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Analysis of Views on Digitalization of Design Studios

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Abstract: Design studios, one of the most important components of architectural education had to move to digital environments urgently and independent of space with the Covid-19 pandemic. This study aims to evaluate whether design studios can be digitized according to the views of students and instructors in two different architecture schools (Firat and Balikesir University) by considering this compulsory experience. The views of 71 students and 5 academicians were taken with a purposeful sampling method. Content and descriptive analyses were performed on the views collected from the participants. As a result, the biggest problem in moving design studios to a digital environment is the disappearance of physical environments in which collaboration, idea sharing, and discussions will occur. In addition, the advantages of online education continued their attraction for some students in the digitalization of design studios. In terms of instructors, games, simulations, modeling, and virtual reality can be used for successful digital studio applications and the infrastructures of these applications can be improved with support from mobile devices.

Key words: Design studio, digital design studio, face-to-face education, architecture education

Tasarım Stüdyolarının Dijitalleştirilmesine Yönelik Görüşlerin Analizi

Öz: Mimarlık eğitiminin en önemli bileşenlerinden biri olan tasarım stüdyoları, Covid-19 pandemisi ile acilen ve mekandan bağımsız dijital ortamlara geçmek zorunda kalmıştır. Bu çalışma, bu zorunlu deneyimin dikkate alınarak iki farklı mimarlık okulunda (Fırat ve Balıkesir Üniversitesi) öğrenci ve öğretim elemanlarının görüşlerine göre tasarım stüdyolarının dijital bir ortama dönüştürülüp dönüştürülemeyeceğini değerlendirmeyi amaçlamaktadır. Amaçlı örnekleme yöntemi ile 71 öğrenci ve 5 akademisyenin görüşleri alınmıştır. Katılımcılardan toplanan görüşler üzerinde içerik ve betimsel analizler yapılmıştır. Sonuç olarak tasarım stüdyolarının dijital ortama taşınmasındaki en büyük sorun, işbirliğinin, fikir paylaşımının ve tartışmaların yaşanacağı fiziksel ortamların ortadan kalkmasıdır. Bunun yanı sıra online eğitimin getirdiği avantajlar tasarım stüdyolarının dijitalleşmesinde bazı öğrenciler için cazibesini sürdürmektedir. Eğitmenler açısından başarılı dijital stüdyo uygulamaları için oyunlar, simülasyonlar, modelleme ve sanal gerçeklik kullanılabilir ve bu uygulamaların altyapıları mobil cihazlardan destek alınarak geliştirilebilir.

Anahtar kelimeler: Tasarım stüdyosu, dijital tasarım stüdyosu, yüzyüze eğitim, mimarlık eğitimi

1. Introduction

Architecture, which meets the needs of shelter and coming together since the existence of humanity, is one of the oldest known professions. In addition to reflecting the culture and philosophy of the period in which they existed, architecture and its products have important clues that can help us to understand the social values, habits, and technological knowledge level of the societies in the geography they existed. From this point of view, *the art of building constructions*, which can be expressed quite technically, is important in terms of the continuity/sustainability of social structure and social life habits. With this aspect, unlike the organizational use of

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"innovation", the act of "creativity", which is the most important argument in designing space, takes reference from the knowledge of the social structure and mediates the reflection of creativity at the personal level from a psychological point of view[1, 2].

Although architectural education requires having information about structure systems, construction methods, and structural materials to produce a *product of design* with theoretical and practical training [3], it is considered an art in many areas [4, 5]. Therefore, different from basic engineering sciences; architects, who are the performers of the profession by giving life to works that have symbolic values with different aesthetic and beauty criteria, are considered artists [6]. *Function-revealing the final form*, which is considered the essence of architectural works, shows a parallel course with knowledge and quality of education. In this aspect, architecture, which includes the stage of creativity, has a process in which the act of creating does not occur at a fixed point in time, but instead manifests itself as an act that spreads over time and changes the flow [2, 7].

In addition to providing art and aesthetic education, the curriculum of architecture is prepared by taking into account the acquisition of engineering competencies. Although sometimes there are small differences in details and practices, architecture education is realized almost everywhere in the world with education programs that have design studios in the center. In this context, the main setup of the education program is built on the fact that design studios, which are the essence of architecture, are supported and complemented by other courses [8]. Although many parameters are required for these courses, *"studio spaces"* constitute the main backbone of design studios. Design guidance carried out by the master-apprentice method contributes to training students through a studio environment in all national/international schools. In this sense, architectural design studios are considered spaces where irrational creativity and subjective knowledge dominate [9].

Studio pedagogy, which has been developed as a tool to solve uncertain problems and to train students with technical disciplines, is commonly used in disciplines of fine arts [10]. The most common method followed in educational studies carried out in studio environments in architectural schools is the method called problem-based learning which was put forward at the end of the 1960s [11]. The design studio is also known as the core of architectural pedagogy, which advocates "learning by doing". It is generally accepted that besides theoretical subjects, students' works are carried out by making and breaking, retrying, using different principles/elements and most importantly being curious within the framework of these theories contribute to developing learning styles and creative souls [12]. Students also have important missions such as having an all-around approach to problems resulting from the needs program of the design problem given each academic term, understanding the needs of the society to develop the most suitable design suggestions, and completing the natural environment as function-appearance. Today, design spaces that make creativity and rationality possible simultaneously and encourage these have special importance for engineering [9]. Design studios, which are considered the basis of architectural education, provide a creative learning environment and offer opportunities such as getting a multi-functional interactive area and providing transformable personal space and a sustainable completing design process [13]. Getting studio education and acquiring creative learning is much more important for first-year design students with its significance in shaping especially engineering ideology and thinking ways. Design studios, due to reasons such as a natural design environment, an interactive discussion environment, and private and personal areas are accepted as the most important and most effective design areas in this respect [13].

While studios enable students to internalize and transform new information with the active participation of students, they also enable educators to build a strong relationship with their participation levels [9, 14]. For this reason, the most important factors that distinguish studios from other course environments are "one-to-one interaction with the instructors" and "feedback from the instructor" [15]. In general, they are both a learning environment and also social spaces in which students have the chance to study with their peers and continue the act of learning outside the classroom hours -when instructors are not present- and also places where the art of learning is encouraged [16]. Courses held in these places with the participation of students who are in the same or different years of study enable learning design processes, supporting learning with interactive and motivational activities and increasing the quality of the end product with critical discussions. Design activities carried out in groups or collectively in the studio are effective in instilling a sense of belonging and responsibility in addition to th ability to work in a team [17].

Studio environment, which plays an important role in the socialization of students at different levels from the beginning to end of architectural education, as well as in increasing the level of discussion and professional etiquette, became digitized in architecture schools in the whole world with Covid-19 pandemic and practices that took place underwent important transformations. The pandemic process eliminated the traditional "studio culture" in almost all architecture schools. This has caused the formation of distance education models as an alternative to

usual teaching methods and also the emergence of unprecedented pedagogical problems [18]. Although some of these problems are partly solved with technological means, problems are experienced by first-year students getting used to architecture formation since they have not yet experienced a design studio environment. In addition to this, it is also thought that this new experience will cause some potential problems in the future education process of second, third, and fourth-year students who are used to getting design education in the studio, and it may affect their professional lives in the long run.

In architecture formation, the face-to-face teaching model, which is the traditional model, and the distance education model, which has been experienced globally with the pandemic process, has attracted the attention of many researchers. In line with studies conducted in the literature on face-to-face education and distance education models, the results including the potential and difficulties of both education models have been summarized in Table 1.

Table 1. Research findings regarding learning with face-to-face and distance education.

Importance of face-to-face education	Value of distance education	Reference
	Many problems and difficulties are experienced in design courses	[19]
	There are many difficulties for students in addition to a few positive aspects	[20]
	Students are disappointed and students with low living standards are more negatively influenced	[21]
Face-to-face courses are more preferred by students	The interest and positive perspectives on courses are decreased and even not preferred	[22]
It should be used in design education	It provides suitable opportunities for computer-assisted design courses	[23]
	In addition to the new potentials it includes, it is necessary to focus on new challenges	[24]
	There are also gaps in practices in addition to motivation and socialization	[25]
Studio based courses are more efficient than distance education	Lessons can be recorded, provides ease in Project delivery, encourages participation in seminars, effective education, and knowledge transfer in schools with sufficient infrastructure	[26]
	Level of satisfaction is associated with age, length/skill of computer use	[27]
Mutual dialogue has better results in making use of the educators' potential	Provides efficiency through good opportunities, a knowledge that is not limited to course books is reflected in learning	[28, 29]
Success is higher in face-to-face groups		[30]
	It contributes to educational activities	[31]
Educators' focusing on technical topics makes the education insufficient	It provides a flexible area of learning independent of space and time There is a need for a mixed system integrating virtual + face-to-face education	[32]
	Increasing internet opportunities supported by following courses regularly	[33]
	Developing technology and increasing mobile internet use supports adaptation to courses	[34]
Students prefer face-to-face education instead of the online education model		[35]
	Distance education is insufficient in art teaching and it should be improved	[36]
The processes in design education should be supported		[37]
	It provides equal opportunity-in terms of economic means- for a quality education	[38]

It is preferred in a technical art course		[39]
The limits of the studio are exceeded with virtual practices, In addition to the benefits to educators and students, a mixed system can also provide benefits for design education	It provides the opportunity to answer students' needs actively and dynamically; however, the lack of traditional education is felt	[40]
It contributes to students' mental health and socialization In addition to in-class cooperation, it also develops the experience of learning from peers	Financial costs are decreased, equal opportunities are provided, and innovative software that provides flexibility	[29, 41, 42]
	Lessons have become boring, it prevents socializing, the connection between student-instructor has become weaker	[43]
	It supports schools in answering changing student needs, increasing quality, supporting students, and accessing information	[44]
A mixed model created with the traditional method can be used in the future, too	More than half of the students are satisfied with online teaching	[45]

The studies in Table 1 compare face-to-face and distance education in architectural formation with the advantages and disadvantages of both models. Design studios, which are at the core of architectural education, are physical environments where students can produce simulations in the presence of an educator and where social and cultural interactions take place [46]. Distant design studio activities, which have been experienced with the pandemic process and the closures, have created some disruptions in the design education of both instructors and students. However, no studies were found that examined how design studios can be digitized to minimize these disruptions from the perspectives of both students and instructors.

Studio design is important in terms of increasing the value in learning, contributions to the originality of design, and study skills of students with institutional and practical contexts in addition to imagination. This way, students get the chance to produce their designs by optimizing the balance in artistic, rational, and pragmatic thinking [47]. In addition to the social and physical infrastructure it provides, the studio environment is also supported with materials/equipment that can be a reference to students' studies, inspire them, and help them to create original products. For this purpose, students gain the tradition of working together with study groups by using sketches/discussing with the help of physical models/prototypes on their desks and the magazines/publications in the environment [48]. In studio environments where the act of design is carried out traditionally, contrary to customs, factors such as the instructor and students not getting together, not seeing the designed works at the same time, not being able to make the improvements they want, and not having the chance to discuss have made the process difficult for both sides [49].

Based on these, it is important how the competence that students receiving distance education during the pandemic process should experience and gain is affected during the pandemic process. For this reason, the present study aims to make evaluations about what studio means for architecture faculty students, to address distance education of design studios from the perspectives of students and instructors, and to evaluate whether studios can be digitized in future practices. In this sense, it is important to find out the aspects which are accepted and rejected by students in practices carried out with distance education in studio culture which has existed for centuries as a successful method in providing art infrastructure the foundations of which are in the architecture profession and to determine the precautions to be taken to solve these insufficiencies in the distance education process. In parallel with these, the present study examines how important studios, which enable the master-apprentice training method that form the basis of design, are and how design studios can be transferred to digital platforms with the pandemic process. With this purpose answers were sought to the following questions:

1. What does a design studio mean to architecture faculty students?
2. Can design studios be digitized according to the views of students?
3. How can design studios be digitized effectively according to the views of instructors?

2. Method

2.1. Study Model

The present study, which aims to show the importance of studios for architecture education and how they can be transferred to digital platforms, has been conducted with phenomenology design, one of the qualitative research designs. Phenomenology is a method that focuses on evaluating experiences [50, 51]. It focuses on phenomena that we are aware of, but do not have an in-depth and detailed understanding about. The phenomena that will be discussed in studies can be events in the world we live, experiences, perceptions, orientations, concepts, and situations. Due to the nature of qualitative studies, phenomenology studies may not give definite and generalizable studies. However, they may present explanations and experiences that better describe and help to understand a phenomenon [52]. This study discusses design studios as a phenomenon and examines studio design experiences from the eyes of students and instructors.

2.2. Study Group

A purposeful sampling method was used in line with the purpose of the study. Purposeful sampling is a type of sampling that is selected based on the information about the population and the purpose of the study [53]. The present study made use of maximum variation sampling by using data source (participant) variation. This type of sampling is used to increase variation if the views of a large number of participants are to be taken [54]. In this context, the views of instructors and students studying at the faculties of architecture in universities where the researchers were working [Firat University (FU) and Balikesir University (BU)] were examined. Demographic information of students whose views were taken is presented in Table 2.

Table 2. Demographic information of participants

Student Code	University	Gender	Grade	Student Code	University	Gender	Grade
S1	BU	Female	1	S37	BU	Male	4
S2	BU	Male	1	S38	BU	Male	4
S3	BU	Female	1	S39	BU	Male	4
S4	BU	Female	1	S40	BU	Female	4
S5	BU	Female	1	S41	FU	Female	4
S6	BU	Female	1	S42	FU	Male	4
S7	BU	Female	1	S43	FU	Female	4
S8	BU	Female	1	S44	FU	Female	4
S9	BU	Male	1	S45	FU	Male	4
S10	BU	Male	1	S46	FU	Female	4
S11	BU	Male	1	S47	FU	Male	4
S12	BU	Female	1	S48	FU	Female	1
S13	BU	Male	1	S49	FU	Female	1
S14	BU	Female	1	S50	FU	Female	1
S15	BU	Female	1	S51	FU	Female	1
S16	BU	Male	1	S52	FU	Female	1
S17	BU	Female	1	S53	FU	Male	1
S18	BU	Female	1	S54	FU	Female	2
S19	BU	Female	1	S55	FU	Female	2
S20	BU	Male	1	S56	FU	Female	2
S21	BU	Male	2	S57	FU	Female	2
S22	BU	Female	2	S58	FU	Female	3
S23	BU	Female	2	S59	FU	Female	3
S24	BU	Female	2	S60	FU	Male	3
S25	BU	Female	2	S61	FU	Male	3
S26	BU	Female	2	S62	FU	Male	3
S27	BU	Female	2	S63	FU	Female	3
S28	BU	Female	2	S64	FU	Male	3
S29	BU	Male	2	S65	FU	Male	3
S30	BU	Male	2	S66	FU	Female	3
S31	BU	Female	2	S67	FU	Male	4
S32	BU	Female	2	S68	FU	Male	4
S33	BU	Male	3	S69	FU	Male	4
S34	BU	Female	3	S70	FU	Male	4
S35	BU	Male	3	S71	FU	Male	4
S36	BU	Male	4				

According to Table 2, 30 of the students are male, while 41 are female; 40 are studying at Balikesir University, while 31 are studying at Firat University; 26 of the students are in their first year, while 16 are in their second year, 12 are in their third year and 17 are in their fourth year. It can be said that variation was achieved in terms of the year of study. In addition to these, three of the instructors in the study are female, while one is male; three are working at Firat University, and two are working at Balikesir University.

2.3. Data Collection

Interviews, one of the most preferred techniques to collect data in qualitative studies [55] are the leading data collection tools in phenomenology studies. Researchers conduct interviews to find out the experiences of cases and the meanings of these experiences [52]. Since the study data were collected during the pandemic process, an open-ended question form was used as a data collection tool to find out the views of students. Views of instructors were taken through face-to-face interviews.

The form which was prepared to find out the views of students consists of two parts including students' personal information and questions examining the importance of design studios and their transferability to digital environments from students' perspectives. The data collection form prepared to find out the views of instructors consisted of personal information of instructors and one question on their views about how design studios can be transferred effectively to the digital environment.

While preparing the data collection tool, a form consisting of five questions was prepared by the researchers working in the faculty of architecture in line with the purpose of the study. These questions were then discussed in an online meeting by all the researchers and the questions were revised. The survey questions prepared were answered by 10 students in the architecture faculty and then their views were taken about the comprehensibility and number of survey questions. The students stated that the questions in the interview form would be filled in mostly with smartphones and they recommended for the questions to be short and comprehensible and the number of questions to be as few as possible so that they could be filled in easier. Their recommendations were taken into account and the draft survey form was revised. Later, two experts in the field were told about the aim of the study, and they were asked to examine the questions to be asked to students and instructors. The suitability of survey questions in terms of content was discussed again and the survey forms were finalized. Open-ended questions in the survey form prepared for the students are as follows:

1. What does a design studio mean to you?
2. Do you think that design studios can be digitized?
    a. Yes, they can be. Because …
    b. No, they can't be. Because …

The open-ended questions in the survey form prepared for the instructors are as follows:

1. Design studios are very important environments for architectural education. In your opinion, how can design studios that need to be used in case of an urgent training need or during training be effectively transferred to a digital environment?

With the 06.08.2021 dated and 18/6 numbered ethics committee approval and permission to conduct the study, a data collection tool was sent to students studying at Firat University and Balikesir University through Google forms, and the students were asked to write down their thoughts. Instructors' views were taken through face-to-face interviews.

2.4. Data Analysis

Before analyzing the research data, the views were turned into electronic forms from the survey system. Content analysis and descriptive analysis were then used to analyze the qualitative data. To do this, first, the electronic forms including the views of students were coded starting from S1 to S71, while the forms including the views of instructors were coded starting from A1 to A5.

Content analysis was used to analyze the views about what design studios mean and about whether they can be digitized. In phenomenology studies, data analysis is for finding out experiences and their meanings and there is an effort to conceptualize data and find out themes to describe the phenomenon [52]. In addition, the main aim

of content analysis is to reach concepts and correlations that can explain the data collected. For this purpose, similar data were brought together within the framework of specific concepts and themes, organized, and interpreted in a way that readers can understand.

For content analysis, the steps recommended by Yildirim and Simsek were followed (1) coding the data, (2) finding the themes, (3) organizing the codes and themes, and (4) defining and interpreting the findings [52]. Electronic forms were transferred to Maxqda qualitative data analysis program for content analysis. Next, students' views were coded. The codes formed were then brought together under common categories. Categories were also brought together and main themes were formed.

After the data were analyzed, two experts, one from the education management department who knew and used the Maxqda program and one from the architecture department, were included in the data analysis process. They were told how the coding was performed and they were asked to analyze it again. Miles and Huberman's reliability formula "Reliability = Consensus/ (Agreement + Disagreement)" was used for the reliability of the analyses [56]. As a result of the analysis, Miles and Huberman's reliability formula value was found as .92 for the first research question, .99 for the first theme of the second research question, and .94 for the second theme. These values showed that the interview data were reliable. Direct quotations were included to reflect students' views.

The descriptive analysis method was used to analyze the data obtained from the third research question of how design studios could be digitized effectively. In the descriptive analysis, the aim is to organize and interpret and present the data obtained from interviews. A cause-and-effect relationship is built between the findings and if necessary, comparisons are made between cases [52]. It also tries to reflect the educational benefits of explanations made by researchers [57]. In qualitative analysis, the data are organized and described for readers under specific themes. Therefore, descriptions are enriched with direct quotations from participant views. These quotations also increase the reliability of the study.

3. Findings

3.1. What do design studios mean to architecture faculty students?

In this part of the study which aims to show how important the design studio environment is for architecture education, the **"What is a Design Studio?"** theme was formed as a result of the analysis of data obtained from views to answer the question "What does design studio mean to you?". Categories and codes of the theme are shown in Figure 1.

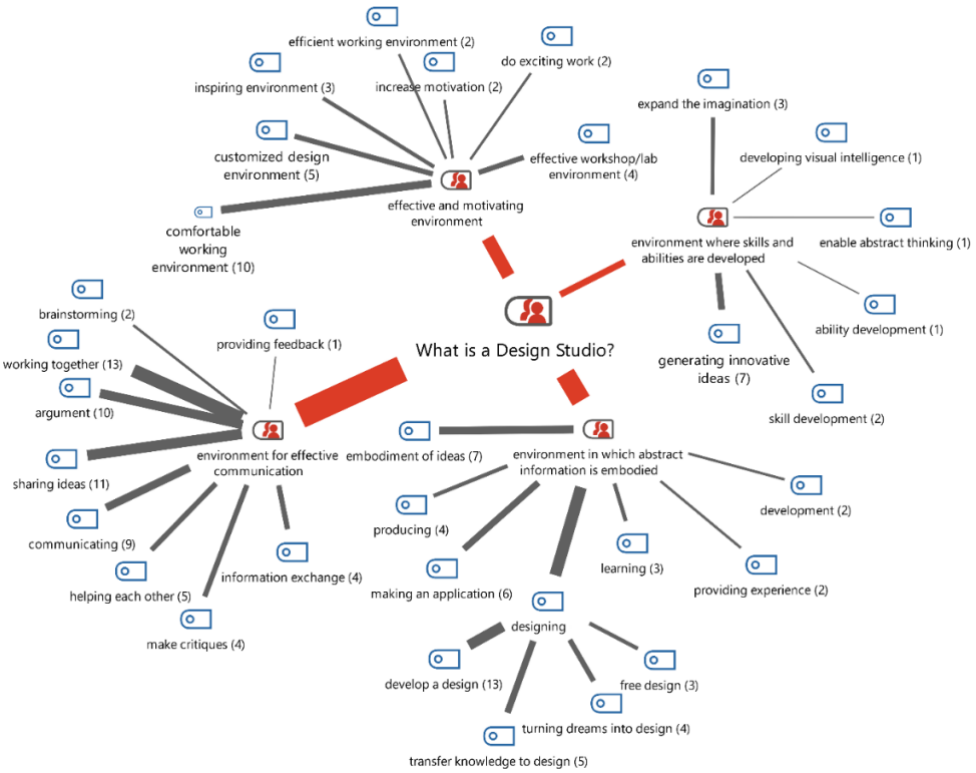

Figure 1. What is a design studio?

As seen in Figure 1, there are four categories under the **"What is a Design Studio?"** theme: *The environment for effective communication* (f = 59), *the environment in which abstract information is embodied* (f = 49), *the effective and motivating environment* (f = 28), *the environment where skills and abilities are developed* (f = 15). Under the category of *the environment for effective communication*, there are make critiques (f = 4), providing feedback (f = 1), argument (f = 10), information exchange (f = 4), sharing ideas (f = 11), helping each other (f = 5), communicating (f = 9), brainstorming (f = 2), and working together (f = 13). Under the category of *the environment in which abstract information is embodied*, there are embodiment of ideas (f = 7), making an application (f = 6), producing (f = 4), designing (f = 25), providing experience (f = 2), development (f = 2), and learning (f = 3).

Under the category of *the effective and motivating environment*, there are efficient working environment (f = 2), do exciting work (f = 2), increase motivation (f = 2), comfortable working environment (f = 10), customized design environment (f = 5), effective workshop/lab environment (f = 4), and inspiring environment (f = 3). Under the category of *the environment where skills and abilities are developed*, there are ability development (f = 1), enable abstract thinking (f = 1), expand the imagination (f = 3), skill development (f = 2), developing visual intelligence (f = 1), and generating innovative ideas (f = 7).

According to the analysis of data obtained from the views, design studios are defined as effective and motivating environments in which students develop their knowledge, skills, and talents by working together and in which they turn the abstract information they have learned into projects and designs.

Some of the attention-getting views of students who participated in the study are presented below by staying true to their essence.

"*Design studio enables the information we are taught to keep more place in our memory and enables our visual intelligence to develop; it enables us to conduct our designs more meaningfully by learning their aims and by communicating with our friends and teachers"* (S15; developing visual intelligence, developing skills and abilities; sharing ideas, providing an opportunity for effective communication).

"*I think that design studios should be working environments which enable students to transfer their imagination to their designs in a free and creative way and which have the required means. The design studio is an area in which we try to turn feelings and emotions into space*" (S30; turning dreams into the design –free design, making abstract information concrete).

"*Design studios are classrooms in which applied project courses are taught and communication is realized most effectively. They are workshops in which we can advance projects in line with the critics taken. In short, I can call design studios workshops in which students, who are designer candidates, look for solutions to design problems through trial-and-error method individually or in groups, interact with the studio executive while searching for solutions, and learn about how to make designs*" (S63; designing, making abstract information concrete, criticizing-communicating, providing effective communication).

"*Design studios are* environments which enable students to keep their minds more alive and to be productive with the advantage of being together and which enables students to exchange ideas with each other and to discuss" (S66; sharing ideas-discussion, providing an opportunity for effective communication).

3.2. Can design studios be digitized?

For the second research question of the study, the students attending architecture faculty were asked "*Do you think that design studios can be digitized? Yes, they can be. Because….* and *No, they can' be. Because…."*. The views of students who answered as *Yes, they can be. Because….* (n=6) were grouped under the theme "**Can Be Digitized**" and the views of students who answered as No, they can' be. Because ... (n=65) were grouped under the theme "**Cannot Be Digitized**". The results regarding the categories and codes of the "**Can Be Digitized**" theme were created through the analysis of views regarding the explanation *Yes, they can be. Because….* can be seen in Figure 2.

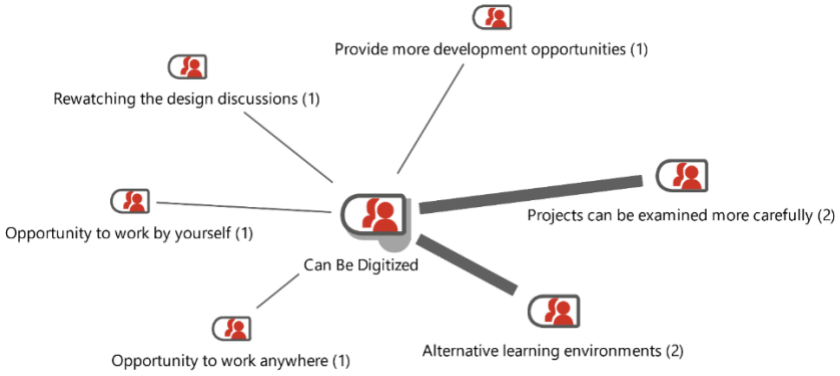

Figure 2. Design studios' digitizable theme

As can be seen in Figure 2, the students (n=6) who stated that design studios can be digitized are in their first-year (n=2; S9, S11), third-year (n=2; S64, S65), and fourth-year (n=2; S68, S70). Six categories were found in the **Can Be Digitized** theme: alternative learning environments (f = 2), provide more development opportunities (f = 1), opportunity to work anywhere (f = 1), opportunity to work by yourself (f = 1), projects can be examined more carefully (f = 2), and rewatching the design discussions (f = 1). It can be seen that the codes obtained as a result of the analysis of views point to the advantages provided by distance education rather than the benefits digitizing design studios will bring.

Some of the attention-getting views of students who participated in the study are presented below by staying true to their essence.

"*Design is a concept that contains originality and a concept with which individuals exhibit their ideas. Therefore, it is not very important for the design to be working in a studio or not, it is possible to work anywhere"* (S11; opportunity to work anywhere).

"*We have the opportunity to examine all projects made in online education together and to see them closely. We have the opportunity to rewatch what we discuss in our designs"* (S70; rewatching the design discussions).
"*I can learn with distance education, too*" (S9; opportunity to work by yourself).

The results regarding the categories and codes of the "**Cannot Be Digitized**" theme were created through the analysis of views regarding the explanation *No, they cannot be. Because….* can be seen in Figure 3.

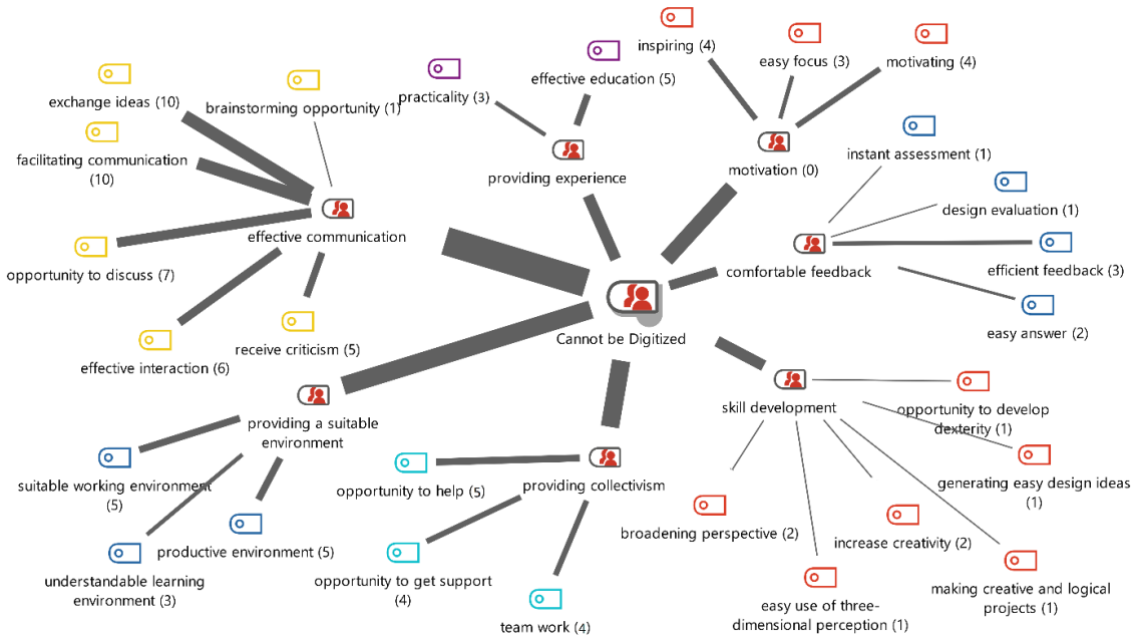

Figure 3. Design studios cannot be digitized theme

As can be seen in Figure 3, the majority of the students (n=65) expressed the view that design studios cannot be digitized. As a result of the categorization of views, seven *categories* were found under the theme **Cannot Be Digitized.** Students mostly stated that design studios cannot be digitized because design studios provide effective communication [*effective communication* (f = 39)]. According to this category, the students stated that they brainstormed (f = 1), interacted effectively (f = 6) and exchanged ideas (f = 10), received criticism easily (f = 5), had the opportunity to discuss (f = 7) and communicated easily (f = 10).

The students stated that in design studio environment they could get support from their friends (f = 4), they could help each other (f = 5) and work in teams (f = 4) and therefore had the opportunity to work collectively [*providing collectivism* (f = 13)]. While design studies provide students with an easy to understand course environment (f = 3), a suitable (f = 5) and effective working environment (f = 5) [*providing a suitable environment* (f = 13)], they also help them to get motivated (f = 4), to focus easily (f = 3) and to be inspired (f = 4) [*motivation* (f = 11)].

It can also be seen that design studios are environments where students receive effective education (f = 5) and practice (f = 3) [*providing experience* (f = 8)]. Thanks to this environment, students develop skills [*skill development* (f = 8)], they can make creative and logical projects (f = 1), they develop hand skills (f = 1), produce creative ideas (f = 2), widen their perspectives (f = 2), they can use three dimensional perception easily (f = 1) and produce design ideas more easily (f = 1).

It can also be seen that design studios provide effective feedback (f = 3), instant evaluations (f = 1) and design evaluations (f = 1) and answers can be taken quickly and easily [*comfortable feedback* (f = 7)].

Some of the attention-getting views of students who stated that design studios can be digitized are presented below by staying true to their essence.

"*Design studios provide a better environment, information, and the opportunity to work in a community. When I try to make designs in my room at home, the comfort of the house brings laziness and sometimes I lose seriousness"* (S3; more comprehensible course environment, suitable environment, opportunity to work in a community, collectivism).

"*I think that I can understand what instructors tell better face-to-face and I can solve more quickly and more effectively when I have a problem, making designs with other people in the same environment will give me more enthusiasm and inspiration and making designs by discussing with these people will have a better influence on my design*" (S17; inspires, motivation; provides the opportunity to discuss, effective communication).
"*We have the opportunity to present our designs and projects concretely by using the experiences of our instructors in the studio environment. We have the opportunity to realize the mistakes we make and fix them more quickly. We also have the opportunity to work more effectively as a group with our friends*" (S24; group work, collectivism).
"*Anything you want can be learned with distant education. I think that architecture is not one of these. With distance education, my perspective is as much as my instructors tell me and as much as I can think; however, in the face-to-face environment, I have friends that can expand my perspective. I attribute an individual's developing architecture perspective to discussions made*" (S40; expands perspectives, skill development, provides the opportunity to discuss, effective communication).

"*I think that there is a lot we can learn by discussing with friends and we have a hard-working environment and we motivate each other. I would like to communicate closely with our instructors in my project courses that I received online, I think that I could not make enough use of my instructors' knowledge and I feel sad; maybe our instructors would want different things from us in the courses that we would learn in the studio, or we would have the chance to make up for our shortcomings immediately. Distance education is different; of course, it has its benefits; however, I believe that studio environment is very important in architecture education*" (S57; motivation, the possibility to discuss, easier communication).

"*In the studio environment, our communication with our instructors may be healthier. I can ask my questions about what I do not understand more quickly and the feedback may be easier. Listening to the critics of our friends may be more useful than resting at home. Finally, discussing a subject with our friends and getting their ideas carries us forward, and we can get more accurate results. For these reasons, courses are better taught in a studio environment*" (S63; easier communication, effective feedback).

3.3. How can design studios be digitized effectively?

In the analysis of views regarding the third research question which discussed how design studios can be digitized effectively;

A1 encoded instructor made suggestions such as "If we have to experience distance education again; the project design process should be supported with new methods. This can be realized through the field of virtual internet, which is used effectively by the new generation; for example, the use of virtual media tools such as metaverse and virtual game classes should be allowed in design courses. Making use of such applications will keep students interested and make it possible to teach project courses like a game" and suggested that design courses and design studios could be realized in three-dimensional virtual environments new generations are interested in and tend to use.

A2 encoded instructor made suggestions such as "Maybe courses can be much more effective if they are supported with virtual glasses and with *virtual space applications* with which spaces can be navigated. Virtual courses in which different platforms are used should be taught in a fun way and virtual environments in which students socialize with each other should be created. Maybe by using *avatars*… Why not?" and stated that virtual space applications can be developed by using virtual reality glasses and designs can be made in these environments through avatars.

A3 encoded instructor stated "…although I do not agree with the view that online education can be very successful in a field like architecture since it has a formation that students have not experienced before, I think that it can be an alternative method that can be used instead of discontinuing education in extraordinary situations such as earthquakes and the pandemic that we have experienced in the recent past. It will be possible to establish special units to develop distance education curricula and teaching techniques in faculties. These units should create a curriculum that should be taught based on design education with innovative approaches that increase the motivation of students to classes in a way that students can understand and be interested in and present these in 3D visualization infrastructures such as games, simulation modeling, and virtual reality. Here not only students but also instructors need support because there are still instructors who have difficulties in using the computer and drawing programs" and stated that the reason why higher education institutions were not effective in distance education was the fact that instructors and students did not have the required experience and formation. For the solution to this problem, they recommend creating the infrastructure of applications such as games, simulation modelling, and virtual reality to increase the motivation of students.

Similarly, A3 encoded instructor made suggestions such as "… advanced technological methods, 3D programs, virtual reality applications, etc. should be developed and first educators should be trained about these. In addition, during this process, educators should be encouraged to minimize rote-based/monologue approach and assessments/exams based on researching/reading should be increased" and stated that advanced technological methods, 3D programs, and virtual reality applications can be used in design studios.

As can be understood from A3 encoded instructor's statement "although I think that equality in education, I mean, providing students infrastructure support such as computer, etc. is not very realistic, I believe that the process can be supported with phone applications that can be developed for architecture formation that can be used with mobile phones which are the devices every student can access most easily", instructor A3 stated that design courses can be digitized through mobile applications.

4. Conclusion and Discussion

The present study aims to research the importance of design studios in architecture education and their transferability to digital environments. According to the results found in the study, it can be stated that the greatest advantage of the studio environment for students is the fact that it creates an effective area of communication in which cooperation, idea sharing, and discussions can take place. Studies conducted on studio environments [9], [13, 14] have also emphasized that they are environments that support students' design skills. Studios are environments that contribute to design, production, and learning activities and they provide important benefits to design education. When a general conclusion is made from the results of studies, for students studio spaces can be defined as "effective and motivating environments in which knowledge, skills, and talents are developed by working together, and knowledge taught abstractly are turned into projects and designs".

When the answers to the second question of the study were examined, it was found that there were fewer students who thought that design studios can be digitized than those who thought that they cannot be digitized. This result supports the results of a study that found that undergraduate and postgraduate students in Turkey preferred the face-to-face education model instead of distance education [22, 35]. Two students expressed their views on why design studios could be digitized in the first year, two in the third year, and two in the fourth year.

When the opinions of these students were examined, it was seen that they did not state a definite recommendation or justification for the transfer of the original structure or usage purposes of the design studios to the digital environment. Students generally focused on the idea that the activities included in face-to-face education can also be carried out in online environments. However, there are also research results showing that students prefer distance education instead of face-to-face education [25, 28, 38, 58].. When the results are examined, it is seen that general conclusions were made such as distance education makes use of advances in technology, provides equality in accessing education, reduces educational costs, and allows the opportunity to rewatch the courses recorded. In other words, it can be understood that students focus on the advantages of distance education.

Another result of the study is that practical and designing courses that should take place in design studios cannot be digitized completely. Similar to the results of the present study, it is stated in studies that discuss design studios in distance education that it is not preferable for studio environments to be digitized since students encounter many difficulties [20, 21, 25] and especially the processes of cooperation, interaction, and peer learning are interrupted [30, 41] and student motivation is negatively affected. Based on this, it is thought that first-year students could not evaluate the difference between the traditional/digital applications of studios since they do not have previous design studio experiences.

In the present study, when students' views about the transferability of design studios to digital environments are examined, in general, they stated that design studios cannot be digitized since they allow effective interaction. According to the results of this study, design studios are environments in which students exchange ideas, discuss, brainstorm, criticize studies and interact comfortably. In addition to allowing students to interact together, design studios also allow for individual or group work during the design process. Similarly, there are also results that distance education, which is used as an alternative to a traditional design studio, eliminates communication and interaction canals which make significant contributions to motivation during the design process [43]. Design studios can be defined as places that enable students to get instant and efficient feedback and evaluate one another's designs, and allow them to learn from instructors or friends when they need help. In addition, by making use of the positive and supportive contribution of studio space to learning, students who work in design studios also can develop design skills, gain experience and make effective-correct decisions.

The students stated that in addition to providing a collective study environment, design studios also provided easy to understand, comfortable, and effective environment. Thanks to this environment, students can prepare creative and rational projects, develop their skills, imagination, and perspectives and make effective designs. Other studies stated that the physical components of design studios and the education provided in this environment support and develop individuals' creativity [59, 60]. The results of the present study also show that students who work together can inspire each other by being influenced by their friends' projects and designs. These benefits and advantages of design studios provide students with being motivated and to focus more comfortably on designs or projects they will carry out due to the environment they are in.

Based on the views of the instructors in the study, it can be understood that design studio formation applied during the distant education period needs solutions that will minimize the problems experienced. In this sense, it can be seen that virtual reality practices have been discussed for inclusion in the education model and are the topic of many studies [11, 18] were also suggested by the instructors in our study, and also an idea came out that infrastructures of applications such as game and simulation modeling can also be created.

It is thought that in environments where virtual space applications can be developed with virtual reality glasses three-dimensional virtual environments that allow for designs through avatars can be designed and supporting the digitalization of design courses with mobile applications will contribute to improving the conditions of distance education of design when it is not possible to be physically together.

While the present study concluded that design studios cannot be digitized completely, it sets forth that a hybrid method can be used. Improving the existing formation can be possible by including the positive characteristics of distance education, which is also included in design education and which we were not prepared for, in education programs. Based on this, by using the thoughts of students who stated that design studios can be digitized, it can be stated that jury and final examinations of design projects can be carried out in a digital environment and thus students can listen to the criticism of instructors or friends. This situation will allow criticism, brainstorming, or interaction in design studios to reach more students and will prevent misunderstanding based on the revisions between the teacher and the student.

Based on the views of instructors, for effective digitalization of design studios, practices such as a game, simulation, 3D modeling and virtual reality can be used to digitize design studios effectively in universities. Infrastructures for these applications should be prepared and mobile support should be provided in the applications

to be used. However, it is also very important to provide students and instructors with the required training to operate these infrastructures effectively and to use applications.

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