EXAMINING ONLINE DESIGN STUDIO COURSE EXPERIENCES OF STUDENTS, ACADEMIC SUPERVISORS AND COMPANY MENTORS IN INDUSTRIAL DESIGN PROGRAM

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ABSTRACT

The aim of this study is to share the experiences and the collaborations carried out within the sector during the pandemic period, in a graduation project which is focused on university-industry cooperation - in order to make the role of the designer in the sector more effective, to transform education into a comprehensive sectoral experience for students and to offer the sector the experience of working with the designer at Department of Industrial Design, Eskisehir Technical University. The method of the research is a case study examining by designing it with a holistic single-case design since it is a single, representative, and typical case. In the case study, the research group consists of the students who were enrolled in the 2019-2020 spring term graduation project course, academic supervisors and company mentors at Eskisehir Technical University, Turkiye. The result of the study is that pandemic opened the door to new educational experiences for design academics, students and companies. This sharp bend mainly affected the implementation processes of one-on-one lessons, just like the design studio, which we define as the heart of design education. It has also paved the way for different online interactive educational tools and platforms to be used for the educational components of the design of the process.

Keywords: Industrial design, online design course, online learning, design education, case study.

INTRODUCTION

Due to the COVID-19 outbreak, face-to-face educational activities in higher education institutions were initially suspended; only to continue online after a while. The opportunities that online education has provided depended on time and place, i.e., flexible applications, came into play with surprising speed. This rapid transition process in the application-intensive and essentially one on one and face-to-face disciplines such as industrial design has enabled/created an environment for the discovery and application of different interface solutions and experiences.

Education for designers (like nearly all kinds of education) is based on learning skills, nourishing talents, understanding the concepts and theories, and acquiring philosophy (Meyer and Norman, 2020). The basis of this approach is established on the perspective of producing and applying together. This situation is primarily and especially valid for the design studio, which is the core of design education, because design is a complex field. It is both a practical and an academic discipline. Each category encompasses numerous specialized disciplines whose parameters are fluid, ill-defined, and changing continually, with a number of different design societies dedicated to them (Meyer and Norman, 2020). Though design education involves a practical education approach that targets getting industrial products, which focus on user needs, ready for production, "practical" not only means the manufacturing process but also the mental practicality that the student performs during the process. While designing, the learning process is mostly not a sequential action but structured within the student's experiences. For this reason, the process of learning by doing, which is the basis of design education, is carried out one-on-one, thus face-to-face education forms the backbone of industrial design education, particularly the studio course.

The studio is a place where students learn by doing, a venue for hands-on learning that requires students to take an active role in engaging with and incorporating distinct components of the curriculum into a comprehensive project (Yocom, Proksch, Born & Tyman, 2012). The design studio is a type of professional education, traditional in schools of architecture, in which students undertake a design project under the supervision of a master designer. Its setting is a loft-like studio space in which anywhere from twelve to as many as twenty students arrange their drawing tables, papers, books, pictures, drawings, and models. In this space, students spend much of their working lives, at times talking together, but mostly engaged in private, parallel pursuits of the common design task (Schon, 1983).

The essential elements of studio-based learning – learning by doing, collaborating with the environment (other students, instructors, and external stakeholders), and re-doing until an agreement is reached among stakeholders (Lackney, 1999) is considered an essential approach for effective student learning of design thinking concepts. Design studio pedagogy is project -based and functions as a mentorship between tutors and students (Milovanovic & Gero, 2020; Cenani & Aksoy, 2020). However, even though the students gained completely different experiences in their actual studios on campus until before the pandemic, the learning experiences of the new generation and the methods of accessing education materials have now become very different / changed. Both outside and inside the classroom, and sometimes even in lessons, they experience learning and socializing on online networks. Therefore, it is not just the format of education that is changing today. At the same time, the students have also changed. They are more mobile and spend more time online than academics do, especially in the last two decades. Nowadays especially, they seek more flexibility and want to work as they prefer. On the other hand, by academics; particularly those who continue giving their design courses with their commitment to the traditional face-to-face education model; this process of change has been constantly ignored. Hence the fact that the actual studio environment is an integral component of design - although both actual and online studio environments offer some distinct and some common experiences for learning - was considered an absolute truth until the COVID19 pandemic era.

The first experiments with remote design collaboration began in 1988, the first major online design studio was established in 1992, with the name of Remote Collaboration between the students of University of British Columbia (UBC) and Harvard University. In 1995, two large virtual design studio projects were realized. The first was an international virtual design studio, which was carried out with the participation of students from Cornell University and MIT in the USA, ETH Zurich in Switzerland, UBC, University of Singapore, and the University of Sydney in Australia. Although online studio experiences have been within design education's field of interest, with various collaboration practices since 1988, mainly a distant and conservative approach against online studios was exhibited until the pandemic.

In fact, although there have been many applications on online studio training for a long time, mostly the academic side of design education believed that online studios would be ineffective and/or inefficient. The issue was that online studio platforms will inhibit efficient student-teacher interaction especially during transition from sketch to technical drawing, from model to prototype, and was the focus of discussion for years. With the pandemic starting almost in the middle of the spring term in 2020, the transition to online education; although it has been a rapid and unprepared one; opened the door to new experiences for design academics as well as students. This sharp bend mainly affected the implementation processes of one-on-one lessons, just like the design studio, which we define as the heart of design education. Moving actual studio spaces, where this process has been structured face-to-face for years, to virtual studio spaces, has evolved the dimension of long-standing debates from verbal discussions to practical experiences. It has also paved the way for different interface solutions to be found / used for the educational components of the design of the process.

Today, the world faces new challenges. Designers are starting to play a larger and larger role in not only designing but managing beyond the design studio and even deciding upon the activities that need to be done across the business. Our concern is that design education has not kept up with the new demands of the 21st century. We know today that the codes of the new century require designers to create value(s) for the industry. The aim of this study is to share the experiences and the collaborations carried out within the sector during the pandemic period, in a graduation project which is focused on university-industry cooperation - in order to make the role of the designer in the sector more effective, to transform education into a comprehensive sectoral experience for students and to offer the sector the experience of working with the designer - at Eskisehir Technical University, Department of Industrial Design.

INDUSTRIAL DESIGN PROGRAM OF ESKISEHIR TECHNICAL UNIVERSITY

The university is the main institution of the higher education system. Universities provide fully trained skilled persons, who will be used as the fundamental input of the entire innovation process. The university is the most appropriate place for critical thinking, problem-solving, developing technical and professional skills, and coordination with programs and institutions where innovations are nurtured. Moreover, combining the knowledge-based production and competencies of universities in the field of human resource training with the competencies of the industry in production and technology is very important in terms of introducing innovative and value-added products for the national economy. While design-oriented studies/projects in these collaborations enable the students to combine their theoretical knowledge with practical skills, at the same time they create an environment for the industry to produce design-oriented innovative products. Design and technology are the primary links that connect these two structures.

Since university-industry collaborations are linked to knowledge and technology transfer, these cahoots are important areas of collaboration for universities, industry and country economies. There are different models built with the cooperation of science and technology. These models undertake pioneering roles, especially for the new university-industry collaborations of the 21st century. First of all, inventions and innovations are of paramount importance for both the national and the international competitiveness of the industry. Design is an important key in demonstrating these added values. Cooperation between Universities and Industry includes collaborative research, research contracts, or scientific consultancy, the results of which are put into practice—in a process comparable to technology transfer for commercialization purposes—by more researchers (Perkmann et al. 2013; Leydesdorff et al. 2014; Berbegal-Mirabent et al. 2015). The effectiveness of research and development (R&D) investment depends on interactions between local companies and institutions in the scientific and technological system. When this interaction becomes progressively more active, R&D investment by companies, universities, and research institutes has a stronger effect on the construction of regional innovation systems (Etzkowitz and Klofsten 2005; Jiao et al. 2016).

While all this progress is taking place and as we experience the fourth industrial revolution, especially in Turkiye, universities and industry are still at a distance from each other. The industry/sector, which is skeptical of universities and design education, on the other hand, expects the design education that it is not involved in and does not support to give a reflex to meet the needs of the industry. Moreover, universities keep away from technology/production. In fact, the university's production of information and solutions together

with the industry accelerates the commercialization of knowledge and increases its widespread influence. Therefore, there is no doubt that the experiences students will gain, in university-industry collaboration projects, will make a significant contribution to their professional business life after graduation. In their graduation project, the students aim is to gain these competencies, especially from the 6th week of the project course, to experience design and production relations in real-time and real space. This process is a simulation of the design and production processes that students will experience in the sectors they will work in after graduation. In the 2020-2021 Spring semester, however, the education process planned within the steps and to be shared in the next section stopped on the 13th of March 2020 due to the Pandemic and moved from face-to-face education to online education platforms.

In the design-oriented graduation / university-industry collaboration project, which is the subject of this study, the process of transforming a creative idea into a commercial product by sharing the knowledge, experience, and production environments of the stakeholders, which is already challenging as a university-industry collaboration project, the interruption experienced due to the Pandemic, reconstruction, experiences of the stakeholders in engagement and remote cooperation, reflexes developed and results achieved are addressed.

DESIGN EDUCATION AND STUDIO CULTURE

The ENT452 coded Product Design VI course, which is given in the spring term of the 8th semester in Eskisehir Technical University, Department of Industrial Design, was designed as a graduation project. The graduation project is a compulsory eight-hour design project course based on university-industry collaboration, in which each student performs product design during the spring semester which covers 14 weeks. In this process where the transition of a creative idea to a commercialized product prototype is experienced, the student, the academic supervisor and the company mentor work together in coordination.

For the graduation project, the Department of Industrial Design aims to enable the student to experience the product development process in the current production environment; by choosing the sector he/she is interested in, and depending on the sector, the company he/she will work together with; before starting his / her professional business life, and to enable him/her to plan the product design process himself/herself and to gain the experience of the professional business environment in industrial product design before graduation. Before taking the graduation course, the students take the 7th-semester compulsory course, Professional Relations and Project Management, which is given in the fall semester at the Industrial Design Department. In the course, students make sectoral analyzes, learn about project management, and prepare a brief so that they can determine the company they want to work with. At the end of the course, they determine the company they will work with for the graduation lesson, sign cooperation agreements, prepare the project brief and project time management chart. Before the spring semester, students are expected to complete their preliminary sectoral research and submit a written brief summarizing possible project subjects with the company they will work with. Students who cannot complete the company agreement within this period are given extra time until the beginning of the fall semester.

A system consisting of three parties, i.e., an academic supervisor, a company mentor and a student, work in an integrated manner during the semester, for determining the project subject, conducting the design research, product development stages, solution of technical details until project ideas become 3D designs. Students should meet at least 7 times within 14 weeks with the companies they run their projects with and prepare meeting reports which will then be submitted for the approval of the academic advisor. The graduation project started on 3 February 2020, according to the Academic Calendar of Eskisehir Technical University. After the interim between March 16 and April 5 due to the Covid-19 outbreak, with the decision of the Council of Higher Education, the course reached an end with the online final evaluation juries held between 22-26 June 2020.

The graduation project course was basically designed, developed, and conducted to include 5 components.

1. Online communication and learning management platform: As information and communication tools for students in the process, a WhatsApp™ group with students and academic supervisors and an account opened for the course on Google Classroom™ have been used.

2. Face-to-face studio meetings: Academic supervisors communicate with their students via WhatsApp groups that they have established for fast communication and they share Zoom links for their online studio calls which they hold during and outside of class hours. This led to critical face-to-face sessions, one of the most important elements of the studio culture, to be continued online.
3. Company meetings: Documents such as weekly company meeting reports and research reports were received via Google Classroom. At the beginning of the semester, the formats of the company meeting reports had been determined and an assignment was created for every report on Google Classroom. The assignments are scheduled to be published every week on Google Classroom and have time limits (deadlines), i.e., they only become visible in the system when the time comes, and students upload their reports within the specified hours. Students held meetings with company representatives via online environments such as e-mail, video calls and Zoom meetings, and instead of submitting the reports with wet signatures as they had done before the Covid-19, they uploaded e-mails and Zoom meeting screen captures as attachments.
4. Reporting of design research: Students submitted the drawings, sketches, 2D and 3D rendered images of their works which they plan to present/discuss during the online joint jury evaluation, in suitable formats such as MP4, PDF, PPT, or JPEG, via Google Classroom at the delivery date/time determined according to the academic calendar.
5. Joint jury evaluations: A document addressing the submission criteria was prepared and shared as a pdf file on WhatsApp groups and Google Classroom, so as to guide the students in the joint jury evaluations. An empty draft program of the 4-day jury was arranged according to each of the project supervisors' groups and with a time slot for each student created via Google Spreadsheets and was shared on Google Drive (with the option "Anyone with the link can edit"). The link to the draft program was shared with the students via Whatsapp. Students added their names to the time slots they deemed appropriate in the lists. The program prepared by the academic supervisors and assistants in the pre-Covid period was now reorganized according to the time intervals preferred by the students in this period. A Google Sheets file opened on Google Drive and was shared with the project supervisors with the option "Closed-Certain people can access", which served as a grading list for the project supervisors to make joint grading.

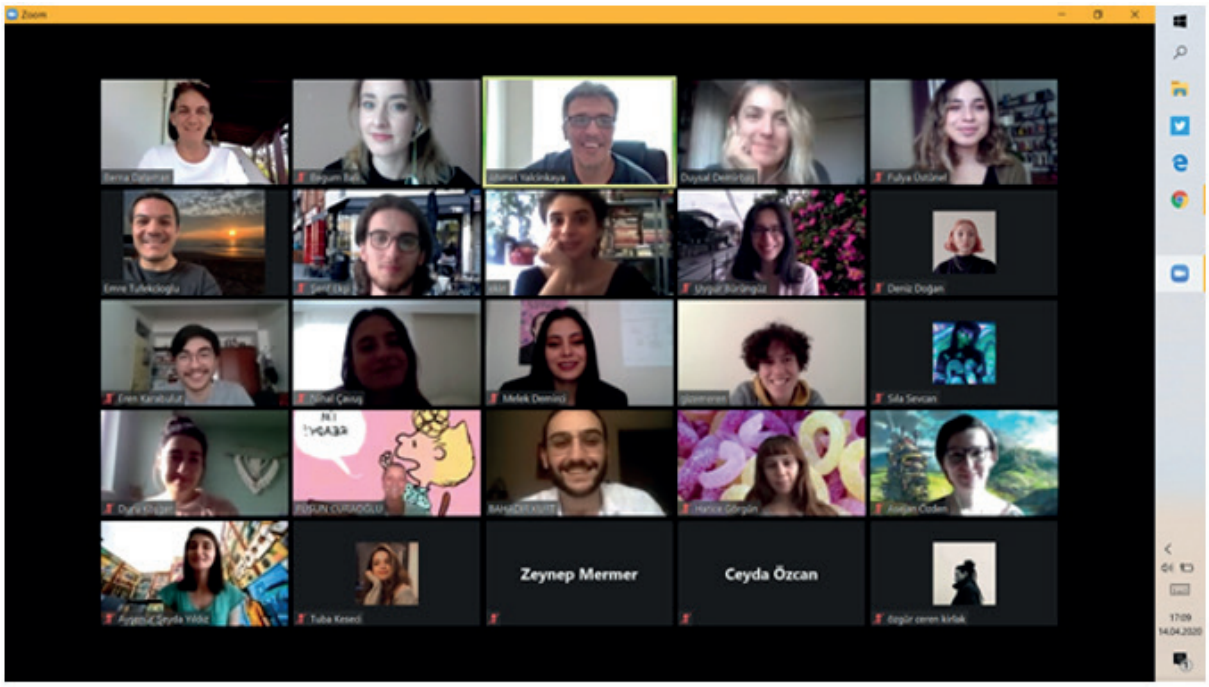

Figure 1. Zoom meeting

RESEARCH METHOD

The method of this research is a case study, which is a mainly qualitative research method aimed at exploring the experiences and perceptions of students, academic supervisors and company mentors towards distance education within the scope of the online graduation project course, which is transitioned with emergency distance education. However, both qualitative and quantitative data can be used in a synchronous fashion in the case study, to illuminate a particular situation. The online course, which is considered in the context of the research, was examined by designing it with a holistic single-case design since it is a single, representative, and typical case, but also has not been reached before. In the case study presented here, the research group consists of the students who were enrolled in the 2019-2020 spring term graduation project course, academic supervisors and company mentors. The graduation project course was conducted with a total of 76 students, 6 lecturers and 54 mentors from different industrial design companies. A total of 42 students, 22 company mentors and 6 lecturers (academic supervisors) participated in our survey research. 69% (n = 29) of the students are females. In this group, seven of the participants have taken online courses before. 55% (n = 12) of the company mentors are female and 45% (n = 10) are male. Among the 22 company participants, 7 (32%) had done online project consultancy before. 4 (67%) of the academic supervisors are female and 2 (33%) are male. Apart from 1 faculty member, other faculty members do not have previous online course experience.

Online questionnaire consists of dimensions such as technology and physical facilities, learning, learning support, and emotional dimensions, students' adaptation and supervising. The questionnaires developed by researchers are used to determine opinions of students, instructors and advisors about the effectiveness of an online design studio course. To ensure the content validity of the questionnaire, we consulted the opinions of 4 experts on the items. Cronbach's Alpha internal consistency coefficient is calculated to determine the reliability of the questionnaire. Reliability coefficient of scale was 0.78 for the questionnaire. The internal consistency was assessed by calculating Cronbach's alpha coefficients categorized as adequate, 0.70–0.79 (Cortina, 1993). Qualitative data were obtained from 6 students and 4 company mentors with whom research was carried out, from focus group interviews. The purpose of the focus group meeting is to obtain the perspectives, experiences, tendencies, perceptions, attitudes, thoughts and feelings of individuals about a subject in detail (Krueger & Casey, 2014).

FINDINGS

Findings of the Students

The student's survey consists of four dimensions (Technology and physical facilities, learning, learning support, and emotional dimensions) to understand student centered experiences. A total of 42 students participated in our survey research. The students' devices that were used are listed as graphic tablet (%26,2), tablet (%23,8), desktop computer (%9,5), smart watch (%2,4) for an online studio course. Mostly the students preferred to use laptops (%95,2) and smartphones (%78,6) to access the online studio course.

It is asked to students that which tools they use for the course and for what purpose. The students prefer mostly WhatsApp and Zoom in order to effectively meet their online studio course requirements. WhatsApp is used more often by participants to send screenshots (%65), text messages (%75), digital models (%50), 2-D image (%78), and 3-D image (%50). Zoom is used mostly by them to send video calls (%98), screenshots (%70), digital models (%76), 2-D image (%83), and 3-D image (%73). E-mail is the other interaction tool used less frequently by students, especially to send text messages (%79), digital models (%61), 2-D image (%82) and 3-D image (%61). Nearly all of the participants used their own computer during the pandemic (%95,2). However, many of the participants shared their room with family members (%78,6). Eskisehir Technical University supported them with computers during the pandemic.

Table 1. Students' views on the environmental conditions in which they live

Statements	N	$\bar{x}$	s
• The place I stayed was suitable for me to carry out the design process.	42	3,07	1,135
• Due to the design process, I did not have to go outside the house	42	2,05	1,188
• The place I stayed was suitable for online classes and meetings (in terms of privacy, noise etc.)	42	3,33	1,373
• The place I stayed was suitable for me to produce 3-dimensional models.	42	2,45	1,329
• I could easily access mock-up, model materials.	42	2,00	1,230
• I made my models at home	42	3,69	1,334
• I got my prototype done in a workshop.	41	2,78	1,782
• My company made my mock-up and sent it to my address.	42	2,02	1,660
• My company made my prototype and sent it to my address	42	2,71	1,642
• I could easily communicate with my company during the prototype process (transferring technical details, etc.)	42	3,02	1,137
• My prototype matched my design suggestion.	42	3,62	1,229
• My company delivered the necessary materials for the prototype	41	1,73	1,304

The students' views on the environmental conditions in which they live in are given in Table 1. The findings show that "they made their models in their home" ($\bar{x}$=3,69, s=1,334), and their place was suitable for online classes and meetings (in terms of privacy, noise etc.) ($\bar{x}$=3,33, s=1,373), and they could easily communicate with their company during the prototype process (transferring technical details, etc.) ($\bar{x}$=3,02, s=1,137). However, the participants don't believe that their company delivered the necessary materials for the prototype ($\bar{x}$=1,73, s=1,304) which is, normally, part of the university-industry collaboration agreement.

Table 2. Students' views on their use of technology

Statements	N	$\bar{x}$	Ss
• Academic consultant / studio tutor / project supervisor had full knowledge of the necessary technologies and applications for the online environment	42	4,21	0,898
• I had full knowledge of the necessary technologies and applications for the online environment	42	4,36	0,727
• I have been informed about which technologies and applications I should use	42	3,83	0,881
• I was able to access reliable communication software / tools (e.g. Zoom, Google Classroom, Whatsapp, Miro).	42	4,57	0,501
• I was able to access reliable internet / service	42	3,95	1,035
• I was able to access a reliable / capable digital device (e.g. laptop, mobile device)	42	4,01	1,093
• I could access specialized software (e.g. Adobe products, Rhinoceros, SolidWorks, Autocad)	42	3,50	1,274
• I could access specialized hardware (e.g. wacom tablet)	42	2,64	1,462
• I was able to access online databases and online library resources	42	3,24	1,100
• I was able to access online collaboration tools (e.g. miro)	42	3,64	1,358

Table 2 shows the findings of the Students' views on their use of technology for the online studio course ($\bar{x}$=4,57, s=0,501), The participants highly believe that they can use the technology for academic consulting ($\bar{x}$=4,21, s=0,898), for getting knowledge ($\bar{x}$=4,36, s=0,727), for getting information about the technology ($\bar{x}$=3,83, s=0,881); for accessing the internet ($\bar{x}$=3,95, s=1,035), digital devices ($\bar{x}$=4,01, s=1,093), specialized software ($\bar{x}$=3,50, s=1,274), online databases and online library resources ($\bar{x}$=3,24, s=1,100) as well as online collaboration tools ($\bar{x}$=4,36, s=0,727). However, they could not access specialized technology such as wacom tablets ($\bar{x}$=2,64, s=1,462).

Table 3. Students' views on learning problems they experienced

Statements	N	$\bar{x}$	s
• I was able to attend the synchronous (online) lessons actively/regularly.	42	3,98	0,924
• Clear guidelines on project expectations/design tasks were shared.	42	3,60	1,211
• I had difficulty following the work schedule determined by academic supervisors	42	2,98	1,179
• The number and frequency of classroom work was sufficient.	42	3,69	0,975
• I was able to successfully manage the remote project execution process	42	3,69	0,975
• I was able to get adequate / appropriate feedback from the academic supervisors	42	3,36	1,100
• I was able to get interactive critics on my product sketches.	42	3,76	1,008
• I was able to get interactive critics on my product mock-ups.	42	3,33	1,162
• I was able to take interactive critics on three-dimensional digital drawings.	42	3,83	0,935
• I was able to have enough meetings with my academic supervisor.	42	4,07	1,135
• My meetings with my academic advisor were productive.	42	3,90	1,078
• I could easily reach my academic supervisor.	42	4,10	0,983
• I could not find personal motivation to complete the given design tasks (weekly sketches, mock-ups, etc.).	42	3,45	1,087
• During the lesson, I had difficulty continuing to work on my own project with the camera (Zoom) on.	42	3,52	1,110
• Being able to follow the critics given to my classmates made a positive contribution to my process.	42	3,45	1,173
• The critical implementation provided with the appointment system (via google drive) contributed positively to my process.	42	3,36	1,284

Students' views on learning problems are given in Table 3. According to their views, they can easily reach their academic supervisors ($\bar{x}$=4,10, s=0,983), have enough meetings with their academic supervisors ($\bar{x}$=4,07, s=1,135) and attend the synchronous (online) lessons actively/regularly ($\bar{x}$=3,98, s=0,924). Also, they believe that they can take interactive critiques on three-dimensional digital drawings ($\bar{x}$ =3,83, s=0,935). It is said the students are highly positive about their academic supervisor's performance. However; most of students have difficulty following the work schedule determined by the academic supervisors ($\bar{x}$=2,98, s=1,179).

Students' views on the problem of communicating with the company are listed in Table 4. They believe that their mentors are productive ($\bar{x}$=3,67 s=1,223), and they can do interactive critiques on their product sketches ($\bar{x}$=3,67, s=1,074) and receive interactive critiques on three-dimensional digital drawings ($\bar{x}$=3,67, s=1,097) as well as report conversations from their company mentors ($\bar{x}$=3,60, s=1,106).

Table 4. Students' views on the problems they experience in communicating with the company

Statements	N	$\bar{x}$	Ss
• I could easily reach my company mentors	42	3,24	1,284
• I was able to have enough meetings with my company mentor	42	3,26	1,363
• My meetings with my company mentor were productive.	42	3,67	1,223
• I was able to receive interactive critics on my product sketches from my company mentor	42	3,67	1,074
• I was able to receive interactive critics on my product mock-ups from my company mentor.	42	3,17	1,267
• I was able to receive interactive critiques on three-dimensional digital drawings from my company mentor.	42	3,67	1,097
• I easily reported the conversations I had with my company mentor.	42	3,60	1,106

Students' views on their concerns are shown in Table 5. The students' concerns are typically centered upon presenting their three-dimensional design models such as a model/prototype in the evaluation juries in the most appropriate way ($\bar{x}$=4,64 s=0,727), internet-related problems during final delivery ($\bar{x}$ =4,60 s=0,939), and completing three-dimensional design models such as mock-ups/prototypes ($\bar{x}$=4,40 s=0,885). Students' secondary concerns focus on not being able to see classmates ($\bar{x}$=3,21 s=1,440, getting high marks (scores) ($\bar{x}$=3,24 s=1,206, taking attendance / absence / class attendance ($\bar{x}$=3,12 s=1,014).

Table 5. Students' views on concerns about emergency distance education

Statements	N	$\bar{x}$	Ss
• Getting high marks (scores)	42	3,24	1,206
• Performing well in the classroom	41	3,54	1,247
• Changes in grading structures (e.g. successful/unsuccessful, with/without credit)	42	3,74	1,014
• Concerns about taking attendance / absence / class attendance	42	3,12	1,310
• Changes in the final (expected) delivery criteria	42	4,38	0,882
• Changes in the final jury evaluation criteria	42	4,26	0,989
• Internet-related problems (large file size, upload time, internet interruptions, etc.) during final delivery.	42	4,60	0,939
• To present three-dimensional design models such as model-prototype in the evaluation juries in the most appropriate way.	42	4,64	0,727
• Inability to perform adequately in remote / online jury evaluations	42	4,21	1,116
• Completing three-dimensional design models such as mock-ups/prototypes.	42	4,40	0,885
• Not being able to see classmates	42	3,21	1,440
• Not being able to communicate with the Project Supervisors	42	3,83	1,228
• Possible delays in finishing / completing the education program	42	4,02	1,115
• Missing out on extracurricular/on-campus activities	42	3,95	1,188
• Online privacy protection of personal data	42	3,26	1,345

Findings of the Companies

The company mentors' survey consists of four dimensions (technology, students' adaptation, supervising, emotional dimensions) established to understand industry-centered experiences in online education. A total of 22 company mentors participated in our survey research.

Company mentors prefer to use laptops (%90,5), smartphones (%76,2), desktop computers (%47,6), tablets (28,6) as technology to interact with students. They don't use smart watches and graphic tablets. Also, they use whatsapp (n=18), zoom (n=15), email (n=17) tools. One mentor prefers to use facebook messenger and google classrooms as a communication platform. Participants prefer to use mostly video call (%33), voice recording (%11), screenshot (%11), text messages (%28), digital models (%6), 3D image (% on whatsapp platform. 95,5% of mentors have a suitable place for online class and meetings (in terms of privacy, noise etc).

According to mentors' technological and physical facilities findings, it was observed that 15 mentors have their own desk and space during pandemic. 13 participants stay at their own house, 11 participant work from home, 10 participants work mostly in the company, 13 participants use their own computer, 1 participant share a room with a family member, and 1 participant stay at the relative house during the pandemic.

Table 6. Company mentors' opinions on the use of technology

Statements	N	$\bar{x}$	Ss
• Academic consultant / studio tutor / project had full knowledge of the necessary technologies and applications for the online environment	22	4,27	0,456
• I had full knowledge of the necessary technologies and applications for the online environment	22	4,32	0,477
• I have been informed about which technologies and applications I should use	22	3,59	1,297
• I was able to access reliable communication software / tools (e.g. Zoom, Google Classroom, Whatsapp, Miro).	22	4,59	0,590
• I was able to access reliable internet / service	22	4,41	0,666
• I was able to access a reliable / capable digital device (e.g. laptop, mobile device)	22	4,55	0,596
• I could access specialized software (e.g. Adobe products, Rhinoceros, SolidWorks, Autocad)	22	4,23	1,193
• I could access specialized hardware (e.g. wacom tablet)	22	3,00	1,512
• I was able to access online databases and online library resources	22	3,59	1,221
• I was able to access online collaboration tools (e.g. miro)	20	3,70	1,218

Table 6 shows the findings of the company mentors' views on their use of technology for the online studio course. The participants believe very highly that they can access; reliable communication software/tools (e.g. zoom etc) ($\bar{x}$=4,59, s=0,590), and a reliable / capable digital device (e.g. laptop, mobile device) ($\bar{x}$=4,55, s=0,596), reliable internet/service ($\bar{x}$=4,41, s=0,666), specialized hardware ($\bar{x}$=4,23, s=1,193). They trust themselves highly to technology knowledge for the online environment ($\bar{x}$=4,32, s=0,477), and academic consultant technologies for the online course ($\bar{x}$=4,27, s=0,456).

Table 7. The opinions of the company mentors regarding the education problems experienced during the emergency distance education transition process

Statements	N	$\bar{x}$	Ss
• I was able to participate actively/regularly in synchronous (online) meetings.	20	4,30	0,865
• I was able to successfully manage the remote project execution process	20	4,40	0,598
• I was able to give adequate/appropriate feedback to students	20	4,30	0,733
• I was able to give interactive critiques on students' product sketches	20	4,25	0,550
• I was able to give interactive critiques on students' product mock-ups	20	4,00	0,725
• I was able to give students interactive critiques on three-dimensional digital drawings.	20	4,25	0,786
• I was able to have a sufficient number of meetings with the students.	20	4,45	0,510
• Our meetings with the students were productive.	20	4,45	0,510
• I could easily access the students.	20	4,45	0,605
• I could easily communicate with academic supervisors.	20	3,60	1,046
• I was able to have a sufficient number of meetings with the academic supervisors.	20	3,45	1,050
• Our meetings with the academic supervisors were productive.	20	3,75	0,967

It is visible from Table 7 the findings of the mentors' views on problems for the online studio course. The mentors believe very highly that their meetings with students were productive ($\bar{x}$=4,45, s=0,510), they can access the students easily ($\bar{x}$=4,45, s=0,605), and they have sufficient number of meetings with students ($\bar{x}$=4,45, s=0,510). Moreover, mentors' opinion is that interaction between academic supervisors and mentors is sufficient but it can be improved ($\bar{x}$=3,45, s=1,050).

Table 8. Company mentors' opinions on adaptation to distance education

Statements	N	$\bar{x}$	Ss
• I was not familiar with online apps/tools or not comfortable using them	22	1,82	0,958
• I had limited knowledge of online meeting options	22	1,95	0,950
• I had limited personal time or energy to adapt to the process	22	2,36	1,049
• My personal preference is face-to-face consulting	22	3,32	1,041
• In this environment, I was not sure about the department's expectations from the company mentors	22	2,55	1,011
• In this environment, I was not sure about the department's expectations from students.	22	2,68	1,211
• Students were not responsible/sensitive enough.	22	1,82	0,733

It is seen in Table 8 that the findings of the mentors' views on online learning adoption. They believe highly that they are comfortable using online apps/tools and have knowledge of online meetings. They have an intention that their face-to-face consulting but is not highly ($\bar{x}$=3,32, s=1,041).

Table 9. Company mentors' opinions regarding their concerns about transition to emergency distance education

Statements	N	$\bar{x}$	Ss
• Deterioration (decrease) of student performance	20	2,95	0,999
• Inability to communicate with students	20	2,86	1,082
• Making prototypes of students	20	3,77	1,152
• Submission of students' prototypes	20	3,82	1,053
• Online privacy, protection of student data	20	3,05	1,290
• Online privacy, protection of my personal data	20	3,24	1,221
• The adequacy of my consulting performance	20	3,05	1,133

Table 9 shows the findings of the mentors' concerns on the online studio course. According to company mentors, the most concern is for students to make and submit prototypes ($\bar{x}$=3,77, s=1,152; $\bar{x}$=3,82, s=1,053).

Findings of the Academic Supervisors

The academic supervisor survey has four dimensions (technology, students' adaptation, supervising, emotional dimensions) to understand online education experiences. Six lecturers participated in our survey research.

Academic supervisors prefer to use laptops (%100), smartphones (%83), desktop computers (%33), tablets (33) as technology to interact with students. They don't use smart watches and graphic tablets. Also, they use whatsapp (n=5), zoom (n=5), email (n=6), google classroom (n=5). One advisor prefers to use facebook messenger and Instagram chat as a communication platform. Participants prefer to use mostly video call (%60), voice recording (%60), screenshot (%80), video recording (%40), text messages (%100), digital models (%40), 2D image (%80), 3D image (%40) on whatsapp platform. All supervisors use video call on zoom as a communication platform, and also send students text messages on whatsapp, facebook messenger and Instagram chat. 5 mentors except 1 mentor have a suitable place for online class and meetings (in terms of privacy, noise etc).

According to supervisors' technological and physical facilities findings, it was observed that all 6 supervisors have their own desk and space during the pandemic. Three supervisors stay at their own house, one participant works from home, 5 participants work mostly in the university, 6 participants use their own computer, 2

participants share a room with a family member, and 1 participant stays at the relative house during the pandemic. All supervisors believe that they can access reliable communication software/tools, internet and capable digital devices and specialized software as well as they know the use of online technologies and tools. Also, all supervisors believe that they attend the synchronous (online) lessons actively/regularly, successfully manage the remote project execution process, give adequate / appropriate feedback to the students, have enough meetings with my students, and easily reach my students. Also, in their opinion, their meetings are very productive and their critiques are efficient.

All supervisors think that they are comfortable using online applications/tools, and they are sure about the department's expectations from the academic supervisor. However, four supervisors have limited personal time and energy for online education and prefer to use face to face consulting. One supervisor believes that he/she has limited knowledge on online learning and department expectations from students. Also, according to one supervisor, students have not enough responsibilities to meet online learning course needs. Besides, the most concerns of academics are to decrease student performance and evaluate of their teaching activity.

QUALITATIVE ANALYSIS

Findings of Students

Another important evaluation made by the students regarding their individual learning processes was the negative effect on their own design processes is the interruption of peer learning during the pandemic. The fact that the features such as learning from each other, helping each other and feeling the class synergy, which take place in their natural flow in the studio environment in face-to-face-formal education, were not effective enough in the online environment, were described as a major deficiency by the students. The students who participated in the interview stated that the process was even more difficult especially for their classmates who were alone at home. One of the students expressed the result of the lack of face-to-face communication as follows: "It was not possible for the student to learn from the student. We were able to improve ourselves more in the classroom". Another student expressed the support she received from his classmates during the pandemic period as follows: "When we were alone at home, we could not create synergy. We continued the process by giving feedback to each other."

Students defined online critical sessions as an important problem, which includes difficulties such as accessing the teacher's meeting link, not being able to find a place in the appointment system or setting prerequisites for feedback sessions, instead of the physically open studio system that allows them to naturally receive feedback from other advisors other than their own academic advisor during the pandemic period.

All of the students who participated in the interview emphasized that face-to-face-formal education is very important especially in terms of feedback sessions. A student expressed the contribution of a critical session in which he had the opportunity to meet face-to-face with his academic advisor in the garden of the school as follows: "There were times when I could not understand the critics in their critical processes. Then when we met face to face, I suddenly understood."

Theme 1. Evaluation of the Process in Terms of Project Management

The students defined one of the important disadvantages of distance education as the difficulties they experienced during the production of 3D working models. Problems such as inadequacy of physical environment, inadequacy of materials and production tools were mentioned as an important problem by all students. One of the students expressed the problem he experienced as a result of the sudden change of city following the announcement of the bans; "There was no workshop, no space to make models, all of my materials were left in Eskisehir. I had a lot of problems during the modeling phase. In terms of company relations, being able to meet online was evaluated by the students with both positive and negative aspects.

The students stated that it is an important advantage to eliminate the financial burden created by the transportation and accommodation conditions that arise during the company meetings-visits that they must carry out during the term. Before the pandemic, four of the seven mandatory meetings were expected to take

place face-to-face and in the company. One of the students expressed the advantage of not having to go out of the city for a company interview as follows: "Since the company is in Inegol... We used to go to Inegol every week. The transportation cost was very high. This has provided significant convenience."

As another advantage, interview sessions in which both the company consultant and academic consultant and student come together were mentioned. One student expressed the advantage of this situation as follows: "If it were not online, it would not have been possible to have a joint meeting with the academic supervisor and the company mentor. This critique sessions have been very useful for me."

Theme 2. Opinions on the Online Environment and Tools Used

The students expressed the biggest advantage of the individual appointment system, which was created using Google Drive tools, as the ability to organize face-to-face academician -student meetings that extended in critical sessions. One student expressed the advantage created by this situation as follows: "I used to get in and out of the appointment system at my exact appointment time with the teacher. It was not a waste of time."

The technical problems experienced in the appointment system are expressed as follows: due to the publication hours of the appointment lists students cannot find a place for themselves, some students can make more than two appointments per week, allowing multiple entries to the same appointment time at the same time due to synchronization problems.

It is understood that there is a common opinion that this system has positive effects in terms of providing equal time and opportunity to everyone in the individual evaluation processes of the students, especially in jury evaluations. One of the students expressed this contribution as follows: "The time limit of online education enabled everyone to use equal time in the juries. It was a positive process that contributed to us."

All of the students who participated in the interview stated that they used different tools during the pandemic process. It is seen that the tools used are basically for two different functions. It has been determined that the first of these is the tools used in terms of process management, and the second is the tools used for interactive critique sessions.

Finding of the Company Mentors

All company mentors, who evaluate it regarding the communication dimension, define this new process as a disadvantageous process compared to the pre-pandemic period by saying "not like face-to-face". However, all of the company mentors stated that since student meetings were online, they could be organized faster and easier, and they could organize the participation of experts who will contribute to the meetings more easily. One of the company mentors stated the advantages of this process as "there was a time management advantage, there was no problem of catching up". In addition, another company mentor expressed the contribution of online communication tools and environments, which he/she saw as an advantage in terms of both communication and organization, as follows: "It was easier to include different human resources in the team".

All company mentors stated that they held meetings with students regularly every week, and that there were no problems, delays or postponements during the meeting days and hours. Mentioning that they experienced technical problems such as connection problems and sound problems during their meetings at the beginning of the process, company mentors stated that these problems became less frequent as the process progressed. All of the company mentors mentioned that they experienced similar difficulties in the learning curve of the process, and that there is a learning curve in using the new environment and the new tools that are used accordingly. A company mentor, who stated that finding the right communication environment and tool in the adaptation process is a natural part of the process, expressed her experiences in this process as follows; "We used Skype, (Microsoft) Teams, Whatsapp Web, Miro and Zoom, respectively. Finally, we started sharing screens via Miro and Zoom only".

A company mentor evaluated the design process which was carried out by one of the two students, whom she supervised, via drawing on a tablet instead of paper and stated that this made a significant difference in

the online process compared to the other student, and drew attention to the importance of the tools used in the process.

All company mentors stated that they assess the performances of the students in the adaptation process as positive. A company consultant pointed out emotion management as one of the important pillars of success in project management during this process stating; "Rather than using one's abilities, personal characteristics are effective; the one who manages the stress well, wins". Two company consultants stated that they experienced Miro, a remote interactive working platform, through students for the first time and continued to use it actively within the company.

They stated that the biggest disadvantage of the process in terms of communication is the evaluation of 3-dimensional working models during the project development process. Although more than one medium such as photographs, videos and video calls are used in the evaluation of 3D models, company mentors mentioned that they could not make an evaluation that would be sufficient to offer a product development proposal over models that they could not 'pick up and take a look'. One of the company mentors stated that "maybe we became distanced from experiencing via touching and seeing". Another company consultant, however, expressed his/her opinion on product critiques in the virtual environment as "We could not create a scale in the 3D part, I could not understand, I could not feel ..., choices such as fabric, color etc. were problematic because we could not meet face to face.

All company mentors stated that the students' inability to physically experience the company conditions/ environment negatively affected the design processes. A company consultant expressed the positive contribution of the process for a student in Eskisehir who could come to visit the company within the framework of the measures taken according to the pandemic conditions by saying, "the student came by herself - this has been better/different of course"

One of the company mentors expressed the process of evaluating the final prototype as "Very troublesome and difficult. It was uncomfortable not to feel and not to see the scale". Another support that companies had difficulty in providing during the process was the delivery of the prototype, which is one of the most important elements of evaluation in the final jury. Due to reasons such as cessation of production activities, decrease in personal capacity, material supply problems, companies stated that they could not provide the prototype support this year, which they could offer in previous years. Another problem experienced in the prototyping process was that the final products which were produced by the students under their own conditions were not easily evaluated by the company consultants, as in the evaluation of 3D working models.

All company mentors who participated in the meeting expressed a common view that the graduation project should continue in a face-to-face manner, but they also approached the hybrid solutions positively due to their advantages in terms of time management.

RESULTS AND DISCUSSIONS

Due to the COVID-19 outbreak, face-to-face educational activities in higher education institutions were initially suspended; only to continue online after a while. The opportunities that online education has provided depending on time and place, i.e., flexible applications, came into play with surprising speed. This rapid transition process in the application-intensive and essentially one on one and face-to-face disciplines such as industrial design has enabled/created an environment for the discovery and application of different interface solutions and experiences. The results of the study show that Whatsapp and Zoom tools effectively meet students' (Students') online studio course requirements rather than e-mail to send videocalls, screenshots, text messages, digital models, 2-D images, and 3-D images. Similar to the results of the Ozguven et al. (2020), students found it positive to experience new communication tools in the study. The results also exhibit a strong tendency, among students, to use mobile devices like laptop computers and tablets instead of desktop computers even though most of them attended online classes without leaving home during the pandemic. The element that the students were most satisfied with was the formation of a communication triangle with the participation of the firm and the academic supervisor and allowing the participation of the technical support teams in the relevant meetings. These results show that the advances

in mobile device technologies which lead to flexible online communication and creation tools enabled Students experience an effective and creative communication chain with their supervisors and mentors. As Sonmez et al. (2018) stated, mobile technology enables users to access knowledge free from time and place constraints and is available for everyone regardless, to some extent, of income and level of education. With the onset of the pandemic, zoom was purchased and used under license by the University. It is predicted that the series of trainings and seminars organized by the university for the use of online learning tools, as well as the unlimited use of time and other tools obtained through licensed use, accelerate the adaptation process of academicians and students without interruption. As a result, all the parties of the online courses (academic consultant, learner and the company mentor) had full knowledge of the necessary technologies and applications for the online environment. A recent study by Hall et al. (2020) compares mobile learning approaches in six countries, namely United Kingdom, Australia, Belgium, Cyprus, Ireland and The Netherlands during the pandemic. The results show that what was done face-to-face before the pandemic was just carried online. The research conducted by Us (2021), it was found that the students prepared for the juries more easily, but had difficulty in getting critiques; however, it stated that the instructors are more involved than the face-to-face course. Our study on the other hand, shows that the students were able to get enough interactive critics effectively from their supervisors and mentors and also there were some enhancements on the process; i.e., the appointment system had a positive effect on Students' performances. The students' real concern gravitated towards presenting their three-dimensional design models in the evaluation juries, the most appropriate way. This concern is primarily related to shut down conditions during the pandemic and to safety precautions which the companies had to take to protect their employees. These conditions caused Students to not reach essential workshop facilities inside the companies which led to fear of making poor quality models.

There is no border to an interaction between stakeholders in online studio course, moreover, with the changes during the pandemic, time and budget management are more feasible for each and every party. Students can communicate interactively and get feedback from different perspectives from sector and university about their project by using online tools. Students' concerns are mostly about internet-related problems during final delivery and presentation of 3D design models to the jury. Inability to perform adequately in online jury evaluations is one of the anxiety points for Students. On the other hand, strict time limits, which is an integral part of online class and jury sessions, have strengthened the motivation of Students because they believe all peers had equal time limits and conditions. This supported their confidence in the process. Similarly, in the study conducted by Bingol (2020) it has been determined that a group of students in the Architecture Department encountered internet connection problems in the education process and this had a negative impact on their motivations. Disruptions experienced in the process of students accessing workshop facilities and production tools/methods, which are considered as the most important learning outcomes of the graduation project, have been identified as the biggest deficiency in the transition to online education. Due to the inadequacy of online tools in this regard, especially the problems experienced in the 3D prototyping process, getting consultancy (Bingol, 2020; Ozguven et al, 2020; Us, 2021), or working on a real model, etc. are seen as an important cause of anxiety for students.

For this, technological infrastructure may be strengthened for university students to not live with internet problems and virtual learning platforms should be developed for design education for the effective presentation of 3D models of prototypes. Thus, distance and face-to face education are not alternatives to each other. A hybrid studio education system is proposed for more qualified design studio courses.

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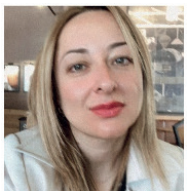

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