DESIGN THINKING AND ART EDUCATION

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Abstract: Design Thinking is a collaborative, interdisciplinary, innovative, creative, problem-solving and human-centered process for creating user-oriented products, services or experiences. Because of its ability to foster creativity and innovation, it is applied in the fields of industry, business, engineering, technology and education by applying an empathetic, flexible and iterative approach. Along with the search for a teaching strategy for the acquisition of 21st century skills, there has been an intense and broad interest in Design Thinking applied in education in recent years. Since the design thinking approach is similar to the content of the theoretical and practical applications of the artistic production process, art and design thinking are related concepts.

The study aimed to determine the interaction between design thinking and art and also the development of an individual's design thinking skills through art education. As a result of the literature review; by examining the relationship between art and design-oriented thinking, it has been evaluated common and influence sides each other with art education, and the ability to develop design thinking skills through art education is also determined and discussed. The paper also presents some evaluations and recommendations about raising productive individuals with design-oriented thinking through effective art education.

Keywords: Art, Art education, Design, Design thinking, Visual art.

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TASARIM ODAKLI DÜŞÜNME VE SANAT EĞİTİMİ

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Özet: Tasarım odaklı düşünme, kullanıcı odaklı ürünler, hizmetler veya deneyimler oluşturmak için işbirlikçi, disiplinlerarası, yenilikçi, yaratıcı, problem çözmeye dayalı ve insan merkezli bir süreçtir. Empatik, esnek ve yinelemeli bir yaklaşım uygulayarak yaratıcılığı ve yeniliği geliştirme yeteneği nedeniyle, orijinal tasarım çalışması alanının ötesinde endüstri, işletme, mühendislik, teknoloji ve eğitime uygulanmıştır. 21. yüzyıl becerilerinin kazanımı için bir öğretim stratejisi arayışıyla birlikte, son yıllarda eğitimde uygulanan Tasarım Düşüncesine yoğun ve geniş bir ilgi olmuştur. Tasarım odaklı düşünme yaklaşımı, sanatsal üretim sürecinin teorik ve pratik uygulamalarının içerikleriyle benzerlik gösterdiğinden sanat ve tasarım odaklı düşünmenin birbiriyle ilintili kavramlar oldukları görülmektedir.

Bu çalışmada, tasarım odaklı düşünme ile sanat arasındaki etkileşimin ve sanat eğitimi yoluyla bireyin tasarım odaklı düşünme becerilerinin gelişimi arasındaki ilişkinin belirlenmesi amaçlanmıştır. Literatür taraması sonucunda; sanat ve tasarım odaklı düşünme arasındaki ilişki incelenerek sanat eğitimi ile ortak ve birbirini etkileyen yönleri üzerinde değerlendirmeler yapılmış, sanat eğitimi yoluyla tasarım odaklı düşünme becerilerinin geliştirilebilirliği tartışılmıştır. Ayrıca etkili bir sanat eğitimi ile tasarım odaklı düşünme yapısına sahip, üretken bireyler yetiştirilmesi ile ilgili tespitler ve önerilere yer verilmiştir.

Anahtar Kelimeler: Sanat, Sanat eğitimi, Tasarım, Tasarım eğitimi, Görsel sanatlar.

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1. INTRODUCTION

Imagination has been one of the most important innovation factors in mankind history. Encountered problems have been solved by imagination and also basics of design idea were found in that way. Design is a solution-oriented phenomenon in addition to bringing innovation. A design is a planned outline, a prototype, product or process for the construction of an object or system, or the implementation of an activity or process.

Design thinking is a popular interdisciplinary approach that includes design in life. Design thinking is an active process that empathizes and defines the clear solution of the problem, by defining with empathy, developing innovative ideas by brainstorming and also testing these ideas and implementing solutions. The design thinking approach will be stronger with a comprehensive analysis of design processes.

Design is the set of processes from the first occurrence of the problem to the completion of the solution. Many researchers agree that design is a problem solving process while describing it. The word design comes from the Latin word "disignare". It entered English from French "dessiner" and Italian "disegno" after the Renaissance (Barnard, 2002). Literally, it means "the first draft of a work of art, structure or technical product" and "The framework that designs the path and procedures to be followed in various periods of a research process" in the TDK dictionary.

In general, it is possible to define design as an information-oriented process that starts with the definition of the problem and provides data from previous experiences. While designing, some information is learned and taken, and this new information causes some changes in human minds, also additional knowledge emerges. As a result of this new synthesis of knowledge,

the designer makes the design by seeing the design problem from another perspective or by establishing the structure of relations (Bayazıt, 2004). But, the designing process mind is not only related to the information sets related to the design problem, but also to the information sets that the designer has acquired through his past experiences. The design process is a special thinking process that includes reasoning, imagination, two or three dimensional representations (such as diagrams, sketches, models) that describe the forms formed in the mind of the designer, and the use of many mental activities (Özcan, 2009).

Is design an artistic-intuitive process or a scientific-rational process? The answer to this question has been discussed for many years. The believers of design thinking are an intuitive act of art have argued with the believers of design thinking is a rational science field. According to Koçkan (2012), the believers of design thinking is an intuitive act of art (Osborn,1963; Gordon, 1961; Matchett, 1968; Broadbent, 1966), have esteemed it is not a scientific explanation of action because it is a designer's instinct driven process. The believers of design thinking are a rational science field have argued that design should have objective and scientific aspects different from art, and it would not be right for the designer to direct action with her instincts.

According to Mozota (2003), it is a controversial issue whether the design is a science or an art. Because design covers both. The design combines the logical and analytical approach of science with the creative approach of art. As a bridge creating between two disciplines design is a creative, problem-solving, systematic and coordinating activity. According to Özer (2009), since design is a problem-solving activity based on various data (i.e. informational basis), in both cases, problem solving activity should be placed within the framework of the information problem

even it's an intuitive approach.

For design to be accepted as a scientific process, there must be an objective process. Design theorists have argued that systematic processes, which are the necessities of the scientific method, exist in design as well, therefore the mentioned process should be examined as scientific studies and solved with scientific methods. These developments led to the discussion of design in methodology. By establishing parallelism between scientific research methods and design methods, the scientific structure of design was researched, and those dealing with design methods first sought rational methods that integrate scientific methods with the design process. In this context, the search for methods that have developed over time has turned into knowledge-based cognitive approaches in which the designer can discover her method during the design act, instead of suggesting a specific path taken from science (Koçkan, 2012).

The designer's ability to explore her creativity, produce ideas with verbal and visual thoughts and express them with visual expressions in the face of a problem is the basis of the design process that takes place with the balance of intuition and mind. In this context, the design process is also the designer's self-discovery and expression process. The fact that every stage of this process is made transparent provides both an increase in design awareness and the usability of design as a communication tool. The designer benefits from both his/her knowledge and the needs of the users during the design process. For this reason, it is accepted that design can be successful not only with the subjective approaches of the designers but also with their objective perspectives (Bayazıt, 2004).

As long as the design is innovative and creative, it has been a sustainable process that is needed in many areas, bringing new solutions to new problems. Due to its innovative and problem-solving aspects, it stands out by gaining more value every day in areas that seem very different such as design, art, engineering, industry, business life and education. Design is developed for the use of not only designers but also individuals working in all these fields, and the whole method is a design-oriented thinking approach.

The design thinking approach, which is a rising trend in the world, is integrated into systems by many countries as it increases innovation and originality. Finland, Ireland, the United Kingdom, Taiwan and Korea have been developing policies that encourage the design process for the last decade to increase international competitiveness. There are international design centers in Japan and active centers in Denmark that fund research, publish publications and organize exhibitions. Design incentive policies have been implemented in the industrializing Latin American countries and Far East Asia since the 1960s. Today, thirty industrializing or industrialized countries form a "Design Policy" and implement it formally (Bohur, 2007).

2. DESIGN THINKING

Design thinking, which enables the concept of design to be used in other fields by taking the concept out of designers, brings creativity and innovationtor these areas. Therefore, it would not be wrong to define design thinking as a method that can transfer the design spirit to other fields. Design thinking is a human-centred problem solving method focused on original and innovative solutions in terms of feasibility, desirability and applicability of products and services (Brown, 2009). Design Thinking is compatible and complementary to other approaches, such as open and user-oriented innovation. Among innovation theories, Design Thinking is more interesting in terms of "thinking direction than the organizational theory perspective" (Rylander, 2009). While design

thinking was a method used almost intuitively in the past by designers, it wasmodeledd for the benefit of non-designers, and its principles and components were discussed. has been included in the literature (Akdemir, 2017; Buchanan, 1992). Miziolek (2021) explains design thinking clearly and comprehensibly:

"it's more of a collaborative process where creativity is welcomed, no ideas is ridiculed, and the designer's input is welcomed to match a consumer need with what is technically feasible and a viable business strategy".

The most important difference of the design-oriented thinking approach, which includes the whole of 21st century skills development approaches such as critical thinking, problem solving and creative thinking, is not only to produce an idea, but also to concretize that idea by pouring it into the design. Looking at the historical development of the design thinking approach, it is seen that it started to be used as a systematic program at Stanford University in 1968. Since the 1980s, it has become an approach used to produce products and services in many areas (Aydemir, 2019). The origins of design thinking are in two parts: the criticism of the "first generation" design theory in the 1960s-1980s, and then the "second generation" theories from the 1980s to the mid-1990s. Brief basic movement summary of design theory, where and how did the design idea come about? and where will it lead in the future? It should be questioned for the formation and development of a conscious understanding.

The intellectual roots of the approach can be traced back to the works of Simon (1969) and McKim (1972). Simon explained it as problem identification, identifying ideas that can be solutions, trying ideas and finding the best, implementing and developing the idea. McKim, on the other hand, discussed for the first time some of the ideas that would be the source of

today's design thinking method in the titles of seeing, imagining and idea drafts (2017).

While Stanford Design School defines Design Thinking as a problem-solving method, Harvard University Teaching and Learning Lab defines it as an approach and mindset using the concepts of learning and collaboration (Şahin, 2019). Vanada (2016); defines it as an interdisciplinary process that combines creative thinking, analytical thinking and practical skills. Another approach to design thinking is made by Razzouk & Shute (2012). Accordingly, it is a learning approach that involves implementing learning projects, focusing on questioning and problem solving, researching possible solutions, creating sketches and prototypes, redesigning as well as products and ideas emerging by working in collaboration and feedback. Dunne & Martin (2006) and Brown (2009), the founders of two different interpretations and practices of design thinking, do not turn to research on design studies and the management of organizations, but rather formulate an approach derived from experience gained during practical activities. For all that, both theories are gaining acceptance from designers, companies, and government agencies.

IDEO founder Brown, introduced the idea of design thinking to the business world; He calls design thinking a human-centred innovation approach that uses design tools to combine people's needs, technological possibilities, and business success requirements (IDEO Design Thinking, 2020). Johansson-Sköldberg et al. (2013) categorized design thinking into two different parts:

"First, it contains theoretical views and explains the methods of interpreting designed thinking, professional designer practice, and competencies as well as nonverbal skills. Designed thinking is rooted in academic design and seeks to combine theory and practice from a design perspective. Second, it focuses on people without an academic
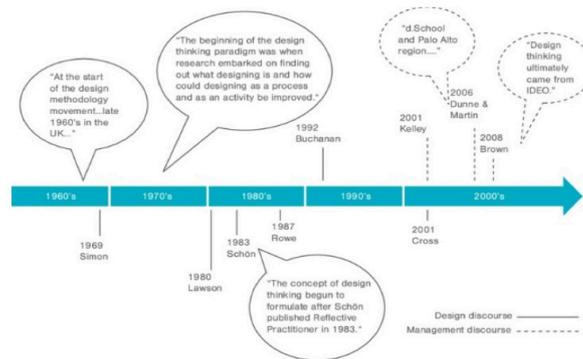
Figure 1: *The origins of design thinking in both views. It is reference to the main literature (Hassi and Laakso, 2011).*

background and those who work with them, beyond experience and talent beyond design (including art and architecture). Design Thinking is a way of influencing designers' methods through simplified design thinking or academic and applied management".

Although design thinking is thought to be a phenomenon related to design, it is an approach in which many disciplines can interact with each other. It was developed to enable designers to use the design process in other unfamiliar disciplines (Chasanidou, Gasparini, & Lee, 2014). The know-how of designers is much larger than what is thought of as their limits. Over time, designers have dealt with problems and offered solutions in many areas where they play a role such as complex social relations, organizational management, and strategic innovation. Generally, people who are their employers/managers (non-designers) have benefited from this knowledge and learned to "think like a designer" (Brown & Katz, 2011). As a result, the natural development process from design to designer thinking has shown that design is an important area that can no longer be limited to designers. Chesson (2017) stated that to unlock the full potential of design thinking, it is necessary to go beyond seeing design thinking as a process. He emphasized that this can be overcome by becoming a design thinker. He stated that there is a gap between the

skills a person has and the skills they need, and this gap can be filled by taking TOD training. Non-designers can also acquire design-oriented thinking skills, and the important thing is to be a design-oriented thinker. Design thinkers characteristically carry the basic principles of design and design thinking. Efeoğlu et al. (2013) determined the basic characteristics of design thinkers by analyzing the design thinking approaches of different theorists. Accordingly, individuals who think design-oriented have the following characteristics; Empathic, Observant and curious, Holistic and Integrative Thinking, Tolerant, Pragmatic and experimental, Optimistic.

Hassi and Laakso (2011) "propose a framework to illustrate the dimensions and related elements underlying the concept of design thinking (Figure 1 below). Their outline consists of three scopes: practices, thinking styles, and mentality. Each section consists of 'elements of design thinking' – approaches, methods, values, and concepts that continuously surfaced from current literature. In their outline, they identify several recurring subjects crossing the boundaries of the three groups. For example, 'thinking by doing, which needs e.g. early prototyping, is signified in the applies, but it also shows itself in the mentality element as the explorative characters of design thinking".

2.1. Stages of Design Thinking Approach

Although the stages of the design thinking approach are modeled differently according to different sources, the contents of the theoretical and practical applications in the entire design process are parallel. The best known of these approach models are Brown's Design Thinking Approach, Dunne and Martin's Design Thinking Approach, The Stanford D. School Approach, The Sap Design Thinking Approach, and St. Gallen's Design Thinking Approach (Efeoğlu et al. (2013).

Due to its widespread use, Design thinking stages in The Stanford D. School Approach are included. Accordingly, Stanford's Design Thinking stages are as follows; (Figure 2 below).

• Empathy: On-site observation and user understanding

• Defining: defining the problem and setting its framework

• Idea generation: ideas for solutions, brainstorming

• Prototype: developing rapid prototype concepts

• Testing: Testing concepts quickly, getting feedback and iterating the process (d. School, 2010).
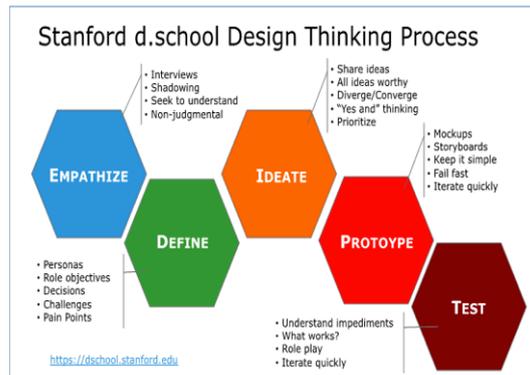
Figure 2: *"The Stanford's Design Thinking Process" (Plattner, Meinel & Weinberg, 2009).*

A sequential approach is seen in the Design Thinking stages. In a basic statement, these approach stages are classified as problem and solution of the problem. The problem area consists of empathy and definition stages. The solution area consists of idea generation, prototype and testing stages.

Empathize; this step is the step of understanding the user and the problem by observing the environment the user lives in. To put people at the center of the process, one should start with an empath. Since the problem being addressed is usually user specific, it is necessary to understand the user deeply. Three points are important in this step: (i) Observe. (ii) Get involved (engaged). (iii) Immerse yourself. At the end of these steps, the designer first observes the user while interacting with his environment. After then he/she then interacts with the user, communicates with him, so he learns his values and beliefs. Finally, he/she tries to put himself/herself in the user's position and live his / her experiences (Doorley et al., 2018).

Defining; in the light of the findings gathered from the user, the problem to be addressed is determined thoroughly and with all its dimensions. For the next step to be efficient, the problem must be redefined in light of the insight taken from the previous step. Here, the designer's point of view is the element that will make the design process unique within the framework of user needs (Doorley et al., 2018). From the perspective of creative systems theory, this step is thought to be an auto poetic (self-constructing) system building act that includes exploratory elements related to problem awareness. The idea of solving the problem requires a chain of "discovery" linked to the individual creative system. This step has an important role in determining what problem the designers are willing to solve in the system (Iba, 2011). Another description, it is aimed to determine the user needs and define the problems during the definition phase. For this purpose, users are

contacted verbally and in writing, and the user is observed to determine what he/she needs.

Ideates; at this stage of the TOD process, radical design alternatives are sought. A study of "seeing the big picture" is done with divergent thinking. There is an approach to thinking that shines and grows instead of focusing. The more diverse ideas are produced, the more likely it is to find an ideal solution. Ideas are not judged or evaluated. There are no bad or stupid ideas. Prototypes will be made in the next step with the material from this (Doorley et al., 2018). According to Akdemir (2017), who transferred from Ingle, the problem is defined when it comes to generating ideas. At this stage, creativity can be unleashed and solutions can be produced by dreaming. This stage is the stage where many unique ideas emerge and the participants enjoy the most.

Prototype; this phase is the phase in which ideas emerge from the intellectual ground and enter the real world. Anything that has a physical form can be a prototype. A wall full of sticky papers or a drama can serve as a prototype. The more interactions and experiences with the design team, users, or other people, the more successful the prototype will be (Doorley et al., 2018). The prototype is to create a common definition within the team by embodying the idea created as an image. The prototype stage enables rapid learning iteratively, which makes it possible to explore many different possibilities (Sakama, Mori, and Iba 2018). The goal of the prototype is to move forward with potential solutions that may have an impact and feasibility while using fewer resources. This process allows students to focus on design, not perfection, and enable them to see failure as an opportunity to learn, not something to fear (Carroll et al., 2010).

Testing; the test step is an important step for deeper empathy with refined solutions, feedback and the user. This stage is a repeatable process that provides evaluation and feedback. It can be said that this process is the most critical process in terms of human-centered design in the design thinking method, because it cannot be seen whether the ideas and designs or goals of the developers are appropriate without considering the opinions of the end users. It is important to get feedback in terms of evaluating creativity (Sakama, Mori and Iba 2018). Plattner (2010) suggests leaving the prototypes in the hands of the users and showing the experience without telling. He says that by standing back and observing, feedback can be collected that helps change the design. Based on the feedback, it may be necessary to either return to the matrix and choose a new idea or perhaps identify weaknesses in the prototype and continue to review the design (Şahin, 2019).

3. DESIGN THINKING IN EDUCATION

Most students in the 21st century have the knowledge, skills and technology to get to the facts quickly. This discipline knowledge is essential to be successful in this rapidly developing and changing world. You also need to know how to be creative and critical in solving problems, work as teams, use rhetoric to form an argument, and develop social-emotional skills. This kind balanced people, education systems and interdisciplinary teachers. It must work for maintenance (Vanada, 2010). Today, design thinking studies are carried out with students in many educational institutions from preschool to higher education, with employees in many small or large-scale companies and government institutions (Brown, 2015). It has been stated by the researchers that this approach used in the classroom environment has many positive effects in terms of educational goals.

While design thinking is used in business or product/ service design, its applications in education have started to attract more and more attention. However, the novelty of design thinking in education and training also means

that there is a lot we don't know. Some examples of design thinking approach studies applied experimentally in learning environments will enable us to see the necessity of this approach in education. A study with 215 students from 3rd, 6th and 7th grades of Carroll et al. (2010) explained how the design thinking approach affects learning environments, and found that classroom activities with a design-oriented approach improve students' empathy skills, blend better with each other, develop feelings of trust, and overcome difficulties together. Altan, Yamak and Kırıkkaya (2016) designed a study with the design thinking approach of pre-service teachers, and they identified some features such as the strongest aspects of the engineering design process enable learning by doing, the goal of the major design task is motivating, providing permanent learning and being based on inquiry. Wiley &Yang (2018), applied an experimental teaching method to introduce design thinking in his study with a design thinking approach in his packaging design study with the middle school group. At the end of the study, it was observed that the team spirit of the students improved and their motivation towards the lesson increased. Mosely, Wright, and Wrigley (2018) found that by applying a design thinking learning experience to non-designers, the design process and problem complexity significantly affect the value of the learning experience.

Şahin (2019) examined the effects of an approach on problem solving skills, self-confidence and cognitive flexibility by evaluating the answers before and after taking the design thinking training of the students who participated in the test using the creative thinking scale and self-esteem scales in a design-oriented thinking activity attended by 31 students. As a result of the study, he stated that it caused an increase in the creative thinking perception and positive emotions of the participants, and a decrease

in their negative emotions. Dorie, Cardella, & Svarovsky (2014) used the design thinking method to examine the engineering behavior of children aged 4-11. In this study conducted with the belief that there is no consensus on engineering-oriented thinking in children, a program was organized in the science museum and children were asked to solve a problem with two different materials with the participation of their parents. The program process is divided into 4 main phases in accordance with the design thinking approach (Defining the problem, ideate, evaluating design and reviewing). In the study it was stated that the way children participate in the process gives clues about their engineering thinking abilities, this participation is quite different from adults, especially in some stages, and they can distinguish design activity. Hawthorne et al., (2016) can make a creativity measurement prepared to the principles of design thinking by their developed test. It was stated that a case-based and innovation-oriented creativity test is required. Noel and Liub (2017) examined the effects of design-based learning and design-oriented thinking in the education of primary school children. In their study, Yang and Hsu (2020) integrated TOD into the packaging design course of the Visual Communication Design Department, and determined the differences in creative self-efficacy and flow experience between the student groups with high and low creativity tendencies. In addition, design thinking increased the self-efficacy of low creativity tendencies students, and improved the creativity of all students.

They underlined that design education helps children develop in areas such as problem-based learning, people-oriented creativity, product development and testing.

In contrast to IDEO's circular approach, IDEO and Riverdale (2012) developed a sequential approach to design thinking. This method d.

It is similar to the school approach. Discovery and interpretation stages are important to the problem. The solution consists of thought, experiment and evolution stages. In this view they have developed, they have placed divergence and convergence at the centre. Many reputable US universities (for example, Harvard, Stanford, MIT) have provided trainings for teachers and administrators on design thinking strategies (Dow, 2012). He has currently set up Stanford University Education and Design Research laboratories to ensure the inclusion of design thinking in 21st century K-12 education (Stanford University, 2012). The main purpose of these laboratories is to develop a design-oriented thinking method as a learning method that incorporates academic content from different disciplines to improve students' critical, creative and practical capacities (Carroll et al., 2010).

In today's education system, where the problems encountered in daily life are at the forefront, pouring them into designs to find solutions to these problems will provide a better understanding of the solution and the solution of the problem in a more permanent way. There are also recent studies of the Ministry of National Education regarding the intertwining of education and design (MEB, 2019).

From this point of view, STEAM education, which is used as an education model aiming to evaluate more than one discipline together, to increase thinking skills, innovation, innovative design and production, should be mentioned. STEAM education is an approach to meet the rising need for creativity-based learning, and is an acronym for Science, Technology, Engineering, Art and Mathematics (Figure 3 below). It adopts the evaluation of these disciplines as a whole. The "Art" field was added and the design dimension was strengthened due to the lack of design power in the creation of method ideas, which was first established as

STEM education. For STEAM, the incorporation of art and design into STEM should be a significant aim of education for the future's innovation economy (Trilling & Fadel, 2009).
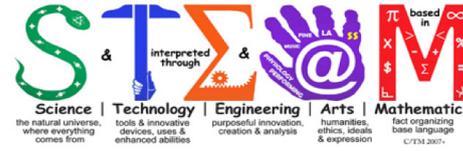
Figure 3: *STEAM Education.*

The image summarizes the Steam training visually. Again, looking at the skills used based on visuals, it is seen that the skills of Design-oriented thinking and the essence of STEAM education are very close to each other. Adding art to STEM disciplines often appears to be an application of Design Thinking to project-based learning focused on innovation or problem solving (Henriksen, 2017). Design Thinking supporters argue that STEAM applications help students develop collaborative solutions to complex challenges and develop 21st century skills (Norton & Hathaway, 2015).

STEAM improves students on how to think critically, solve problems, use creativity, and supports them to prepare for real life in a student-centered learning environment. Not all students need to be a scientist, engineer, or designer, but it is important to learn how to think like a scientist, engineer, or designer. Students in the STEAM program not only learn the subject matter, but also learn how to study, research, analyze, experiment, and create. Some STEAM opportunities for students can be explained as below (MEB, 2016):

• It exposes students to the creative learning process by asking thought-provoking questions, discovering answers, applying what they have learned, and solving problems.

• It develops necessary 21st century skills

(critical thinking, creativity, cooperation, social skills, technology literacy, productivity, etc.) for students' success.

• Needs students to think systematically and critically through problems and apply new knowledge or past experiences to find the best solutions.

• Offers meaningful collaboration as students engage in teamwork, exchange ideas and discuss ways to solve a problem, share responsibilities and encourage each other.

• It offers practical and experiential learning opportunities to all students by using different tools and materials in the learning process.

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• Increases students' self-confidence to be productive, motivates them to participate and contribute to the learning process.

Taking advantage of the relationships between disciplines, STEAM aims to create generations that learn design-oriented, think problem-based and project-based, work based on engineering design and produce. Creativity, interdisciplinary work, problem and solution-oriented approach to the real world put STEAM at the center of design thinking. Despite the difficult design activity, the primary reason for the popularity of the "design thinking" approach is its elastic model, which creates a structure between creativity and analysis. Creativity, interdisciplinary, reality and problem-project orientation are the basis of STEAM and design. Design is open-ended, but Design Thinking is gaining admiration for its flexibility. STEAM emphasizes the stages and practices of the process between creativity and analysis. Recently, many new "design-oriented thinking models" have been developed with common grounds (Watson, 2015).

Bullitt and Bullitt (2012) argued that design-oriented thinking approach is a field that will provide coordination between science and art and stated that design-oriented thinking is a bridge in STEAM education. While both STEAM and Design Thinking emphasize interdisciplinary collaboration, the integration of Art can create new ways of understanding complexity and representing knowledge (Peppler & Wohlwend, 2018). However, stating that art education and design-oriented thinking have different aspects and goals, they stated that they can both support each other, and they argued that design-oriented thinking and STEAM education cannot replace art education.

4. DESIGN THINKING AND ART EDUCATION

Considering the effectiveness of the skills used in artistic activities on the development of design thinking skills, it is seen that art and design-oriented thinking are not independent concepts due to their problem solving approaches. While searching for visual solutions to visual problems, art tries to find solutions in all areas of design life. When artistic creativity is reflected in the design, it ensures that the design idea is new and original. For this reason, art stands out as an effective discipline to use design thinking skills. Similarly, art stands out as a unique field for the development of design-oriented thinking, as it frequently uses skills such as finding solutions, creativity, thinking, understanding and doing, which are the prominent and basic skills of design-oriented thinking.

Design process consists of defining and limiting the design problems conceptually, collecting the information that will feed the creative process with research and examination, structuring and developing the solution suggestions with the acquired knowledge and thoughts, and finally revealing the most appropriate solution with reflection, evaluation and elimination. At

the design process, a path is followed in the form of seeing, understanding, perception and interpretation. When considered within the scope of design, visual perception skill stands out in terms of defining visual components and utilizing the experienced and sensed visual components while creating a structure or pattern (Gökbulut, 1992).

Although intelligence performs functions such as linking information, determining distinctive quantities and qualities, placing in spatial space and time, and classification in imaginary, symbolic and conceptual processes in the brain, it would be wrong to construct a hierarchy between mind and perception. Thinking, or in other words, cognitive processes are not the mental processes that take place above perception, but the essential materials of perception and there is an interaction between them. The processes that define the stages of the design process such as effective examination, selection, comprehension of the essentials, simplification, abstraction, analysis and synthesis, correction, comparison, problem solving, as well as combining, separating, linking, fitting, are not separate from visual perception, but are in a mutual relationship with visual perception. are operations (Atalayer, 1994). Experiments on cognition in the design process reveal that important cognitive movements are related to design representations. Therefore, design activity makes visual perception one of the parts of total cognitive activity. The phrase "visual perception is visual thinking" expressed by Arnheim (2004) clarifies this point.

Considered historically, design and fine arts are related to each other both philosophically and functionally. Many creative methodologies are common to both designers and artists, besides, designers focus on solving some defined problems, while artists present problems in need of solving (Lawson, 2006). The perspective of the

designer and the artist to the problems and the solution processes they produce are also different from each other. The fact that artists pose new problems creates creative and complex new areas that need to be solved for designers. "In fact, many creative thinking methodologies share commonalities across domains, including art and design, yet there are differences in both processes, personality attributes, and skills" (Kaufman & Baer, 2005). Although their approach to problem seems different, artists and designers follow close processes for solution. Here, design-oriented thinking, which is developed as a human-centered problem-solving method and a creative process model, includes the stages that both artists and designers use to reach a solution. An artistic solution approach overlaps with design thinking.

In visual arts education, behaviors such as expressing yourself more freely by using the general laws and techniques of the arts, and in this process, perception, learning, thinking, designing, synthesizing, establishing the connection between relationships, interpreting, being able to look critically, can be done by using the design language in line with the aesthetic principles (Orhon, 2011). It is seen that the elements of the design language used here are very similar to the principles of design thinking.

As Jacobs (2018) highlights; "Artists are not necessarily more creative than non-artists nor do they bring out more creative solutions. Besides, the artistic process allows for a different kind of understanding of creativity, one that highlights self-generation, metacognition, and thematic consistence. These link could help designers in a modern environment in which creativity is seen as essential in rising novel solutions to complicated and rapidly evolving environments, circumstances and problems".

One of the skills used to solve problems is creativity. Creativity catches up with the

innovative and innovative processes of design. One of the most important achievements of my art education is creativity. Torrance (1987) emphasizes the process of creativity and explains creativity as the feeling of problems or gaps in knowledge, the creation of thoughts or hypotheses, testing and developing hypotheses, and communicating data. According to Zampetakis, Tsironis, and Moustakis (2007), we are currently in such a contentious environment that the speed of problem solving and the ability to be creative among entrepreneurs and industrialists have become critical. The theme of creativity known as the "Rise of Creativity" has been the main force driving the economy. Education systems must also contribute to creativity and creativity in problem solving. According to Craft (2003), there is a need for creative thinking in departments such as engineering for innovative and creative thinking. Creativity is important in engineering and many other disciplines. TOD and creative thinking are two concepts that are closely related to each other (Hawthorne et al., 2016; So, Jun & Nah, 2016). In order to develop creativity, free thinking and producing skills must be learned within certain techniques and methods. Creative thinking techniques; As in many fields, they are techniques that help to expand the limits of imagination as much as possible while generating ideas about the problem in design (Hatırnaz, 2010).

Basic skills such as creative thinking, critical thinking, brainstorming, visual analysis, analyzing, problem solving and producing come to the fore in the design thinking process. This process is very valuable to educators because it supports students in using 21st century learning skills such as creativity, communication, problem solving, and critical thinking. These skills are the same as the skills that art education provides. Students who engage in art activities use and develop these skills while creating their works. In addition to its importance in education, design thinking is parallel to the basic practices of art. The stages of the production of a work of art are the result of deep, conceptual and interpretive thinking, and this process can be described as a whole of the skills of analyzing facts, generating and organizing ideas, defending ideas, making comparisons, making inferences, organizing, organizing, evaluating arguments and problem solving. Therefore, design thinking skills are used effectively and functionally while producing a work of art. Because of the supportive role of critical thinking to creativity and creativity to critical thinking, students' balanced thinking abilities and tendencies (creative, critical and practical) can be developed by approaching design-oriented thinking while studying art (Cross, 2007). Jacops explains the similarities between art thinking and design thinking as follows (Jacops, 2018);

"Art thinking overlaps with design thinking in several areas, but has a domain-dominant emphasis in the following conceptual tactics and mindsets: Conceptual tactics metacognition use of resource banks extended research problem - creation use of constraints and generators conversation with the work delaying closure reflection and evaluation of thematic coherence engagement intuition tolerance of ambiguity. Some designers deliberately cultivate some of these practices, but it is not a point of emphasis in the design process/methodology research. If educators embed these mindsets and practices into design pedagogy, it may be possible to develop larger and more expansive frameworks for students to understand creative problem-solving".

One of the other skills used to design thinking is visual communication. Visual learning and visual perception are skills that can be developed with artistic work. Communicating with visuals skills accelerates the development process of Design thinking. "Visual learning helps students

in how to think, how to learn and how to achieve academic success. Visual thinking is a learning technique in which the student understands better and saves the information when the thoughts, words and concepts are correlated with pictures. The student perceives how to classify and organize the knowledge. Visual learning helps the students in analysing and organizing the knowledge. For that reason, students can use mind mapping, graphics and concept maps for any kind of topic" (Taşpınar, 2016).

As Cross (2007) says, designer thinking makes education more student-oriented by changing the way a designer conveys information, placing design in the middle of the process. In this context, 'design-oriented education' for students is an approach used with interdisciplinary academic content to support personalized abilities and lifelong learning.

The design thinking process in art classes works in small groups where ideas are presented and discussed. It is a critical step in creating a flowchart of sticky note ideas and quick sketches to visually illuminate your thoughts. It is empowered by drawing a few different concepts to prototype the idea or refine the concept from broad thoughts to details. The conceptual work proceeds to the step where students create a bill of materials for the elements and materials required for the design. This is valued for every student's opinion in the process and is built on equal collaboration. This is the step where students can share leadership roles at different times and show each other's abilities and strengths in the design-oriented thinking process.

The interaction between design thinking and art is mutual. They are like gears that get stronger as they turn each other. Because artistic activities develop design thinking skills, and the use of a design oriented approach contributes to innovative work in artistic activities.

Painting education, as many people have interpreted, does not aim to enable individuals to become painters in the future through beautiful painting. This education aims to improve children's creativity and learn to solve the problems they encounter in a brand new way. The aim of art education should be to develop the ability of individuals to design, to raise young people who are creative, self-confident, have artistic literacy and aesthetic taste. When this goal is achieved, a civilized society with the same qualities would also be created (Dikici, 2006).

Children and young people, who are educated by experiencing the versatility and multidimensionality of art in its various forms, can see and interpret events and phenomena in their versatility and multidimensionality; Open to innovations, all kinds of contemporary developments, all kinds of new forms and shaping, open to understanding new developments in both science and technology as well as in social change processes, tolerant; but at the same time it is certain that he will develop a dynamic personality. For example, according to Gökaydın (2010), art education, which is an important activity in the environment of the general education program, is an education system that develops the brain powers of the child and the young person at all levels of education. In this environment, the student learns to see, search, ask, try, think, reach conclusions and apply. As a matter of fact, the main purpose of this education is to make the individual think and ultimately creative.

It is a common belief that art activities are entirely based on talent and skill. However, the main aim in painting education is artistic sensitivity, expression and expression of feelings and thoughts. In the visual arts course, students gain knowledge and skills related to the field; To think critically, to solve problems by research, to make decisions after knowledge and

experience, to gain the ability to work in a group (cooperation), to appreciate different cultural and artistic values, to be willing to protect and keep them alive, to develop their imaginations, to develop their emotions and thoughts with different techniques. Using critical thinking skills while defining, analyzing, interpreting and judging the work of art as they are expected to reflect on their work. Young people who spend time with memorized content of television, computer games and social media cause to be lost or blunt because they do not use many skills, including design-oriented thinking, in their daily life. In artistic activities where our thoughts are more creative and our thoughts are more active, on the contrary, we start the artistic production process by going through the thinking stages that will trigger design-oriented thinking skills.

CONCLUSION

Design thinking is an approach for problem solving and developing which is human-centered, iterative, holistic, probability-oriented and options-oriented solving and development in various sectors. Design Thinking enables the redefinition of problems and the development of a solution-based approach to solving problems in the attempt to set assumptions and alternative strategies and solutions. It is a methodology based on solution-oriented thinking within the framework of different perspectives. A human and empathy-oriented solution process is adopted instead of to the product-oriented approach. New and innovative solutions can be produced for every subject and event by a thought system established in that way. Design Thinking is a cross disciplinary creative problem-solving process which combines analytical thinking, creative thinking, and practical skills (Vanada, 2011).

In order to realize these stages of design-oriented thinking, which consists of five stages as empathy, definition, idea generation, prototype

and testing, it is possible to produce innovative and original products by using skills like critical thinking, creative thinking, visual thinking, analysis, creation, problem solving, etc. When the studies in which the design thinking approach is used in education and training environments are examined, it is seen that many skills such as "learning by doing, problem solving motivation, permanent learning, questioning skills, team spirit, motivation towards the lesson, problem solving, self-confidence, engineering skills development, creativity, innovation" are used and developed.

In addition, when the skills that students will acquire from the artistic design processes are examined, it is seen that they overlap with these skills. Visual arts are also a problem-solving activity in itself. It has been found that the use of design thinking models in the art education classroom improves students' balanced thinking skills and dispositions (creative, critical and practical) (Cross, 2007; Burnette & Norman, 1997). In this context, a designer who can establish a balance between design and function approaches while concluding visual problems with a solution, can achieve the ideal form of interaction with this field skill.

Renewed and self-improving training programs skills such as problem solving and critical thinking, which he defines as 21st century skills, are also used in design-oriented thinking processes. Furthermore, it has been seen that these skills are used in learning environments with STEAM education as a whole. STEM education has emerged as an educational approach that examines these processes. With the addition of the art discipline, a process called STEAM has emerged, which offers interdisciplinary and collaborative solutions to complex problems, develops students on how to think critically, how to solve problems, how to use creativity, and supports them to prepare

them for real life in a student-centered learning environment. The successful results of STEAM applications are expected to guide art and design applications to have a more and more appropriate place in school curricula.

Since art activities develop the individual's design-oriented thinking skills, it is thought that art education will be a gain for the development of design-oriented thinking skills. Today, the industrial needs of the world are closely aligned with the goals of a holistic arts education. In addition, also innovative approaches which gained from design-oriented thinking would produce creative and original results for artistic works.

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Visual Resources

- *Figure 1. The origins of design thinking in both views. It is references to the main literature. (Source: Hassi and Laakso, 2011)*

- *Figure 2. "The Stanford's Design Thinking Process" (Plattner, Meinel & Weinberg, 2009)*

- *Figure 3. STEAM Education,(www.iteea.org, 2020).*