Research Article GU J Sci, Part B, 10(1): 31-41 (2022)

Gazi University

Journal of Science

PART B: ART, HUMANITIES, DESIGN AND PLANNING

http://dergipark.gov.tr/gujsb

A Research on Remote Teamwork in Computer Oriented Internship for Industrial Design Education

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Article Info

Received: 05/03/2022
Accepted: 21/03/2022

Keywords

Teamwork,
Remote Teamwork,
Industrial Design Education,
Internship

Abstract

Industrial designers work with different people in their professional lives. In order to train industrial designers, the acquisition of these skills and their implementation to current working styles must be studied. This study evaluated the distant group work experience of the first-year students of the Atılım University Industrial Design Department during their summer internship. Within the scope of the research, the students' end-of-training reports were analysed by the content analysis method. The findings were discussed in terms of group work and distance education in industrial design education.

1. INTRODUCTION

According to [25] one of the ways to reach the result in the quickest and most efficient way with different people is good teamwork. In their professional lives, designers work in a group including different people [15, 23, 42].

When working with a group, team spirit develops and motivation towards the work increases. An environment of trust is created in which people will not feel alone and strong communication skills are developed. Also, a common goal is determined and innovative ideas emerge while these goals are being achieved together [5, 9,42]. In addition, studies that examine the work of designers around the world with people from different disciplines and the integration of similar work practices into industrial design education which study the consistency of teaching and learning methods and assessment practices are becoming widespread in the current literature [9, 26, 27, 38].

Studies in the literature [9, 26, 27, 38] reveal that the basis of the competencies that designers use in practice is based on the knowledge and skills they learned in their internships. These knowledge and skills are acquired in summer internships (first computer oriented internships, then production and office internships), which are the courses where design students gain the most experience for their professional practice. For this reason, internships have an important place in industrial design education. Internships provide students with opportunities to "complete" the process of applying and transferring the knowledge they learn in design education to real-life situations [20] and allow students to transform their knowledge into applied skills and experiences [4,32]. In addition, these courses enable industrial design students to get to know the

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profession-specific knowledge and aim to help students develop professionalism, communication and interpersonal skills [4].

The importance of internships in the field of industrial design for design students and their necessity for education is obvious. However, the precautions taken due to the Covid-19 epidemic directly affected the functioning of the applied and formal summer internship courses. Most of these face-to-face courses have changed to online courses. When the literature was examined, it was noticed that the literature lacked studies regarding how the working arrangements of the compulsory summer internships had to be updated and become distant courses due to the Covid-19 measures and how the students perceived this compulsory change. For this reason, this research was designed to enable students to work together by supporting to learn from each other through group work in a distance internship course within the scope of the summer internship course that industrial design students have to complete at the end of their first year, and to observe how this situation is perceived by the students.

While explaining the importance of designing the distance summer internship courses in industrial design education as team work for the literature on design research, primarily industrial design education and distance education, internships in this education, and group work in distance education have been mentioned. After the literature review, the method and setup of the research and then the findings of the research were conveyed. Finally, the result of the research and the discussion were shared.

Industrial Design Education

Industrial design education in Turkey is designed to meet the anticipated demands expected to arise from the import substitution strategies implemented in the 60s and 70s [12]. Today, design education supports the training of designers who are ready to work in the industry with the compulsory studio and support courses in their curriculum, and with the help of elective courses, it allows design students to gain knowledge and skills according to their interests [13].

The design education curriculum also includes a wide range of practical and theory-based elective courses that offer specific skills, knowledge and experiences [29]. In addition, design students must complete two different summer internship applications, one from manufacturing companies and one from professional design offices, to learn in context.

In the curriculum of Atılım University Industrial Design Department, where the research was conducted, the design studio courses are accompanied by compulsory courses that provide students with detailed theoretical and technical knowledge and skills. The design education curriculum includes visualization and modeling techniques, including freehand drawing techniques, technical drawing, model making, and computer-aided 3D modelling; and material knowledge, production techniques, ergonomics, user research, marketing, design management, history of design, and cultural and critical aspects of design [38]. Computer Summer İnternship with the code EUT299 is organized by Atılım University Industrial Design Department with the aim of providing first-year students with the necessary basic knowledge and experience to improve their presentation skills by using computer aided design programs. Internship classes, which were held face-to-face before the Covid-19 epidemic, had to be done online due to the pandemic. While homework that focuses on computer-aided presentation programs was given in order to measure the individual knowledge and skills of the students in face-to-face education, this process could not be followed in the distance internship courses. The fact that online video conference courses replaced physical environments negatively affected students' motivation to work individually [8]. For this reason, the EUT299 coded internship course held at Atılım University Industrial Design Department was designed with a focus on online group work in order to increase students' motivation to learn, enable them to learn from each other, develop better communication skills with each other and educators, and increase learning interactions.

Distance Education

Looking at the definitions of the concept of distance education, the USA Ministry of Education defines distance education as an education system that uses one or more kinds of technology to instruct students

who are separate from the instructor and to support regular and meaningful interaction between students and instructors, synchronously or asynchronously [36]. According to [31] distance education has been used to bring education through print media, radio or television to thousands of people who would never be able to go to school or college. [17] also defined distance education as a structured form of education in which students and instructors become independent in terms of space and sometimes time. According to Simonson's transfer from [11], distance education is generally a planned and systematic activity which is conducted by closing the physical distance between the student and the teacher and which includes the selection of teaching materials, their didactic preparation and presentation, and the supervision and support of student learning through the appropriate technical environment.

The roots of distance education are at least 180 years old. An advertisement published in a Swedish newspaper in 1833 may be considered as the first attempt which gave the opportunity to study "Composition by Mail". Distance education crossed the Atlantic in 1873 when Anna Eliot Ticknor founded a Boston-based association to promote home-study. The Society to Encourage Studies at Home has attracted more than 10,000 students in 24 years and the classical curriculum students who were mostly female corresponded monthly with teachers conducting guided readings and frequent tests. The process continued with radio channels in the 1920s and experimental television training programs in the early 1930s, and the use of educational television began to spread with the use of satellite technologies in the 1980s. In the late 1980s and early 1990s, the development of fiber optic communication systems allowed the expansion of live, two-way, high-quality audio and video systems in education. Since the mid-1980s, both credit and non-credit courses have been offered online. In most cases, a teacher organizes course materials, readings and assignments, students read the material, watch videos, listen to recordings, complete assignments, and participate in online discussions with other classmates [34].

Massive Open Online Courses (MOOC) within the concept of distance education is one of the most prominent trends in higher education in recent years, which first came into our lives as a term in 2008 [10]. It represents open access, global, free, video-based educational content, problem sets, and forums available to a great number of participants who aim to take courses or learn through an online platform. MOOC brings together academicians and students from all over the world thanks to the flexibility of time and place [3]. Courses are a digitized version of a traditional lecture classroom, with sessions usually recorded as video, audio, and broadcast online [34]. In the fall of 2019, there were 7,313,623 postsecondary students enrolled in any distance learning course in the USA [37]. In 2020, the number of MOOC participants in the world (excluding China) exceeded 180 Million [35].

In addition to online courses, distance education has become a special field of study in higher education in the last 10 years [2, 6, 10, 39, 43]. Especially with the pandemic that emerged in 2019, distance education has replaced traditional classroom education with online, offline or hybrid education models. These concepts have also expanded the scope of distance education models [17, 19].

Distance Education in Industrial Design Education

In the background of the Covid-19 measures, how to develop industrial design capabilities with distance education and the education strategies developed in this context [1, 28] have become a prominent issue in design education researches.

The skills gained in industrial design undergraduate education can also be developed through distance design education using the developing technology [5,7,14, 30]. In design education, with distant working, design students in different places can work together in groups and especially workshops and internship studies which have time limits can be carried out efficiently [5,30].

Remote Teamwork in Industrial Design Education

There has been a continuous shift from work organized around individual jobs to team-based structures [18]. Groups offer more adaptability, productivity and creativity than any individual can offer and provide more complex, innovative and comprehensive solutions to organizational problems [33].

In addition, the changing and difficult definitions of design projects have led designers to work with other people to solve these problems [21, 41]. For this reason, it is very important for design education that design students, as future designers, are experienced in working in groups and learn to work and interact effectively in groups (Figure 1).

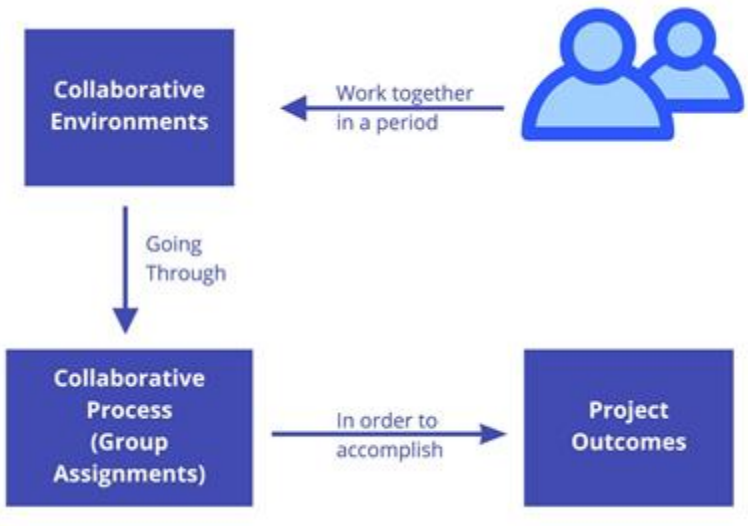

Figure 1. *Interactions in Group Work [24]*

Due to the COVID-19 pandemic, home-based learning has become the new norm in education and new teamwork challenges have emerged [16]. Team projects have also changed, as most face-to-face classes have changed to online classes.

Teamwork is a common practice in the design and media industry where projects are at scale; therefore, teamwork has often been one of the assessment criteria that imitated real-world work scenarios, thus enabled students to be better prepared for employment in the industry [42].

Collaboration and team-based working practices have become common in industrial design education with the pandemic. Because of this relatively recent development, group work (hereinafter the terms "team" and "group" and "teamwork" and "groupwork" will be used interchangeably in this article) has become the basis for much of design students' learning. Experiencing the compulsory interaction of team members with each other in the process of group work in undergraduate courses and internships creates awareness of professional life in design students [22,42] as a team, to make decisions together, to collect feedback and to make presentations together at different stages of the design process [40].

2. METHOD

This study was carried out in the summer term within the scope of the computer summer internship of the first year students in Atılım University Industrial Design Department. The main subjects of the internship course are determined as follows in order to strengthen the knowledge and skills acquired in the first year, to create a basis for the second year target acquisitions and to prepare the students for professional life:

- Group work,
- Computer aided two-dimensional visualization,
- Research on design,
- Visual and oral presentation.

In line with these subjects, the courses were designed as learning the 2D visualization programs during the first two weeks and as a literature review and research presentations with group work for 3 weeks (***Figure2***). Lessons and group studies within the scope of this study were carried out as distance education due to the health measures taken against the Covid-19 pandemic. By randomly assigning students to study groups, a total of 8 groups were formed, with 4 or 5 people in each group.

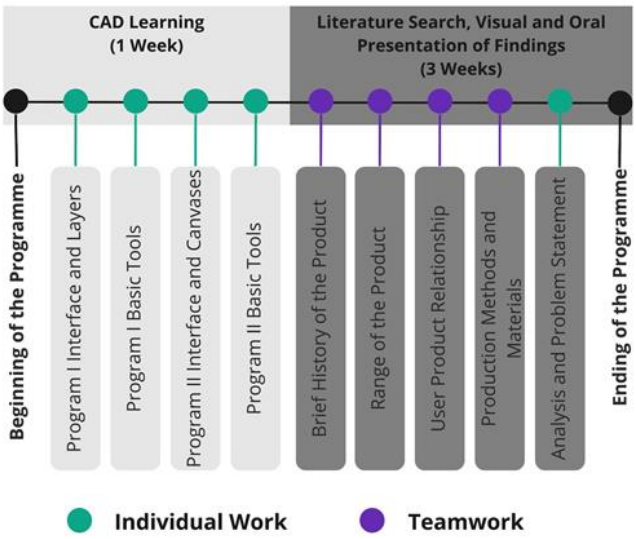

Figure 2*. Lesson Plan*

The first week of the study was planned as the introduction of the course on the first day and the setting of the programs, the Adobe Photoshop program on the following two days, and the Adobe Illustrator program for the last two days. The students were in contact with the lecturers through the conference program during the course. During the 3 weeks planned as group work, one product per week was assigned to the groups. The students in the group made research and presentations within the scope of certain titles specific to the assigned product for 4 days a week: (**1**) Product history, (**2**) Product range, (**3**) Product-user relationship, (**4**) Production techniques and material analysis. In order to evaluate the students individually, on the last day of the week, the students were asked to choose a specific model from the product group that had been researched as a group throughout the week and individually prepare a presentation containing product analysis and problem definition.

This study was conducted with 38 students, 20 female and 18 male students. Before the lesson starts, students' group work experience and knowledge of using 2D drawing programs to prepare presentations are at equal levels among the class.

Collecting and Analyzing the Data

The research data were collected by the participant observations of the course instructors and the internship reports written by the students at the end of the internship. Internship reports, including open-ended questions were structured as (**a**) internship content, (**b**) knowledge and skills gained, (**c**) outputs obtained, and (**d**) suggestions and opinions, and the data analysis obtained was supported by participant observation findings. The students' end-of-internship reports were independently coded by the authors of the study with content analysis. Data describing and exemplifying the findings have been added to the Findings section with direct citation.

Materials

Because the course is carried out as distance education; 2D visualization programs, online conference program, web-based learning platform and open education materials determined by the lecturers were used.

2D visualization programs, one pixel-based and one vector-based; are programs that are widely used by design professionals.

4. FINDINGS

In the findings section of the research, the findings obtained by the content analysis of the internship reports prepared by the students at the end of the internship are included.

Table 1. *Analysis Outputs of the Obtained Data*

Design Education				
Group Work	**Knowledge and Skills Regarding Design**			**Distance Education**
Preparation for professional life	Computer aided 2D Visualization	Design research	Visual and oral presentation	Difficulty of not being face-to-face
Learning to work together	Preparing presentation sheet and sketches by using programs	Making research on different subjects about design	Improving oral presentation skill	
Acquiring new skills by working with different people	Using advanced level program	Making an extensive resource review	Gaining the skill of visual presentation	
Task distribution in group	Learning more programs			
Communication in group				
Transferring knowledge in group				

4.1. Group Work

Group work is the theme that the participants expressed the most in the report they prepared.
stands out as. It was observed that most of the participants considered group work and the achievements related to group work as a professional experience and development. For this reason, it was concluded that the students considered group work primarily as preparation for professional life.

During group work, students learned to distribute tasks to complete the daily research and presentation. Task distribution topics are determined as the subject and resources of the research to be carried out by each group member, the selection of the form of the visuals for the research sheet, the preparation of the layout, the finalization of the sheet and the distribution of the oral presentation at the end of the day. The students were encouraged to take on different tasks, but the tasks were not assigned by the instructors in order to help the students improve their intra-group communication. For this reason, in some of the student groups, some group members tended to repeat the same task, while the rest of the group members did different tasks every day. One of the students who did not have absenteeism expressed the division of tasks in their group as follows:

> *"During the research and presentation weeks carried out in groups, the tasks were distributed according to the product and the researched subject in a way that corresponds to one person each week. In this way, everyone in the group researched one of the subjects at least once and saw what they should pay attention to while researching."*

Due to the fact that the students have received distance education completely since the beginning of the university, their experience in co-production has been quite low. For this reason, the internship program, which is the subject of the study, provided the students with an experience of making design decisions together. Students produced by sharing ideas and discussing in order to distribute tasks, decide on the presentation material among the research findings and prepare the presentation. Intra-group communication arising from this study was one of the most emphasized group work achievements by the participants. The

majority of the participants stated that they learned how to convey their thoughts correctly in group communication. In addition, intra-group communication also provided information transfer. One of the students described the transfer of knowledge with the following statements:

"We have improved our knowledge in the programs by transferring to each other, and we have made strong progress day by day by making up for our lacking skills."

The common view of the participants about the group work is that group work is an important experience to prepare for professional life by learning to work together, to produce with different people, to communicate in a group. Although those acquisitions have been gained during the internship, there are subjects that are still required to be developed. Among the participants, students emphasizing the benefits of working with different people suggested continuous group exchange during the internship. The majority of the participants found it necessary to increase individual work as well as group work.

4.2. Design Education

The feedbacks on the acquisition of knowledge and skills related to design and distance education, which are the other subjects on which the feedbacks of the participants are concentrated, are gathered under this heading.

The majority of the participants stated that they gained skills from the internship as a design student right after the group work. Under this topic, most of the opinions were about computer aided two-dimensional visualization. Other topics that are often mentioned are design research and presentation.

The students learned how to prepare a presentation sheet by using *computer aided visualization programs*. The two skills that come to the fore are the preparation of the layout through the programs and digital use of hand drawings by scanning. Students emphasized program skill acquisitions in terms of presenting their projects in a better way. After the internship, a student expressed the importance of program learning as follows:

"Thanks to these skills, I can edit photos and transfer the layouts I designed in my head into reality."

During the internship, students learned two visualization programs, focusing on layout preparation. Some of the participants found it negative that the learning program was limited to the tools required for interface and layout preparation. The majority of these criticisms were made by the students who stated that they wanted to have more detailed information about the programs. Participants did not specify for what purpose they would like to use the more detailed program (i.e. photo manipulation, vector drawing, etc.). In addition, there are participants who stated that the number of learned programs should be increased. These participants did not specify the programs they wanted to learn.

To sum up, instead of learning two programs at the beginner level, there are participants who expect to learn one of the programs at the beginner level and specialize in the other, or to get to know many professional computer programs at the beginner level.

Design Research is the literature review process which is made at the beginning stage of design. Researching the history, product range, production techniques and user experiences of different products in a limited time and comparing and examining the accuracy of the information obtained from different sources has been an intensive research practice for the students.

The majority of the participants stated that doing a comprehensive research on design issues was a positive research experience for them. Despite this, the research of the products determined at the beginning of the week under different headings was criticized by some of the participants as it was a repetitive research topic and they stated that they would prefer to conduct research on different subjects.
At the end of the day, students shared their research with the class and made a presentation. For this reason, the internship process provided intense visual and oral presentation experience for the students. One of the students stated what they learned under the title of outputs obtained from the internship as follows:

"While preparing the presentation sheet, we must find the information from reliable sources and convey the information using keywords. We must express ourselves correctly while presenting. While conveying the information we will share briefly and concisely, we should include images that are compatible with them."

The majority of the participants stated that they improved their *presentation skills*. For the presentation, the students selected the correct and important information by comparing the findings of their research. In order to convey this information in an interesting way in visual presentation, learning the layout of the presentation and the use of visuals has come into prominence. Participants also emphasized that they improved their verbal presentation techniques.

This internship, which was carried out as distance education due to the Covid-19 pandemic requirements, also enabled students to learn distant group work in design education. The conditions of distance education was the subject with the least opinions among the subjects stated repeatedly by the participants. During the assessment, one student summarized his distance education experience as follows:

> *"..., in the online system, sitting in front of the computer from 9.30 to 15.30 became boring, not during the first days but on the following days, and especially on group work days it caused unwillingness, ..."*

The majority of the participants described the conditions of distance education as a challenging situation where they sit for long periods of time in front of the computer. Also, the participants stated that not working face to face in group work caused difficulties.

5. CONCLUSION

When existing studies are examined, it is seen that internship courses in industrial design education are very helpful in preparing students for their professional life [1,16,22,28,40,42]. This article was designed to enable students to work together by supporting their learning from each other through group work in a distance internship course within the scope of the summer internship course that industrial design students have to complete at the end of their first year and to investigate how this situation is perceived by the students and aimed to share the findings obtained from the study. For this reason, it has been examined why a summer internship course with the focus of individual and group work as distance education during twenty working days is important in terms of industrial design education.

Students generally evaluated distance group work under three headings; They commented on how they perceived group work, distance education and knowledge and skills gained through group work. Subjects such as learning from each other and preparing for the profession, which were explained in the findings part of the study, as [20] stated, were evaluated by the students during this internship course which was carried out with the focus of distance group work. According to the students, it offered opportunities for them to experience the process of applying and transferring the knowledge they learned in design education to their real-life counterparts. All of the students stated that they learned to work together through group work carried out in the internship course. In fact, the majority of them stated that working with different people gave them new skills and they emphasized social skills by defining skill acquisitions as sharing ideas and working in harmony. These findings support the importance of group work [22,40,42] for industrial design education [13,21,41] in the literature review. However, this study was carried out with the participation of a certain number of students for a short time. The importance of this situation in terms of design education can be discussed by designing a practical course to be held as distance education, with the focus of group work, for a longer period of time and with the participation of more students. In addition, it can be discussed how this internship can be reconstructed in terms of design pedagogy and how it will help to determine different educational strategies in the internship focus, based on the comments made by the students.

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