design are given in Table 2.

Table 2. Sample design scoreboard

Name Surname		**Sustainable Home**
General Assessment	**Fit for Purpose**	5
	Elaboration	4
	Composition Inclusion	5
	Emphasis on color	5
	Emphasis on sustainability	4 (recycling, clean environment, green field, solar panel)
Sustainability	**Environmental sustainability**	5
	Economic Sustainability	
	Cultural Sustainability	
Sustainability	**Recycling**	5
	Energy savings	
	Green field	5
	Clean environment	5
	Sustainable energy	5
	Savings	
Using Technology	**Appropriate use of figures for the purpose**	5
	Lack of unnecessary use of figures	5
	Effective use of technology	5
Total points		63

Analysis of the data obtained from the Scientific Creativity Test

The data obtained from the creativity test were evaluated in terms of the flexibility, fluency and originality sub-dimensions of the answers given to each question and scored in accordance with the scoring criteria.

In order to score the scale, the frequency of students' responses to each item was tabulated. In order to calculate the originality scores, the frequency of the answers was determined and tabulated. Hu and Adey (2002), in the calculation of the authenticity score of the first four items of the scale, give 2 points to students who fall within 5% of all correct answers and 1 point to students who fall between 5% and 10%. The other correct answers receive 0 points. The scoring criteria for the questions are given in Table 3.

Table 3. Scientific Creativity Scale Scoring Criteria

Questions	Fluency	Flexibility	Originality
Question 1	1 point for each answer obtained	+1 point for each different suggested answer	Out of all accepted responses, those within 5% get 2 points, those between 5% and 10% get 1 point, those more than 10% get 0 point
Question 2	1 point for each answer obtained	+1 point for each different suggested answer	Out of all accepted responses, those within 5% get 2 points, those between 5%-10% get 1 point, those more than 10% get 0 point
Question 3	1 point for each answer obtained	+1 point for each different suggested answer	Out of all accepted responses, those within 5% score 2 points, those between 5%-10% score 1 point, those more than 10% score 0 point

Question 4	1 point for each answer obtained	+1 point for each different suggested answer	Out of all accepted responses, those within 5% score 2 points, those between 5%-10% score 1 point, those more than 10% score 0 point
Question 5	1 point for each answer obtained	No scoring	Among the answers given, 3 points for 5%, 2 points for 5%-10%, 1 point for more than 10%
Question 6	No scoring	3 points within the method tool, 3 points for principles, 3 points for the path followed	Among the answers given, those ranked within 5% received 4 points, those ranked between 5% and 10% received 2 points, and those ranked more than 10% received 0 points.
Question 7	No scoring	3 points are awarded for each separate function of the machine.	A score between 1 and 5 is given based on a comprehensive overall impression.

Correlation analysis was performed to determine the relationship between the findings obtained from the creative thinking skills test and the scores obtained from the 3D designs for sustainability.

Qualitative Data Analysis

Analysis of data obtained from semi-structured interviews

The data obtained from semi-structured interviews were subjected to content analysis. Content analysis is a method mainly used to analyze written and visual data (Özdemir, 2010). The answers given by the students were formed from codes, themes were created based on these codes and their frequencies were extracted.

Results

Quantitative Findings

Findings for 3D designs

The data obtained from the analysis of the designs made by middle school students using the 3D design tool are included. In addition, different examples of these designs are given. Data and examples for 'sustainable house design', one of the design tasks, are given below.

Figure 1. Sustainable house drawing examples

When these designs are examined, it is seen that the students include renewable energy sources with solar panels placed on the roofs of the houses in their

sustainable house designs, emphasize recycling by placing recycling bins in front of the houses, and emphasize clean environment and green space by designing green subfloor and trees in their designs. In addition to these, there are also elements for energy biodiversity. Examples of designs for sustainable shelter design are given below.

Figure 2. Sustainable shelter drawing examples

When these designs are examined; renewable energy sources, clean environment and green space emphasis are also seen in sustainable shelter design. In addition, it is seen that there is quite a lot of living diversity in the designs of the students regarding biodiversity in the designs.

Examples of the designs made by the students for the last design task, free design, are given below.

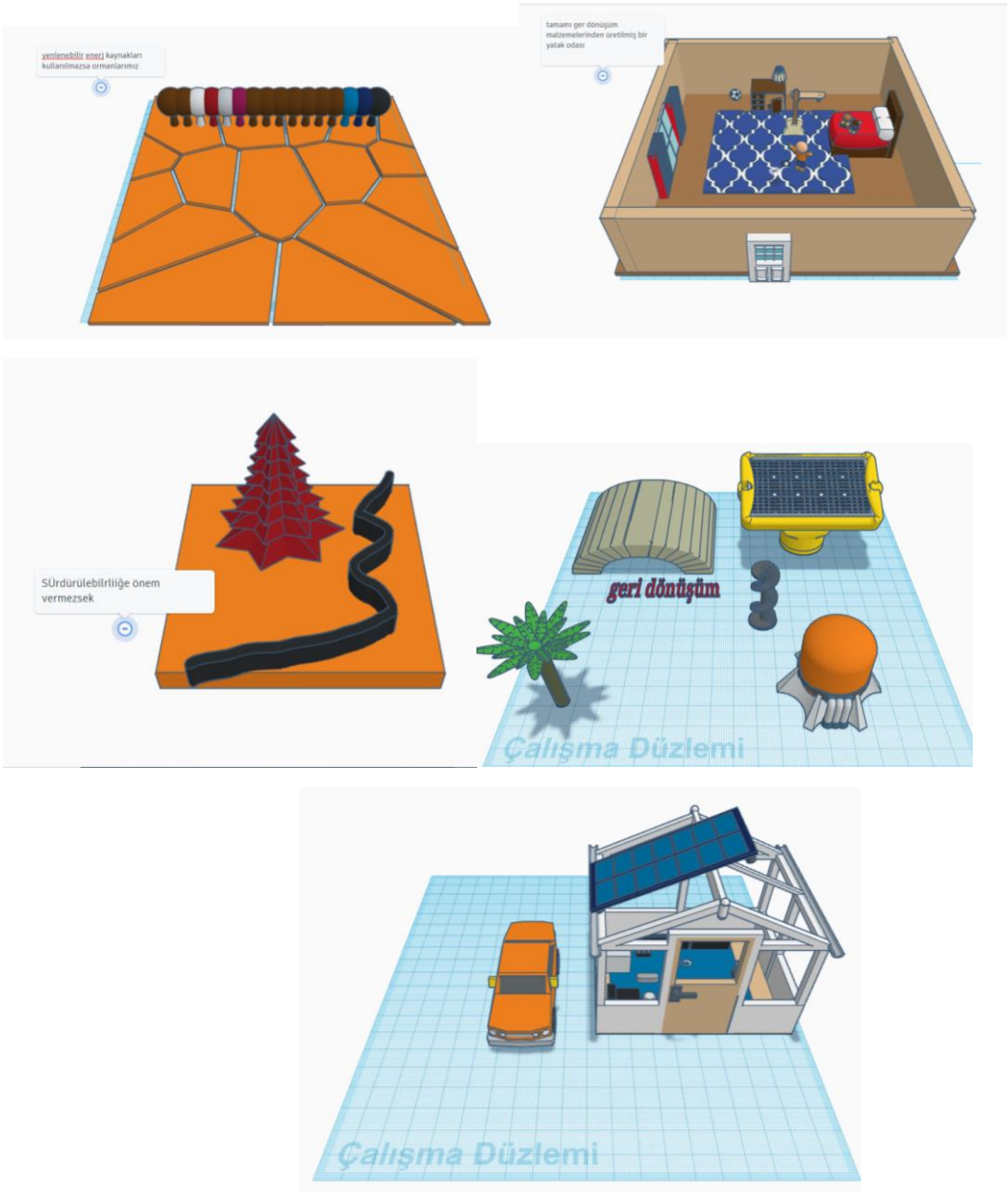


Figure 3. Freehand Drawing Examples

When these designs are analyzed; it is seen that they emphasize green space, clean environment and recycling. In addition, biodiversity and sustainable energy are also included in the designs. In the free design task, unlike the other designs, the learners also transferred what could happen if there was no sustainable life to their designs.

The average of the free designs for sustainability is given below.

The 3D designs prepared by middle school students with the themes of 'sustainable house', 'sustainable shelter' and 'free design' were evaluated separately. Then, the scores that the students received from each design and the averages of the scores were calculated. The data obtained as a result of scoring are given in Table 6.

Table 6. Findings on the evaluation of middle school students' 3D designs

	Total points for sustainable home design	**Total points for sustainable shelter design**	**Total points from free design**	**3D designs average score**
Ö1	57	49	36	47
Ö2	63	51	49	54
Ö3	53	18	37	36
Ö4	62	42	29	44
Ö5	51	53	18	41
Ö6	54	56	22	44
Ö7	44	59	46	50
Ö8	47	41	41	43
Ö9	37	26	0	32
Ö10	48	50	50	49
Ö11	42	60	51	51
Ö12	50	52	51	51
Ö13	50	44	47	47
Ö14	26	22	30	26
Ö15	50	52	48	50
Ö16	45	40	50	45
Ö17	49	45	53	49
Ö18	42	40	44	42
Ö19	50	55	45	50
Ö20	49	40	58	49
Ö21	55	50	60	55
Ö22	25	30	20	25
Ö23	39	43	35	39
Ö24	42	44	40	42

Findings related to creative thinking

Findings Related to Scientific Creativity Scale

In order to evaluate the scientific creativity test scores of middle school students, their averages were calculated. The mean scores are given in Table 7.

Table 7. Findings on the evaluation of creativity scores of middle school students

Name of student	Creativity test score
Ö1	40
Ö2	42
Ö3	36
Ö4	25
Ö5	17
Ö6	37
Ö7	52
Ö8	58
Ö9	0
Ö10	32
Ö11	43
Ö12	50
Ö13	20
Ö14	11
Ö15	52
Ö16	0
Ö17	22
Ö18	14
Ö19	24
Ö20	40
Ö21	25
Ö22	9
Ö23	16
Ö24	14

Findings on the relationship between design score and creativity

Spearman's correlation analysis was performed to determine the relationship between the mean 3D design scores of middle school students and the creativity scale score, and the results are given below.

Table 8. The relationship between design score and creativity score

		Creative thinking test score
3D Design average score	P	,632**
	P	,000

p<0.01, ρ<0.01

According to the data obtained as a result of Spearman's correlation analysis in Table 8, a statistically significant and positive relationship was found at the 0.01 level

between the mean 3D design scores of the students and the creative thinking test score ($\rho = 0.632$; $p<0.01$).

It is seen that there is a moderate positive and significant relationship between the students' creative thinking test scores and their average scores from 3D designs. According to this, at the end of the application, the scores that the students received from 3D designs and the scores they received from the creative thinking test are consistent with each other. In other words, it was concluded that the more the students' creative thinking skills increase, the higher their average 3D design scores will be.

Qualitative Findings

As a result of the content analysis of the data obtained from the semi-structured interviews conducted to determine the students' views on sustainability and the process, it is seen that 3D designs are formed based on the contribution of the 3D design process to the student and awareness of sustainability. The results of the analysis based on the theme codes and frequencies resulting from the analysis are given in Table 9.

Table 9. Findings from semi-structured interviews

	Theme	Code	Frequency
Emerging themes for design	Design considerations	Recycling	3
		Renewable energy	5
		Afforestation	2
	Contribution of designs to the environment/individual	Financial contribution	2
		Positive impact on human life	2
		Energy savings	3
		Renewable energy	1
Themes emerging for its contribution to the student	Desire to learn in a sustainable environment	Yes	6
	Contribution of the process to the student	Sensitivity	2
		Savings awareness	2
		Contribution to sustainability	1
		Learning to save	1
	Difficulties in designing	Due to the program	2
Emerging themes for sustainable environmental awareness	Sustainable Development Concept	Savings	2
		Renewable Energy	3
		Correct use of resources	1
	Ensuring economical use of resources in daily life	Yes	1
		No	4
		Undecided	1
	Taking into account the needs of future generations	Yes	0
		No	6
	Sustainable aspects of the environment	Recycling activities	3
		Efficient use of resources	1
		No use of fossil fuels	1
		Lamps with sensors	1
	Unsustainable aspects of the living environment	Lack of use of renewable energy sources	2
	Sustainable development	Positive	6
	The contribution of sustainable development to everyday life	Savings	2
		Long-lasting items	1
		Sensitivity	1
		Awareness	1
		Consciousness	1
	Individual/societal actions for sustainable development	Savings	2
		Conscious use of resources	1
		Recycling	1
		Community awareness raising	2
	Sustainability	Requirement	6

When the findings on the determination of their views based on sustainability were examined, it was determined that the students defined sustainable development as saving, renewable energy and economical use of resources. While one student defined sustainable development in terms of solar panels with the statement "*When I think of sustainable development, I think of solar panels.*", another student defined sustainable development in terms of energy saving with the statement "*When I think of sustainable development, I think of a sustainable life where we spend less energy.".*

The majority of the students (n=4) stated that the resources available in the home or school environment were not used economically. All students (n=6) stated that the needs of future generations were not sufficiently taken into account in the context of sustainability. One student said, *"We use resources sparingly, for example, we do not leave the water on while brushing our teeth. We try to save both money and water. Otherwise, there will be no water resources left for future generations."* While one student stated that resources are used sparingly, another student stated that resources are used partially sparingly with the statement *"Sometimes I use sparingly. For example, I use water sparingly. If I do not use sparingly, environmental pollution may occur."*

Students mentioned recycling activities (n=3), economical use of resources and sensor lamps as sustainable aspects of the environment they live in, while they stated that the lack of renewable energy sources and environmental pollution are not taken into account sufficiently as unsustainable aspects. One student said, *"Not very much. It is at a medium level. Sensor lamps are one of the sustainable aspects of the place where I live",* while one student cited sensor lamps as an example of sustainable aspects, and one student said, *"The unsustainable aspect of the environment where I live is that we do not use renewable energy resources sufficiently... The problem of air pollution is not taken into account in my environment for sustainability."* He emphasized the insufficient use of renewable energy resources.

Students stated that they paid attention to recycling (n=3), renewable energy (n=5) and afforestation (n=2) while doing their design assignments. Students stated that the structures such as schools, houses, and shelters they designed contributed to the environment, affected human life positively, saved energy, and included the use of renewable energy sources. For example, one student emphasized solar energy with the *statements "I paid attention to generate electricity from solar energy while*

designing." and *"I used solar energy in my design, I used a solar heating system.",* while another student emphasized recycling with the statement *"I paid attention to use sustainable items in my design. I used recycling bins.".*

A student drew attention to the benefits of solar energy with the statement *"I placed solar panels, I placed solar panels to make them useful."* Another student emphasized recycling and solar energy with the statement *"I used solar panels, I used recycling bins, I used solar panels because it saves energy."*

The contributions of the designs to the students were that they gained sensitivity towards sustainability (n=2), learned about saving and became aware of saving (n=2), and contributed to sustainability. Students stated that sustainable development brought savings (n=2), long-lasting items, sensitivity, awareness and consciousness for daily life. This was stated by one student: *"This process made me more conscious, not to spend directly, to make investments for the future and to take care of them."* While stating that the process in which they realized 3D designs brought awareness and care, another student emphasized the awareness of saving with the statement *"In this process, I learned about saving for the environment, saving energy."* Another student emphasized the contribution of this process to savings with the statement *"I learned to use what we need without wasting."*

All of the students (n=6) stated that they wanted to study in sustainable environments where they realized their designs. While the majority of the students stated that they did not have difficulty in making their designs (n=4), some of them (n=2) stated that they had difficulty due to the program.

They stated that for a sustainable society, individual and social savings (n=2) and community awareness-raising (n=2) activities should be carried out, conscious use of resources and recycling activities should be carried out. In addition, all students (n=6) defined sustainable development positively.

One student said, *"We can increase our sensitivity both individually and as a society. Studies can be done on this."* Another student said, *"Individually, we should use our energy resources correctly. We should use buses as a society to reduce air pollution."* emphasized public transportation.

One student said, "*Individually, we should not leave the faucet open and the lights on. We should do these as a society."* While another student emphasized saving

with the *statement "We should follow the rules. We should ensure everyone's economical use."* emphasized saving.

One student said*, "Since there are more renewable items, there should be a more comfortable environment where we can breathe more. We can be more conscious as a society*." Another student said, *"Even if we do nothing, we should recycle the garbage we have. As a society, we can use electric vehicles."* emphasized recycling.

Discussions, Conclusions and Recommendations

At the end of the 3D design process, it was determined that students defined sustainable development as saving, renewable energy and the economical use of resources. It was also determined that the designs focused on the environmental dimension of sustainability. When examined in the literature, it is seen that academic studies on sustainability focus more on environmental sustainability (Ergün et al., 2023). Environmental sustainability is a fundamental part of sustainable development, as it is of vital importance for all living beings on earth and represents a common interest for future generations (Furat, 2024).

Students expressed that they paid attention to renewable energy sources, recycling, a clean environment and afforestation while doing their design assignments both in their designs and in interviews. In a study in the literature, in parallel to this, when the students' reflection of renewable energy and sustainability concepts in their daily lives is examined, it is seen that they prefer renewable energy sources, draw houses intertwined with natural environments, and drawings are made for biodiversity and waste control (Akgün, 2021).

Students stated that the structures such as schools, houses and shelters they designed contributed to the environment, affected human life positively, saved energy, and included the use of renewable energy sources. In addition, there was a moderate, positive and significant relationship between students' creativity scores and their average scores from 3D designs. Accordingly, at the end of the application, the scores that the students obtained from 3D designs and the scores they obtained from the scientific creativity test are consistent with each other. In other words, it was concluded that the more the students' creative thinking skills increase, the higher their average 3D design scores will be. These results are also supported in the literature, and providing students with experiences that allow them to express their ideas in 2D and 3D enables them to establish the link between form and content of creative design ideas (Onur, Zorlu, 2017). It has been found that moving 2D and 3D objects and parts

of these objects in space increases the spatial visualization ability of individuals (Olkun & Altun, 2003). Likewise, when the literature is examined, it is seen that students define the concept of 3D design in a positive sense (Dere, 2017). In addition, robotic activities, which are highly preferred to be used together with the 3D design process, increase students' scientific process skills (Sullivan, 2008). It is seen that coding, robotics, 3D design and game design education have many benefits for students (Dizman, 2018). In addition to all these, it is seen that the applications carried out with Tinkercad, a web-based 3D design tool, are also very effective on the spatial visualization and mental rotation skills of middle school students (Dere, 2017). Considering the results of this study, it was determined that creating 3D designs can improve students' creativity. Moreover, thanks to these designs, learning in education can be made permanent (Dizman, 2018).

The majority of the students stated that the resources available in environments such as home or school environment are not used economically. All of the students stated that the needs of future generations were not sufficiently taken into account in the context of sustainability.

Students mentioned recycling activities, economical use of resources, sensor lamps as sustainable aspects of the environment they live in. Students stated that the lack of renewable energy resources and environmental pollution were not sufficiently taken into account as unsustainable aspects of the environment they live in. The literature supports the view that the needs of future generations are not sufficiently taken into account in today's society (Brundtland, 1987).

When the contributions of the designs to the students are considered, they stated that they gained sensitivity towards sustainability, learned about saving and savings awareness, and contributed to sustainability. It is also supported by the literature that activities aimed at raising sustainability awareness in secondary school students positively affect students' awareness levels towards sustainable living (Suna, 2023).

Students stated that sustainable development brings savings, long-lasting items, sensitivity, awareness and consciousness for daily life. All of the students stated that they wanted to study in sustainable environments where they realized their designs. In addition to these, the students were interviewed about how the process affected them. While the majority of the students stated that they did not have difficulty in making the designs, some of them stated that they had difficulty due to the program. It is thought that this problem is due to the fact that they have not used any 3D design

tools before. In another study, it was observed that students had problems with the 3D design program Tinkercad, which was also used in this study, such as aligning objects (Dere, 2017).

Students stated that for a sustainable society, savings and community awareness-raising activities should be carried out individually and collectively, conscious use of resources and recycling activities should be carried out. In this sense, school administrators can positively support this process by sharing their views on cooperation and participation with stakeholders in the process of developing sustainability strategies, through practices such as information meetings, joint workshops and student participation (Üzel et al., 2024).

In addition, in this study, all students defined sustainable development positively. This result is quite positive. Because in another study, it was determined that students had difficulty in revealing the importance of renewable energy in the context of sustainability (Akgün, 2021).

References

Akan, R. (2022). Hayat bilgisi öğretiminde çocuklar için felsefe (p4c) yaratıcı düşünme becerisi etkinliklerinin öğrencilerin yaratıcı düşünme becerisine etkisi [Yayımlanmamış Doktora Tezi] Uludağ Üniversitesi.

Akgül, F. A. (2020). 8.Sınıf öğrencilerinin sürdürülebilir kalkınmaya yönelik farkındalık düzeylerine sosyobilimsel konu destekli fen öğretiminin etkisi [Yayımlanmamış Doktora tezi]. Gazi Üniversitesi.

Akgün, S. (2021). 8. sınıf öğrencilerinin yenilenebilir enerji kaynakları ve sürdürülebilirlik kavramına yönelik algılarının incelenmesi [Yayımlanmamış Yüksek Lisans Tezi]. Sakarya Üniversitesi.

Allen, Wendy. (1978). Waren-Ästhetik und Angst; (Probleme der Ästhetik II. 14-31). (Çev Handan Tunç), London: Orange Hill.

Aslan, A. E. (2016). Kavram Boyutunda Yaratıcılık. Türk Psikolojik Danışma ve Rehberlik Dergisi, 2 (16).

Aslan, E. (2011). Torrance yaratıcı düşünce testi ‘nin Türkçe versiyonu. Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 14, 19-40. https://dergipark.org.tr/tr/pub/maruaebd/issue/368/2523

Brundtland, G. H. (1987). Our Common Future. Oxford University Press.

Caynak, S. (2024). Okul Öncesi Dönem Çocuklarında Uygulanan Mutfak Becerileri Eğitiminin Çocukların Yaratıcılık Düzeylerine Etkisi [Yayımlanmamış Yüksek Lisans Tezi]. KTO

Creswell, J. W. (2021a). Karma yöntem araştırmalarına giriş. (M. Sözbilir, Çev.). Ankara: Siyasal.Karatay Üniversitesi.

Creswell, J. W., & Plano Clark, V. L. (2020). Karma yöntem araştırmaları: Tasarım ve yürütülmesi. (Y. Dede & S. B. Demir, Çev.). Ankara: Anı.

Çetin, E., Berikan, B. & Yüksel, A. O. (2018). 3b tasarım öğrenme deneyiminin süreç değerlendirmesi ve eğitsel çıktılarının keşfedilmesi, Eğitim Teknolojisi Kuram ve Uygulama, 9(1).

Dağ, M. (2020). Görsel Sanatlar Dersinde Atık Nesnelerle İşlevselliği Olan Tasarım Çalışmaları Uygulama Örneği. [Yayımlanmamış Yüksek Lisans Tezi]. Gazi Üniversitesi.

Dağlı, H. (2022). 7. sınıf fen eğitiminde uzaktan eğitim yoluyla verilen üç boyutlu tasarım uygulamasının etkililiği: Vaka çalışması [Yayınlanmamış yüksek lisans tezi]. Necmettin Erbakan Üniversitesi.

Deniş, H., & Balım, A. G. (2012). Bilimsel yaratıcılık ölçeğinin Türkçeye uyarlama süreci ve değerlendirme ölçütleri. Uşak Üniversitesi Sosyal Bilimler Dergisi, 5(2), 1-21. https://doi.org/10.12780/UUSBD111

Dikici, A. (2006). Sanat eğitimi ve öğrencilerin yaratıcılık düzeyleri. Eğitim ve Bilim, 31(139), 3-9. http://egitimvebilim.ted.org.tr/index.php/EB/article/view/4979

Dizman, A. (2018). Kodlama, Robotik, 3D tasarım ve oyun tasarımı eğitiminin 11-14 yaş grubu öğrencilerinin problem çözme becerileri ve üstbilişsel farkındalık düzeyine etkisi [Yayımlanmamış Yüksek Lisans Tezi]. Bahçeşehir Üniversitesi.

Doğanay, A. (2000). Yaratıcı öğrenme. Eğitim-Sen Yayınları. https://egitimsen.org.tr/wpcontent/uploads/2016/11/Yarat%C4%B1c%C4%B1-%C3%96%C4%9Frenme.pdf

Engin, H. (2010). Coğrafya eğitiminde sürdürülebilir kalkınma, sürdürülebilirlik eğitimi ve çevre eğitimi konularının kazandırılması [Yayımlanmamış Yüksek Lisans Tezi]. Marmara Üniversitesi.

Ergün, Z., Gencel, N., & Kabataş Memiş, E. (2023). The Sustainability Trend In Education in All Its Aspects: A Meta-Synthesis Investigation of Studies In Turkey. İnsan ve Toplum Bilimleri Araştırmaları Dergisi, 12(3), 1435-1473. https://doi.org/10.15869/itobiad.1288310

Erten-Tatlı, C. (2017). Çocuklarda yaratıcı düşünme becerilerinin saptanması ve okul Psikolojik danışmanlarının farkındalığının incelenmesi [Doctoral dissertation, Ankara Universitiy]. National Thesis Center.

Furat, Ş. (2024). Nuh Naci Yazgan Üniversitesinin çevresel sürdürülebilirlik potansiyelinin değerlendirilmesi: Erciyes Üniversitesinden örnek edinme [Yayımlanmamış Yüksek Lisans Tezi]. Nuh Naci Yazgan Üniversitesi.

Gençer, S. İ. (2023). TRT EBA TV Anaokulu Programı'nın, çocuk programı kalite kriterleri açısından incelenmesi ve 60-72 aylık çocukların yaratıcı düşünme becerisi üzerine etkisi [Yayımlanmamış Yüksek Lisans Tezi]. Marmara Üniversitesi.

Gökmen, A., Solak, K., & Ekici., G. (2017). Sürdürülebilir kalkınma için eğitim: öğretmen adaylarının tutumları ile ilişkili olan faktörler. Kesit Akademi Dergisi, 3(12), 462-480.

Gümüş, A. (2015). Üç Boyutlu Tasarımların Bilgisayar Teknolojisinde Uygulanması [Yayınlanmamış yüksek lisans tezi]. Atatürk Üniversitesi.

Hu, W. & Adey, P. (2002). A scientific creativity test for secondary schoolstudents. International Journal of Science Education, 24 (4), 389–403.

Kadayıfçı, H. (2008). Yaratıcı düşünmeye dayalı öğretim modelinin öğrencilerin maddelerin ayrılması ile ilgili kavramları anlamalarına ve bilimsel yaratıcılıklarına etkisi [Yayınlanmamış Doktora Tezi], Gazi Üniversitesi.

Kandemir, M.A. (2006). Matematik eğitimi öğretmen adaylarının yaratıcılık eğitimi hakkındaki goruşleri ve yaratıcı problem çözme becerilerinin incelenmesi [Yayınlanmamış, yüksek lisans tezi]. Balıkesir Üniversitesi.

Katılmış, A. (2024). Sosyal bilgiler dersinde örnek olay yöntemi temelli öğretimin yaratıcı düşünme gelişimine etkisi. Pamukkale Üniversitesi Eğitim Fakültesi Dergisi [PAÜEFD], 60, 281-315. https://doi.org/10.9779/pauefd.1242720

Karlıdağ, İ. (2018). Okul öncesi öğretmenlerinin yaratıcılık kavramına ilişkin görüşleri/Preschool teachers' vıews regardıng creatıvıty, Sosyal Araştırmalar Dergisi, 11 (56).http://dx.doi.org/10.17719/jisr.20185639030

Kılıç, S. (2012). Sürdürülebilir kalkınma anlayışının ekonomik boyutuna ekolojik bir yaklaşım. İstanbul Üniversitesi Siyasal Bilgiler Fakültesi Dergisi, (47), 201-226.

Kılıç, A. G. & Yalım, A. (2023). Görsel sanatlar eğitimi pratiğinde yaratıcılık, Buca Eğitim Fakültesi Dergisi, 57, 1984-1995.

Kontaş, T. (2015). 5-11 yaş arası çocukların zihin teorisi ve yaratıcılık yetenekleri arasındaki ilişkinin çeşitli değişkenler açısından incelenmesi [Yayımlanmamış Yüksek lisans tezi]. Karadeniz Teknik Üniversitesi.

Korkut Demir, C. (2023). Görsel sanatlar öğretmenlerinin sürdürülebilirlik kavramını kazandırmaya yönelik görüşleri [Yayımlanmamış Yüksek Lisans Tezi]. Uludağ Üniversitesi.

Kris, E. (1952). Psychoanalytic explorations in art. Kuru Turaşlı, N. (2020). Erken çocukluk döneminde yaratıcılık ve geliştirilmesi. Pegem Akademi, Ankara.

Kuzu Demir, E. B., Çaka, C., Tuğtekin, U., Demir, K., İslamoğlu, H., ve Kuzu, A. (2016). Üç boyutlu yazdırma teknolojilerinin eğitim alanında kullanımı: Türkiye "deki uygulamalar. Ege Eğitim Dergisi 17(2), 481-503.

MEB (2013). İlköğretim Kurumları (İlkokullar ve Ortaokullar) Fen Bilimleri Dersi (3,4,5,6,7 ve 7. Sınıflar) Öğretim Programı. Millî Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, Ankara.

MEB. (2018). Fen Bilimleri Dersi (3, 4, 5, 6, 7 ve 8. Sınıflar) Öğretim Programı. (07.05.2018) http://mufredat.meb.gov.tr/Programlar.aspx

OECD. (2019). PISA 2021 creative thinking framework. https://www.oecd.org/pisa/publications/PISA-2021-creative-thinking-framework.pdf

Oğuzkan, Ş., Demiral, Ö., ve Tür, G. (1999). Okul öncesinde yaratıcı çocuk etkinlikleri. Ya-Pa Yayınları, Ankara.

Okan Yüksel, A. (2015). Okul öncesi dönemde 3 boyutlu tasarım ve üretimin çocukların bilişime yönelik algılarına etkisi [Yayımlanmamış Yüksek Lisans Tezi]. Gazi Üniversitesi.

Olkun, S., Altun, A., ve Üniversitesi, N. (2003). İlköğretim öğrencilerinin bilgisayar deneyimleri ile uzamsal düşünme ve geometri başarıları arasındaki ilişki. The Turkish Online Journal of Educational Technology, 2(4), 86-91.

Onur, D. & Zorlu, T. (2017). Tasarım stüdyolarında uygulanan eğitim metotları ve yaratıcılık ilişkisi, The Turkish Online Journal of Design, Art and Communication, 7(4).

Öncü, T. (1989). Torrance Yaratıcı Düşünme Testleri ve Wartegg-Biedma Kişilik Testi aracılığıyla 7-11 yaş çocuklarının yaratıcılığı ve kişilik yapıları arasındaki ilişkinin incelenmesi [Yayımlanmamış Doktora tezi]. Ankara Üniversitesi.

Önder, A. (2017). Okul öncesi çocuklar için eğitici drama uygulamarı, Eğiten Kitap, İstanbul.

Özben, Ş. ve Argun, Y. (2005). Buca Eğitim Fakültesi Öğrencilerinin Yaratıcılık Boyutları Puanlarının Karşılaştırılması. Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi, (18).

Özdemir, M. (2010). Nitel Veri Analizi: sosyal bilimlerde yöntembilim sorunsalı üzerine bir çalışma. Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi, 11(1), 323-343.

Özgen, N. (2019). Sürdürülebilirlik kavramı ve kullanım alanları. N. Özgen ve M. Kahyaoğlu (Ed.). Sürdürülebilir Kalkınma içinde (s.2-36). Ankara: Pegem Akademi.

Öztopçu, A. (2018). Sürdürülebilir kalkınma için öğretimde bilişim teknolojileri, Ekonomi, Politika & Finans Araştırmaları Dergisi, 3(1): 86-100

Saka, H. E. (2017). Web tabanlı 3b tasarım uygulamalarının ortaokul öğrencilerinin uzamsal görselleştirme ve zihinsel döndürme becerilerine etkisi [Yayımlanmamış Yüksek Lisans Tezi] Başkent Üniversitesi.

Selena, N., ve Neil, S. (2017). Making the best of it? Exploring the realities of 3D printing in school. Research Papers in Education, 32(5), 578-595.

Somyürek, S. (2015). An effective educational tool: Construction kits for fun and meaningful learning. International Journal of Technology and Design Education, 25(1). 25-41.

Sullivan, F. R. (2008). Robotics and science literacy: Thinking skills, science process skills and systems understanding. Journal of Research in Science Teaching, 45(3), 373-394.

Suna, M. 2023. 6. sınıf sosyal bilgiler dersinde sürdürülebilirlik bilinci kazandırmaya yönelik etkinliklerin öğrencilerin sürdürülebilir yaşama yönelik farkındalıklarına etkisi. [Yayımlanmamış Yüksek Lisans Tezi]. Anadolu Üniversitesi.

Torrance, E. P. (1972). Can we teach children to think creatively? The Journal of Creative Behavior, 6(2), 114–143. https://doi.org/10.1002/j.2162-6057.1972.tb00923.x

Torrance, E. P. (1974). Torrance Test of Creative Thinking, Verbal Tests Forms A And B (Figural A& B), : Scholastic Service Inc. Il, Bensenville.

Torrance, E. P. (1980). More than the ten rational thinking processes. Creative Child & Adult Quarterly.

Torrance, E. P., & Horng, R. y. (1980). Creativity and style of learning and thinking Characteristics of adaptors and innovators. Creative Child & Adult Quarterly, 5(2), 80–85

Üstündağ T. (2014). Yaratıcılığa yolculuk. Ankara, Pegem Yayıncılık.

Ülker, G., Yalçın, S. 2024. Dijital çağda sürdürülebilirlik ve sosyal inovasyon üzerine bir çalışma: hayata dokunuyorum görme engelliler inovatif atölyesi örneği. Kaytek Dergisi, 6(1), 40 – 57s. DOI: 10.58307/kaytek.1388115

Üzel, H., Atasever, S., İdem, U., Çelik, T. (2024). Eğitimde sürdürülebilirlik konusuna okul yöneticilerinin bakışı, Ulusal Eğitim Dergisi, 4(1).

World Commission on Environment and Development (1987). Our Common Future. Oxford: Oxford University Press. s. 27. ISBN 019282080X.

Yavuzer, H. (1989). Yaratıcılık. İstanbul: Boğaziçi Üniversitesi.

Yenilmez, K. ve Yolcu, B. (2007). Öğretmen davranışlarının yaratıcı düşünme becerilerinin gelişimine katkısı. Sosyal Bilimler Dergisi, 18, 96-97.

Yıldırım, A. ve Şimşek, H. (2003). Sosyal Bilimlerde Nitel Araştırma Yöntemleri. Seçkin Yayıncılık. Ankara.