

REFLECTION OF EMPATHIC DESIGN PROCESS ON INTERIOR ARCHITECTURE STUDENTS' UNIVERSAL DESIGN SOLUTIONS (1)

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INTRODUCTION

In design education, applying universal design (UD) and human factors/ergonomics (HF/E) principles can be a complicated task in practice for students who must apply these principles in their designs. Designing products and architectural spaces according to the UD principles make products and environments usable to the greatest extent by people with diverse abilities. The important thing is that the student designers should involve people with disabilities with an increased awareness and without any discrimination and stigmatization of users in their designs. This could be achieved by gaining empathy toward people with disabilities' as well as their needs, problems, and expectations from the environment or products in design studio process. In this respect, the purpose of this study is to explore the empathic design (ED) approach as a design learning and experiential tool in interior architecture education regarding the pedagogical outcomes and process assessment of ED. So, the main aim of this study is to investigate the role of three ED techniques on undergraduate interior architecture students' UD solutions in the design process. To explore the effects of building empathy and its reflections in design studio process, it investigates how experiencing ED process has an impact on students' empathy level, decision making process and perceptions of learning experience.

Design studio process is important as the focal point of interior design education and all the other courses taught in the curriculum are associated with the design studio (Demirbaş and Demirkan, 2003; 2007; Uluoğlu, 2000). Design is a problem-solving process and the extent of experience of designer is significant. In traditional design studios, mostly passive roles are adopted by students such as listening, note-taking, following the instructions, and practicing them as discussed in critiques (Boudhraa et al., 2021; Goldschmidt, 2002; Sagun et al., 2001). Hence, there need to be additional and supportive methods that should be included in traditional

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design process that would enhance the experience of students. ED could be added as a supportive method in design process since it enhances students' empathy ability towards all people and interactions with people who they design for (Heylighen and Dong, 2019). Also, it develops their imagination in use of the product or environment that they created while increasing their creative thinking for innovative design solutions and providing codesign activities.

Following the introduction, this paper is organized in five sections. In the first section, we discuss the theoretical framework based on ED approach to achieve the needs of users with diverse abilities in interior design process. In the second section, we describe the ED process under the methodological approach of the study that also consists of participants, experimental setting, instruments, procedure, data collection and data analysis methods. Then in the third section, we present the results based on the quantitative, qualitative, and mixed data analysis. In the discussion section, qualitative and quantitative findings of this research are compared in terms of similarities and differences with the present literature sources in which the theoretical framework is grounded. Finally in the last section, we draw conclusions and discuss the strengths and limitations of the ED approach in design studio process.

THEORETICAL FRAMEWORK

ED approach enhances the design experience of students as it is presented into the design studio process. Integrating ED approach to design studio process improves students' awareness of human experiences, and more universally designed environments are generated through applying UD and HF/E principles in design process.

Universal Design in Design Process

UD is described as "an approach to creating environments and products that are usable by all people to the greatest extent possible" (Mace et al., 1991, 156). Later, this definition is extended by the addition of 'without the need for adaptation or specialized design' (The Center for Universal Design, 1997). This implication indicated that UD dismisses the adaptable and special design approaches for facilitating the requirements of people with diverse abilities and elderly (Erkılıç, 2011). The aim of UD is not only to create better design solutions, but also it emphasizes the process of designing products or environments by considering all people regardless of their age, ability, or size of users (Ostroff, 2001). A number of experts in the fields of architecture, product development, engineering design at North Carolina State University developed the seven principles of UD namely as (1) Equitable use, (2) Flexibility in use, (3) Simple and intuitive use, (4) Perceptible information, (5) Tolerance for error, (6) Low physical effort and (7) Size and Space for approach twenty-eight guidelines (The Center for Universal Design, 1997) to lead designers in developing UD solutions. The researchers expressed that the principles of UD were not developed just for good design, but these were developed for universally usable design. They also added that other factors such as aesthetic, cost, safety, gender, and culture should be considered.

To fulfill the need of users with a wide range of abilities, there is a growing awareness on UD among designers and design educators (Afacan, 2008; Altay and Demirkan, 2014; Demirbilek and Demirkan, 2004). Several studies in the educational field emphasized the importance of UD

education and integrated UD approach into the design process by applying various pedagogic strategies and methods and utilized the seven UD principles as an evaluation method in their studies. For instance, Olguntürk and Demirkan (2009) designed the objectives of the course called 'Current Issues in Interior Design I/ Universal Design' based on the seven principles of UD the principles of HF/E in the Department of Interior Architecture and Environmental Design at I.D. Bilkent University, in Ankara, Turkey. This course used two teaching approaches; one was based on lectures, and the other one was building evaluations from students. According to the students' feedback, they acquired more information about principles of UD and HF/E and their skills in the evaluation of public building according to the UD and HF/E principles were increased. Also, their design solutions were enriched (Olguntürk and Demirkan, 2009). Ergenoğlu (2013) investigated how UD could be integrated into design thinking among undergraduate architecture students at Yıldız Technical University, in Istanbul, Turkey. The aim of the study was to assess the level of awareness of students in accessibility issues in designed spaces using a multi-dimensional approach. Different teaching methods as lectures, seminars (by the lecturer and people with diverse abilities about sharing their own experiences), site visits, role-playing exercises and video presentations were applied into the UD course. Ergenoğlu (2015) also developed a learning method and presented a UD education model for architecture students. Another similar study (Helvacioğlu and Karamanoğlu, 2012) underlined the significance of UD in education process and the awareness of the UD concepts. Researchers interviewed students from the department of Interior Architecture and Environmental Design at Atılım University, Ankara, Turkey. The researchers found that most interior design students need to know the concept and context of the UD. So, the researchers suggested that there should be more educational settings such as workshops, courses, conferences, etc., to develop UD concept in academic and design environments (Helvacioğlu and Karamanoğlu, 2012). Another similar experimental course module was developed by the educators in the Institute of Design at Oslo School of Architecture and Design, Norway (Vavik, 2011). The researcher proposed a holistic model with a pedagogical aim and embody user involvement in UD process in the course called 'User Oriented Design'. Students made direct contact with their end users and designed for them. At the end of their meetings, the students stated the user involvement forced them to gain experience while using this learning strategy. Another strategy as an experimental learning of disability was used by Mulligan, Calder and Mulligan (2018) in architectural education, in New-Zealand. Their study highlighted that UD need to begin at the start of the design process. The experiential learning module about UD was developed by collaboration among architectural design teaching staff and research physiotherapists who are experts in disability issues. The module composed of three parts 'an information session, a practical role-playing experience, and a supported reflection and discussion session' and was experienced by the twenty-four undergraduate architectural students. According to the findings of the study, students' perceptions of UD were explored in their reflections on their design practice and students learned about the perspectives of people with diverse abilities. Furthermore, Dong (2010) studied different teaching strategies with undergraduate design students to teach UD, in United Kingdom and researcher proposed using personas, scenarios and co-design may be applied as different strategies. In these studies, the holistic way of teaching was supported, and multi-dimensional approach is suggested and stated that UD education should

involve mixed methods (Dong, 2010; Ergenoğlu, 2013; 2015; Helvacioğlu and Karamanoğlu, 2012; Mulligan et al., 2018; Olguntürk and Demirkan, 2009; Vavik, 2011). As critical reflection, self-awareness of learning, observing, experiential learning are the tools that researchers emphasized besides lecturing, discussing, and searching. To create universally designed products or environments, designers need to increase their empathic understandings, as empathy is an inseparable part of design that enhances the living qualities of people (Campbell and McDonagh, 2009). As an additional and supportive educational method, empathic design and its research techniques and strategies could be used in design education.

Empathic Design

Empathic design is an observation-oriented research method (Leonard and Rayport, 1997) and as one of the human-centered design approaches (Steen, 2011) that has been used since the late 1990s (Suri, 2001). Design researchers mainly focused on exploring the empathic ways of learning and assessed the empathic process by gathering reflections from students. They reported positive impacts of ED process in design, as they received positive feedbacks on students learning experience and outcomes (Altay, 2017; Altay et al., 2016; Altay and Demirkan, 2014; Surma-aho and Hölttä-Otto, 2022).

Several techniques and research strategies were developed for providing a deep understanding of people with diverse abilities. Kouprie and Visser (2009) emphasized that empathy can be enhanced by stepwise process and developed a framework that consists of four phases: (1) discovery, (2) immersion, (3) connection and (4) detachment. They divided ED techniques into three major research strategies in the design process. Firstly, techniques for creating “direct contact between designers and users (research)” (Kouprie and Visser, 2009, 439) that include several techniques, such as observing, interviewing, and codesigning. In design process, as an example, students observed people with diverse abilities while conducting physical activities at their home by a field visit and obtained direct feedback on the use of the environment or products. In addition, students collected data about user’s needs and problems by interviewing them or their relatives (Altay, 2017; Gomez-Lanier, 2018; van Rijn et al., 2011). Also, some studies investigated how codesigning with people with diverse abilities’ have an influence on students’ design solutions (Hess and Fila, 2016; Ho, Ma and Lee, 2011). Secondly, “techniques for communicating findings of user studies to design teams (communication)” (Kouprie and Visser, 2009, 439) that could be practiced, when it is not possible to have direct contact with users. Students collected data about users by using special communication tools such as storyboards, personas, empathy map (EM), (Bairaktarova et al., 2016; Tschimmel, 2012) or video recordings (van Rijn et al., 2011). Thirdly, “techniques for evoking the designer’s own experiences in a domain relevant to the user (ideation)” (Kouprie and Visser, 2009, 439) were realized by taking the perspective of users or assimilating their abilities and act as a user, called role-playing. In many studies, students assumed people with diverse abilities’ role by restricting their sensorial or physical abilities to deeply understand their problems, encountered obstacles and experiences in a campus environment (Altay and Demirkan, 2014; Altay et al., 2016; Kocaoğlu and Demirkan, 2019; Mulligan et al., 2018). However, most instructional research in interior architecture focused on research and ideation phases, but rarely investigated communication, and comparison of these three techniques. In

this respect, this study aims to investigate the effectiveness of the three ED techniques and explores how experiencing ED process reflect on students' empathy, design process and perceptions of their learning experience. As a result, the research questions are proposed as follows:

1. How does experiencing empathic design process affect interior architecture students' individual differences in multiple dimensions of empathy?
2. How does experiencing empathic design process reflect the interior architecture students' design process based on finding universal solutions?
3. What are the reflections of experiencing empathic design process on students' perceptions of their learning experience?

THE EMPATHIC DESIGN PROCESS

In this section, the ED process is grounded on the four phases of Kouprie and Visser's (2009) study that is structured on Merrill's First Principles of Instruction (Merrill, 2002) is explored. Also, the participants, experimental setting, instruments, procedure, data collection and analyzes methods are introduced.

The objective of this study is to investigate how experiencing ED process have an influence on students' design process. The assumption is that more universally designed interior projects would be created if empathic understanding is promoted by integrating problem-based learning with collaborative group tasks into the interior design process. The methodology of the study involves mixed research method. The empirical research is carried out based on the four phases of empathy framework (discovery, immersion, connection, and detachment) presented by Kouprie and Visser (2009) and the educational objectives of the study are structured according to Merrill's First Principles of Instruction (1. problem centered, 2. activation, 3. demonstration, 4. application, and 5. integration) (Merrill, 2002) (**Figure 1**). The study is accomplished at a digital environment. Students conduct the tasks by participating in online sessions, because of Covid-19 pandemic.

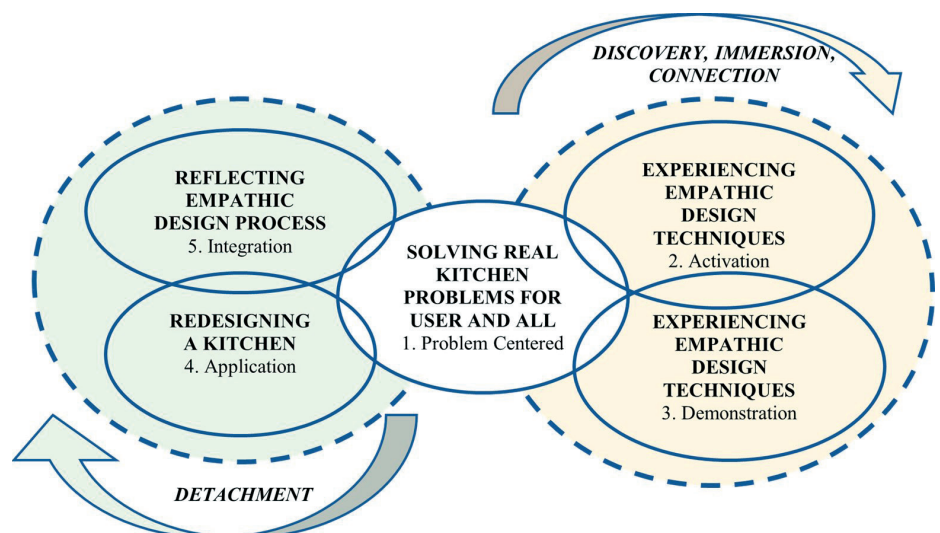


Figure 1. Conceptual framework based on the four phases (discovery, immersion, connection, and detachment) of empathy framework (Kouprie & Visser 2009) and Merrill's First Principles of Instruction (1. problem centered, 2. activation, 3. demonstration, 4. application, and 5. integration) (Merrill, 2002).



Figure 2. The user kitchen environment from two points of view (Source: First Author).

Participants

The approval of the ethics committee at I.D. Bilkent University was obtained before starting the experiment (No: 2020_11_23_01). The participants are twelve second-year students (9 female and 3 male) ($M_{age} = 23$ years) from the Department Interior Architecture and Environmental Design at I.D. Bilkent University. Participation in this study is entirely on voluntary basis. The user of this study is a woman at the age of 60 with the height of 1.55 cm and has a broken arm caused by a home accident. She thinks that her kitchen is not particularly useful, accessible and do not have appropriate size and spaces.

Experimental Setting

The experimental setting is an online environment where all students participate in online sessions. Group A visited the user's kitchen environment, Group B attended the lecture and created an EM and Group C conducted the role-playing activities in their own kitchen environment. All groups participated in design sessions and group interviews on the online environments. The user kitchen environment is on an apartment flat (135 square meters) with a balcony (3.5 square meters), has L-shaped layout type and has a floor area of 16 square meters, and its ceiling height is 2.60 meters (**Figure 2**). This kitchen involves some interior design features that are not designed according to the UD principles and guidelines.

Instruments

The instruments used for the quantitative data collection consist of the Interpersonal Reactivity Index (IRI) developed by Davis (1980; 1983) and the kitchen survey that is adapted from Afacan and Demirkan's (2010) study. The instruments for qualitative analysis are the design brief, lecture on ED, researcher's logbook, and semi-structured interviews.

Procedure

The students are randomly assigned to four groups, each composed of three students (S1, S2 and S3) and labelled as Group A (S1A, S2A, S3A), Group B (S1B, S2B, S3B), Group C (S1C, S2C S3C), and Group D (S1D, S2D S3D) as the control group. Students are asked to complete seven tasks in one week (**Figure 3**). At the beginning of the experiment, the multiple dimensions of empathy, namely as, fantasy (FS), perspective taking (PT), empathic concern (EC), personal distress (PD) are measured by IRI (Davis 1980, 1983). Firstly, students in each group (A, B, C and D) filled

out the IRI and sent their responses to the researcher via e-mail (task 1). Then Groups A, B and C experienced three different ED techniques in three days. Group A built direct contact with the user by interviewing and observing. Group B experienced techniques for communicating, as they attended a lecture about ED and learned special communication tools, observed the user through video and created an EM. Group C (each member) was asked to play a broken arm role and perform the role-playing activities (cook pasta for one person and eat it) in their own kitchens. In order not to create hazardous situation for students, a helper guided each student and recorded the video. Group C members attended the others' sessions to watch their friends' activities (task 2, discovery, immersion, and connection). Then, each group (A, B, C and D) redesigned the user's kitchen with an increase in understanding of user needs and considering all people's challenges for generating improved design solutions. Four independent online meetings were organized in two days and duration of each meeting was 2.5 hours. The design brief and the plan drawing of the user's kitchen were uploaded for each group. The researcher observed the students without interfering with their design decisions. The design sessions were recorded (task 3, detachment). Then, only Group A visited the user's kitchen in an online session and presented their design ideas

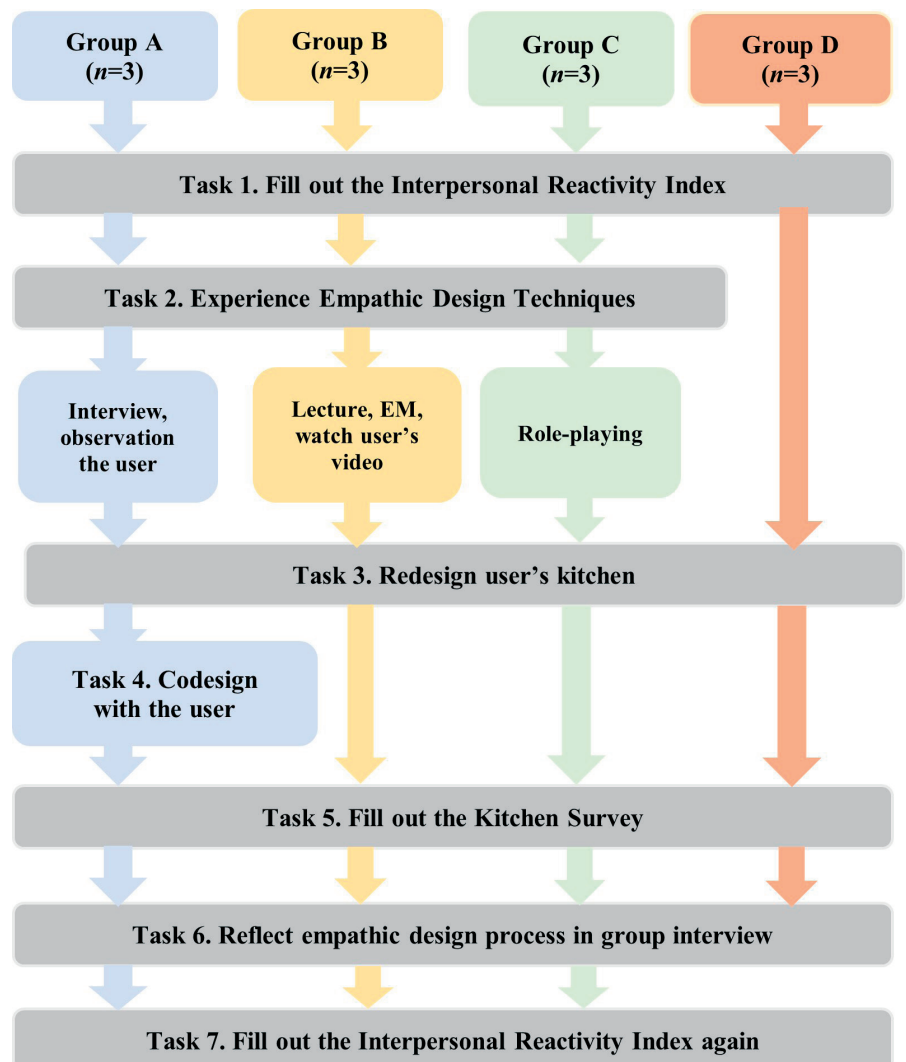


Figure 3. Procedure of the study showing the tasks accomplished by all groups in the empathic design process.

and codesigned with the user (task 4). Students in all groups were asked to fill in the kitchen survey from the user who has a broken arm's point of view. They were asked to rank the importance level for each 47 kitchen design items on a scale of 1-5 (1 being the least important and 5 the most important) (task 5). All students participated in the group interview to discuss and share their experiences in ED process and answered the researcher's questions. The interview session was recorded (task 6, detachment). At the end of the group interview, students were asked to fill in the IRI again and send their answers to the researcher (task 7) (Figures 3-7).

According to Merrill's First Principles of Instruction (Merrill 2002), students were asked to complete the learning tasks and solve the universal kitchen design problems (principle 1: problem-centered). Students remembered the relevant previous ED experiences in the design process (principle 2: activation). Demonstrations like information from a lecture to be given to the students, interview, and EM are considered as new knowledge (principle 3: demonstration). Students were asked to apply their newly acquired knowledge and empathy skills in solving a kitchen design problem in the redesign of the user's kitchen (principle 4: application). Lastly, students were encouraged to reflect on and discuss the new knowledge and skills in group interviews and expected to transfer them into their future design projects (principle 5: integration).

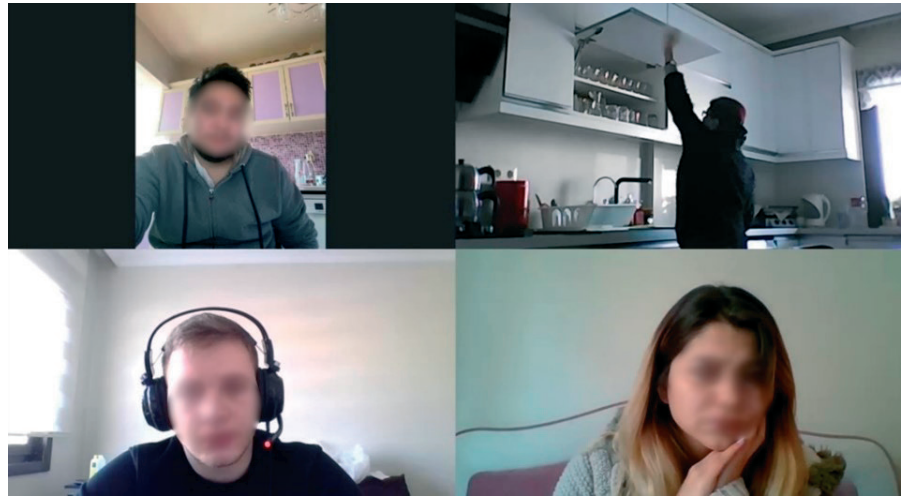


Figure 4. Group A observing the kitchen activities of the user.

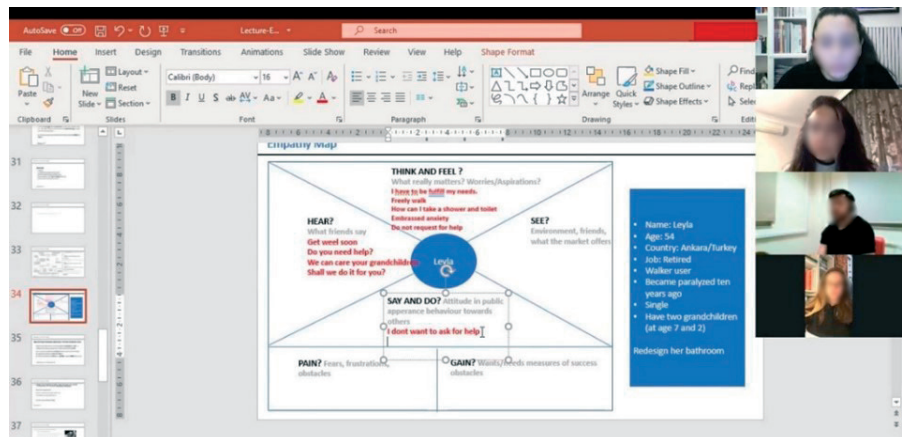


Figure 5. Group B listening to the lecture and learning to make an EM.



Figure 6. S2C conducts role-playing activities while other members and researcher watches her.

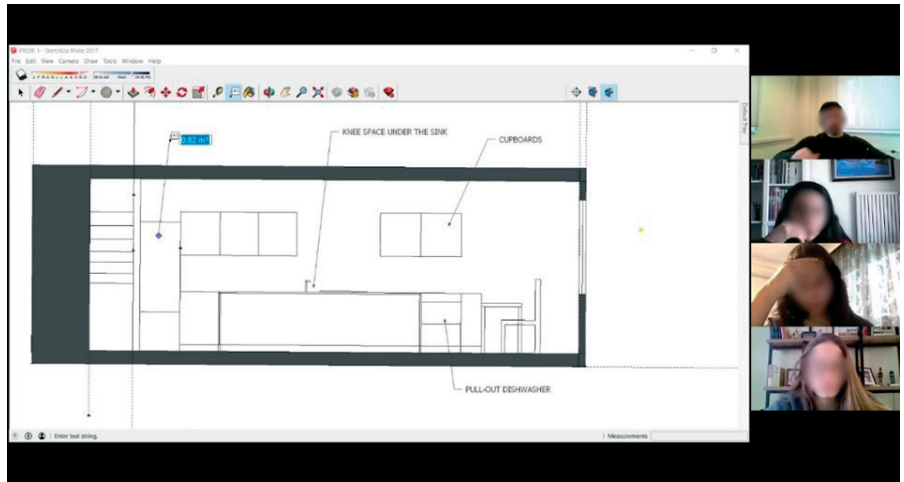


Figure 7. Group B re-design user's kitchen collaboratively as researcher observes them.

Data Collection and Analysis Methods

The data collection methods of qualitative research are behavioral observations, researcher's logbook, video recordings of online sessions, verbal response measurements (group interview and design conversations). The data collection methods for quantitative research are written response measurements of IRI (Davis, 1980; 1983) and the kitchen survey developed in Afacan and Demirkan's study (2010). The kitchen survey originally consisted of eight categories and 87 items that aims to identify the kitchen needs of diverse user groups, but the detailed 40 items related to controls and appliances are not included in this study, since the requirements of the design brief do not involve the fine details about them. Consequently, the kitchen survey used in this study consists of 7 categories and 47 items. Mixed data analyses are used. The qualitative data analysis method is thematic analysis. The transcripts from video records including data obtained from the group interviews, and design conversation protocols are analyzed by the thematic analysis. Schön (1987) stated that reflexive conversations as protocols should be analyzed deeply to understand teaching and learning processes. The six-phase approach developed by Braun and Clarke (2006) are followed and the codes are manually identified in manifest level with the reference to Boyatzis's study (1998) and characterized as data driven. The codes are identified as the code label, the



Figure 8. A visual presentation of codes in theme groups.

definition of what the theme contains, and the relevant indicators that are determined and lastly the examples are presented as differentiation in each group. Then, the visual presentation is generated to see the similarities, differences, and relationships between codes (Figure 8). Then, codes are examined and collated into potential themes. The collated codes are reanalyzed and developed by generating thematic maps, then themes and subthemes are defined and named, and the report is produced.

The quantitative data analysis is conducted through statistical analysis methods consisting of descriptive statistics and correlation analysis. All quantitative data were analyzed by using the Statistical Package for the Social Sciences (SPSS, version 19) software.

RESULTS

Analysis of the IRI and the kitchen survey provided the data for the quantitative data analyses. Students' reflections on the ED process that were the results of the thematic analysis and the information transmitted in the design conversations related to the design process provided the data for the qualitative data analysis. Furthermore, correlation analysis among the universal kitchen design items and the corresponding themes are explored.

On the Analysis of the IRI

To answer the research question 1, the univariate analysis of variance test is used to find out if there is a significant difference between the IRI scores of pre-tests and post-tests (Figure 9). Each response from Groups

A, B, and C were scored and calculated into four different dimensions of empathy considering both cognitive (FS and PT) and affective (EC and PD) components of empathy. As seen in Figure 9, the descriptive statistics and the univariate analysis of variance indicated that in FS dimension the scores of both Group A ($M_{pre} = 16.00$, $SD = 7.81$, $M_{post} = 18.33$, $SD = 6.51$) and C ($M_{pre} = 17.33$, $SD = 4.62$, $M_{post} = 19.33$, $SD = 1.53$) have increased, while Group B ($M_{pre} = 21.33$, $SD = 5.04$, $M_{post} = 20.00$, $SD = 6.08$) has decreased. In PT dimension the scores of Group B remained almost constant ($M_{pre} = 23.00$, $SD = 3.00$, $M_{post} = 23.00$, $SD = 4.36$), Group A had a small decrease in scores ($M_{pre} = 19.00$, $SD = 2.00$, $M_{post} = 18.33$, $SD = 5.78$) and there was an increase in the scores of Group C ($M_{pre} = 16.00$, $SD = 2.65$, $M_{post} = 19.33$, $SD = 2.08$). In EC dimension, the scores of Group A ($M_{pre} = 18.33$, $SD = 3.06$, $M_{post} = 18.00$, $SD = 3.60$) and B ($M_{pre} = 18.67$, $SD = 2.08$, $M_{post} = 16.33$, $SD = 3.21$) have decreased, but in Group C ($M_{pre} = 17.33$, $SD = 2.08$, $M_{post} = 19.67$, $SD = 4.51$) it has increased. In PD dimension, the scores of both Group A ($M_{pre} = 13.00$, $SD = 5.29$, $M_{post} = 10.67$, $SD = 0.58$) and B ($M_{pre} = 12.67$, $SD = 3.79$, $M_{post} = 11.67$, $SD = 0.58$) have decreased, while Group C ($M_{pre} = 14.67$, $SD = 3.22$, $M_{post} = 16.00$, $SD = 6.00$) have increased.

To summarize, in PT dimension (related with cognitive component of empathy), the scores of Group B remained almost constant, Group A had a small decrease in scores and there was an increase in the scores of Group C. In EC dimension (related with affective component of empathy), the scores of Group A and B have decreased, but in Group C it has increased. In PT dimension (related with affective component of empathy), the scores of both Group A and B have decreased, while Group C have increased. Only in the FS dimension (related with cognitive component of empathy), the scores of both group A and C have increased, while group B has decreased but in the other IRI dimensions (PT, EC, and PD), the scores of group C always have increased.

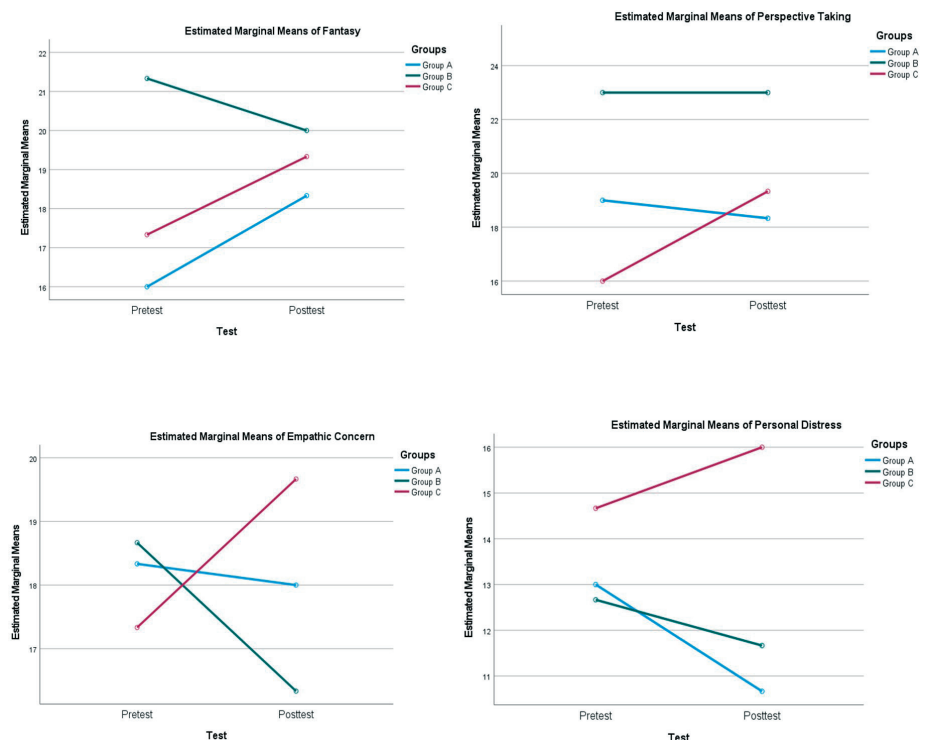


Figure 9. Univariate analysis of variance of each IRI subscales in pre-tests and post-tests for each group.

On the Analysis of the Kitchen Survey

Students and the user ranked their importance level for each 47 kitchen design items in 7 categories as; category 1- circulation includes 5 items, category 2- cabinets and storage areas includes 10 items, category 3- counters/work surfaces include 10 items, category 4- appliances includes 10 items, category 5- sink and faucets includes 3 items, category 6-illumination includes 4 items, and category 7- materials includes 5 items) in working successfully within a kitchen environment. To understand to what extent the students became aware of the user's needs after experiencing ED techniques, the students filled out the kitchen survey from the user with a broken arm's point of view. The user filled out the survey at the beginning of the experiment.

The group ratings were analyzed to determine the level of empathic understanding of each group and the degree of similarity with the user. Also, the kitchen survey category levels were analyzed to find if there was a significant difference in the ratings of the different ED technique groups. Three missing values were noted from 'cabinets and storage' category. Since the level of measurement was ordinal, the best central tendency measurement for the data is the median (Md), and the median scores for the total categories was equal for Groups A, B, and the user (Md =4.00). Only group C's median score was different (Md =5.00). The equal scores indicated the similarity level of empathic understanding of students on their user's needs. Students' awareness on understanding of the kitchen user's priorities was enhanced through ED techniques. A one-way unrelated analysis of variance showed an overall significant effect of the emphatic techniques in the ratings of the kitchen survey categories, $F(4,30) = 5.42, p = 0.002$. Scheffe's test indicated that the direct contact group A ($M = 3.71, SD = 0.49$) differed from the role-playing group C ($M = 4.71, SD = 0.39$) at $p = 0.012$, and from the control group D ($M = 4.64, SD = 0.63$) at $p = 0.023$, but no other significant differences were found.

On the Thematic Analysis

The data from (1) group interviews and (2) design conversations among students in design process are analyzed thematically. The result of students' reflections in group interview are categorized as learning process and learning outcome and indicated three emergent themes (Theme 1. Instructive aspects of empathic design process, Theme 2. Affective aspects of empathic design process, Theme 3. Raising awareness in design process) and four subthemes (Subtheme 2.1 Pleasant aspects of empathic design process, Subtheme 2.2 Challenging aspects of empathic design process, Subtheme 3.1 The self-awareness and Subtheme 3.2 Design awareness). Secondly, the analysis of students' design conversations protocols in design process revealed two major themes (Theme 4. Past experiences and Theme 5. Universal design solutions) and twelve subthemes (Subtheme 4.1 Individual empathic design experiences, Subtheme 4.2 Experiences from prior courses, Subtheme 5.1 Passages and circulation spaces, Subtheme 5.2 Reach problem of cabinets, Subtheme 5.3 Inadequacy of storage cabinets and areas, Subtheme 5.4 Safety, Subtheme 5.5 Sequence of use- work centers and counters, Subtheme 5.6 Accessibility of appliances, Subtheme 5.7 Dining table height (posture problem), Subtheme 5.8 Adjustable dining table, Subtheme 5.9 Illumination and Subtheme 5.10 Materials) as seen in Table 1.

Analysis	Category	Major Themes and Subthemes
Group Interview	Learning Process	Theme 1 Instructive aspects of empathic design process
		Theme 2 Affective aspects of empathic design process
	Learning Outcome	• Subtheme 2.1 Pleasant aspects of empathic design process • Subtheme 2.2 Challenging aspects of empathic design process
		Theme 3 Raising awareness in design process
Design Conversations	Design Process	Theme 4 Past experiences
		• Subtheme 4.1 Individual empathic design experiences • Subtheme 4.2 Experiences from prior courses
		Theme 5 Universal design solutions
		• Subtheme 5.1 Passages and circulation spaces • Subtheme 5.2 Reach problem of cabinets • Subtheme 5.3 Inadequacy of storage cabinets and areas • Subtheme 5.4 Safety • Subtheme 5.5 Sequence of use, work centers and counters • Subtheme 5.6 Accessibility of appliances • Subtheme 5.7 Dining table height (posture problem) • Subtheme 5.8 Adjustable dining table • Subtheme 5.9 Illumination • Subtheme 5.10 Materials

Table 1. Themes and subthemes that emerged as a result of the thematic analysis

Students' Reflections on Empathic Design Process

All students participated in the group interview online session (task 6). According to students' reflections, the first theme revealed was related to the instructive aspects of the ED process. Students mentioned the words useful (six times), instructive/educational (four times), informative (one time) and helpful (one time) to describe the learning process.

It was like a totally different education. At the same time, trying to protect the UD principles and values was the part that forced us, but it was instructive...It was very educational; I was very pleased. It was a useful study (S1A).

Group A also underlined the importance of building empathy in design education and made suggestions. To illustrate, S2A emphasized the practical basis of the empathic design approach as a design learning tool, and he suggested that empathic design approach should be integrated into the Interior Design Studio course. One student in Group B also highlighted learning by doing approach and suggested that empathic design should be integrated to design critics of design projects in Interior Design Studio

courses. Group C emphasized that learning by experience was more instructive than just attending the lecture.

The second emergent theme affective aspects of empathic design process included two subthemes as pleasant and challenging aspects. Nice, good, fine and beautiful (eleven times), enjoyable/fun/ joyful/exciting (eight times), difficult (thirteen times), different/unusual (six times) were the words that students used frequently to describe the process. Besides, some students started their responses with I forced..., I had to... (two times) to express the difficulties that they have faced.

I liked that we used the knowledge we gained, and then explained it to the user in codesign, it was exciting and beautiful. It was also nice and instructive process (S1A).

I am glad that I have participated. I have experienced a short summary of my future professional life (S3A).

Trying to do something with one arm was a different and difficult experience (S2C).

All groups also commented on working collaboratively in an online session. They all agreed that they used to work online. However, S1A found drawing together via Zoom was difficult and unusual. Specifically, she found it unusual that only one student was drawing, and the others were intervening verbally. However, S2A found working collaboratively was fun and he emphasized the importance of helping each other when drawing and exchanging ideas to find the appropriate design solutions.

The third theme was raising awareness consisting of two subthemes as self-awareness and design awareness. Several students' comments included explicit expressions about raising his/her self-awareness and design awareness and some students started their responses as I realized that... (six times).

Sometimes, you cannot experience everything by yourself. We never have broken our arm, leg etc., and never encountered any disability...I had not been able to establish a relationship between empathy and design very much. So, it was pleasant and good experience for me (S2B).

One student in Group C explained her design awareness by giving an example from her previous design project as shown in the excerpt below:

We did our projects in the studio with UD in mind, but let me be honest about myself, in my restaurant project in Interior Design Studio course, I did not measure anything other than just providing 150 cm turning radius for a wheelchair user. When I think it over now, I remembered the width of the corridors is not accessible for a wheelchair or walker user. If the wheelchair user pass through that aisle, he/she would not be able to come back so, a wheelchair user cannot leave the cafe that I designed (S1C).

Students also commented that filling out kitchen survey increased their design awareness, since they recognized the important design characteristics of kitchen environment from the user's point of view and IRI raised their self-awareness.

After I filled the IRI, I became aware that I was a sensitive person (S1A).

Students' Conversations in Design Process

All groups participated in the online design sessions (task 3). The fourth theme (twelve times) was about the design approach of each group. It was based on the students' recalls of their past experiences in generating UD

solutions derived from their individual empathic design experiences and accumulated knowledge from their prior courses.

Each group had a different approach to the design problem. Group A recalled the knowledge that they gained from the interview and observation session. Their design approach was mostly user-centered, since they mainly focused on the problematic areas of the kitchen related to accessibility and reach problems of the user. Group B occasionally recalled their EM. Group C remembered their role-playing activities. They indicated the most empathic approaches since they tried to build the relationship between their experience and user's experience. Their problem-solving approach was activity-based, as they created scenarios and designed accordingly. Group D was indecisive in finding a design solution and needed extra time to finish their drawings. They generally focused on wheelchair users in accessibility issues.

We should place a counter next to the refrigerator since in the role-playing exercise, I had difficulty in putting the jar into the refrigerator. I looked for a counter for putting down the jar and then opened the door. Then I got the jar and put it into the refrigerator (S1C).

The fifth theme was the universal design solutions that were applied in design process. Students spoke aloud and tried to generate appropriate UD solutions. Ten subthemes were revealed. The most frequently repeated subtheme was subtheme 5.1. Passages and circulation (31 times) and the least mentioned was subtheme 5.8 adjustable dining table (3 times).

We must consider a knee-space under the sink for a wheelchair user (S1B).

We should locate the refrigerator, sink and cooker according to the principle of the work triangle (S2A).

Correlation Analysis among Universal Kitchen Design Items and Subthemes 5

The relationship between the importance rank given to the universal kitchen design items in kitchen survey (1) circulation, (2) cabinets and storage areas, (3) counters/work surfaces, (4) appliances, (5) sink and faucets, (6) illumination, and (7) materials) and the number of universal kitchen design items proposed in the UD process were analysed using Somers' *d* measure of association. According to the results, there is a very strong positive correlation between the number of universal kitchen design items (dependent variable) used in the UD process and the importance rank given to the universal kitchen design items (independent variable) in Group A (Somers' $d=0.90$, $p=0.009$) at alpha level 0.05. To illustrate, Group A ranked their importance level as $Md=4.00$ (out of 5) for category 1- circulation and proposed 4 (out of 5) circulation design items in their kitchen design. They provided enough free space for the passages and circulation spaces and allocated adequate clear floor area by breaking down the balcony wall, enclosed balcony with glass and designed that space as a dining area, opened the kitchen door to the outside so that the wheelchair or walker user could pass easily. Also, they proposed a 150 cm radius free space to make a 360-degree turn for wheelchair users. They also proposed a non-intersecting work triangle between the refrigerator, sink and cooking surface, although they did not propose an adequate clearance at the side of the dining table. No significant relationship is found between these variables in Groups B, C and D. Moreover, the relationship between

the number of universal kitchen design items proposed in the UD process and the frequency of UD solutions (Theme 5- subtheme 5.1 Passages and circulation spaces, 5.2. Reach problem of cabinets, 5.3. Inadequacy of storage cabinets and areas, 5.5. Sequence of use, work centers and counters, 5.6. Accessibility of appliances, 5.9. Illumination, 5.10. Materials) mentioned in the design conversation were analyzed using the Gamma measure of association. Subthemes 5.4. Safety, 5.7. Dining table height (posture problem) and 5.8 Adjustable dining table were not included in the analysis since they could not match with the universal kitchen design items in kitchen survey. The results indicated that there is a significant moderate association between the frequency of subthemes 5 in design process and the number of items used in the UD process in Group C (Gamma= 0.579, $p=0.021$) and Group D (Gamma= 0.667, $p=0.010$) at alpha level 0.05. To illustrate, Group C mentioned subtheme 5.5 six times and proposed 8 (out of 10) universal kitchen design items. They did activity analyzes and recalled the right sequence of use as sink-counter-cooker-counter. While considering the sequence of use, they considered left and right-handed person for access and use. They also remembered the difficulties that they had faced in their role-playing activities and thought that the user could face the same problems. One student recalled that she had trouble opening the refrigerator door with the jar in one hand and proposed an appropriate counter space at the opening side of the refrigerator. There was no significant relationship between these variables in Groups A and B.

DISCUSSION

On the Results of IRI and Kitchen Survey

We expected that students' FS, EC, and PT dimensions of empathy would increase, and PD decrease after experiencing the ED process, since PD is negatively correlated with the EC and PT dimensions (Davis, 1983). However, only Group C's FS, EC, PT were increased and interestingly their PD scores also were increased. This may be the consequence of the role-playing activities, where the students took the user's perspective and acted as if they had a broken arm, and their empathy was increased. So, simulating people with diverse user's abilities enhanced students' empathic understanding as in the previous studies (Altay et al., 2016; Kocaoğlu and Demirkan, 2019; McDonagh and Thomas, 2010). About the PD dimension, Group A and B's PD scores decreased as expected but Group C's PD scores were increased. Group C members were stressed in completing the role-playing activities. So, their personal anxiety could have increased. The findings of the kitchen survey indicated that there is no statistically significant difference between the groups A and B and user in ranking the importance level of universal kitchen design items. This similarity indicated the level of empathic understanding of students on the user's needs. This may be the reason that students could understand the user's priorities better for the sake of direct contact, lecture and creating an EM collaboratively.

On the Results of Thematic Analysis and Correlation Analysis

About the instructive aspects of ED process, students commented that learning by experiencing approach is more effective than the lecture which only involved acquiring theoretical knowledge, since the knowledge had better settle in their minds (Altay, 2017; Altay et al. (2016). The sub-theme 4.1. Individual empathic design experiences were directly related

to the subtheme 3.2. Design awareness and all were associated with the fifth theme Universal design solutions. When students recalled their ED experiences, their design awareness increased, and they tried to find more UD solutions. So, remembering individual ED experiences positively affected students' design awareness and caused them to find UD solutions. The common findings of the similar studies that students commented on learning by experience was more distinct and educative. The students also proposed that the ED approach on practical basis could be in the curriculum (McDonagh and Thomas, 2010) and practical experiences were important knowledge sources in design process that would lead to successful design outcomes (Strickfaden and Devlieger, 2011; McDonagh, 2015; McDonagh et al., 2011). Moreover, the EM was found as a useful tool in understanding the user's priorities and needs even though it was a new tool for students. In Bairaktarova et al. (2016)'s study, EM technique as one of the ED techniques was found to be helpful for engineering students to find better design solutions.

The affective aspects included pleasant aspects of revealed enjoyable feedbacks, as it was found to be a very important component of a perceived learning experience. In Altay et al. (2016) and Altay (2017) studies, enjoyable quality of the empathic design process was found as one of the emergent themes. Students also stated collaborative design process was fun (Altay et al., 2016) and emphasized the significance of helping each other when drawing and exchanging ideas to find the design solutions. Challenging aspects of the students positively affected students' self and design awareness and encouraged them to find more UD solutions. The students had difficulties in doing the activities, they had left their comfort zones and forced themselves to empathize with the user (Campbell and McDonagh, 2009). The sub-theme 2.1 Challenging aspects of the empathic design process was directly associated with the third theme raising awareness and the fifth theme universal design solutions. While the students were acquiring knowledge about the problems, barriers, needs and expectations of the user by observing, listening and/or experiencing, they had faced some difficulties, and they became more aware of the difficulties in the life of a person with an impairment. Thus, their self and design awareness were increased, and they tried to find more UD solutions. Altay and Demirkan's (2014) study also found that difficult was the most repeated word used by interior architecture students to describe their empathic design process.

Students' expressions in their learning outcomes also indicated positive feedbacks including a psychological self-awareness and design awareness (Altay and Demirkan, 2014; Altay et al., 2016). Some students realized that their previous design projects were not universal and criticized themselves on this issue. This inference is so vital for novice interior designers to create more UD solutions, since their understanding of user context was expanded and realized how essential and difficult it was to design while considering both the user with diverse ability and all people. This understanding was noteworthy since one of the intentions of this study was to make students understand that ED research is not only for people with diverse abilities but also for all people (McDonagh, 2015).

The findings of analysis on design conversations were supported by the correlation analysis since the association between the number of universal kitchen design items proposed and the frequency of UD solutions (subthemes 5) mentioned in the design conversation indicated that Group

C mentioned the greatest number of subthemes 5, their designs involved more design items. The findings suggested that role-playing was more effective ED technique to deeply understand the user and find more universal solutions (Altay et al., 2016; Gomez-Lanier, 2018) compared to the other techniques. Another association analysis indicated that since Group A was using the technique of direct contact; the interaction between the designers and user through observation, interview, and codesign had an influence on this finding (van Rijn et al., 2011). Group A understood the user's needs and problems better through the direct contact method and conducted extensive research to obtain information about the user as well as ranking the importance level through the user's point of view, efficiently. The results indicated that direct contact was successful way of expressing empathy and understanding the user (Heylighen et al., 2013; van Rijn et al., 2011). The findings also indicated that experiencing ED technique shortens the design time and helped the designer in finding UD solutions easily since in this study Group D (control group) had a hard time finding a design solution and needed extra time to complete their drawings.

There were some limitations of the empathic approach in learning and teaching universal design. Since empathic ways of learning asked students to leave their comfort zone and required a comprehensive and in-depth analysis on design problems, they were forced in learning universal design. Especially, while finding design solutions, it was difficult for them to consider the needs and problems of both the user with a broken arm and everyone. In addition, some students had difficulties as safety issue while they were trying to conduct role-playing activities in their own kitchen environment (Altay and Demirkan, 2014). Also, there were some limitations of the empathic approach in teaching universal design. Since students were interviewing and co-designing real user for the first time, they needed encouragement. Also, it was so difficult to control students' safety remotely while they were conducting the role-playing activities.

The findings of the analysis of students' reflections were supported in the earlier research with similar findings that had analyzed students' learning processes and outcomes in an ED experience through thematic analysis (Altay, 2017; Altay et al., 2016).

CONCLUSION

This study explored the impact of experiencing three ED techniques in interior design process and assess students' reflections related to their learning process and outcomes. Collaborative learning with multi-method approach occurred in every task. Students experienced ED techniques in discovery, immersion, and connection phases and re-designed a kitchen and reflected their ED experiences in detachment phase (Kouprie and Visser, 2009). The learning activities were designed based on the Merrill's First Principles of Instruction (Merrill, 2002). These principles were valuable criteria in the ED learning activities, and they were found to be compatible for online education and supported collaboration among students to work together.

Firstly, this study questioned how does experiencing ED process influence interior architecture students' individual differences in multiple dimensions of empathy. To answer the first question, the cognitive (FS and PT) and affective (EC and PD) empathy components were measured and analyzed to see whether there was an increase. Quantitative analysis

indicated that Group C's (role-playing technique) empathy scores were increased in all dimensions of empathy and the role-playing technique was found to be more effective than the other techniques in developing students' empathy. Secondly, it was examined the reflection of ED process on students' design process based on finding UD solutions. The thematic analysis in design process revealed that empathic approach as a design learning tool improved students' problem-solving skill and encouraged them to integrate UD and HF/E principles into their end products. Two emergent themes (4. past experiences and 5. universal design solutions) indicated that students mostly remembered the theoretical knowledge that they had acquired in the prior courses and determined their practical knowledge from their ED experience to produce UD solutions. Also, experiencing ED techniques influenced students' design decision making process positively. To illustrate, Group A was user-centered, Group B recalled their EM and Group C was activity-based while proposing design solutions. It was found that each learning method in ED has its own potential as stated in the previous literature (Altay and Demirkan, 2014) and mainly helpful and effective in supporting the learning domain, but role-playing technique was found more effective towards finding universal solutions compared to the others. Thirdly, this study examined the reflections of experiencing ED process on students' perceptions of their learning experience. The findings of the thematic analysis demonstrated that experiencing ED influences students' perceptions positively, since it expands their empathic understanding of the challenges of people with diverse abilities encounter and increases their self-awareness and design awareness. The three emergent themes (1. instructive aspects of the empathic design process, 2. affective aspects of the empathic design process and 3. raising awareness in the design process) supported these reflections. In addition, the findings of the kitchen survey indicated that students' design awareness (subtheme 3.2) on understanding the user's priorities and needs was enhanced, since there was similarity between the scores from the students and the user. As they had never filled out a survey from someone else's perspective before, it was new and different experience for them, and they commented that they recognized the important design characteristics of kitchen environment from the user's (with temporary physical impairment) point of view.

The major limitation of the study was Covid-19 pandemic situation. So, the experiment was carried out with a limited number of students with time restriction in online sessions. Future studies might increase the number of students and duration of sessions. Also, students may conduct each ED techniques in face-to-face sessions. This study contributes to the literature by exploring reflections of empathic design process on interior architecture students' universal design solutions. With the guidance of this study, design educators can compare the effectiveness of different teaching methods in design process. Many universities have theoretical courses titled as Human Factors or Ergonomics, or Universal Design. In these courses, the instructors could introduce the ED approach and demonstrate the ED techniques by emphasizing their importance (Altay and Demirkan, 2014; Altay, 2017) or empathic way of learning could be incorporated to 'Interior Design Studio' courses by integrating related assignments. Design educators could also apply different and additional learning methods including empathic approach to promote students to create more universally designed projects. In ED process, students can have fun and be pleased but they can have difficulties, but it would reflect positively on

their design process as it realized in this study. Since, this study indicated that building empathy plays a significant role in developing successful interior design projects in architectural education.

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SYMBOLS AND ABBREVIATIONS

EC: Empathic Concern

ED: Empathic Design

EM: Empathy Map

FS: Fantasy

HF/E: Human Factors/Ergonomics

IRI: Interpersonal Reactivity Index

M: Mean

Md: Median

SD: Standard Deviation

SPSS: Statistical Package for Social Sciences

PT: Perspective Taking

PD: Personal Distress

UD: Universal Design

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Anahtar Sözcükler: Tasarım eğitimi; tasarım süreci; empatik tasarım; insan faktörleri, evrensel tasarım.

EMPATİK TASARIM SÜRECİNİN İÇ MİMARLIK ÖĞRENCİLERİNİN EVRENSEL TASARIM ÇÖZÜMLERİNE YANSIMASI

Çoğu iç mimarlık öğrencisi, evrensel tasarım yaklaşımını ve insan faktörleri/ergonomi prensiplerini projelerine yansıtmak konusunda zorluklarla karşılaşır. Tasarım eğitiminde, öğrencilerin empati yetisi artıkça, evrensel tasarım anlayışları da artar ve daha erişilebilir, kullanışlı evrensel ürünler ve/veya mekanlar tasarlanabilir. Bu çalışma, empatik tasarım tekniklerinin, öğrencilerin tasarım sürecindeki evrensel tasarım çözümleri üzerine yansımalarını incelemektedir. Kullanıcı (kolu kırık olan) hakkında veri toplamak için, 12 ikinci sınıf iç mimarlık öğrencisi (kontrol grubunda bulunan 3 öğrenci hariç, Grup D) bir öğrenme yöntemi olarak empatik tasarım tekniklerini (Grup A, kullanıcı ile doğrudan temas etme, Grup B, kullanıcılar hakkında dolaylı bilgi edinme ve derse katılma ve Grup C, rol alma tekniği) deneyimlemişlerdir. Daha sonra tüm katılan öğrenciler (12 kişi) kullanıcının mevcut mutfağını yeniden tasarlayarak, öğrendiklerini tasarımlarına yansıtmıştır. Çalışma Kovid-19 pandemisi nedeniyle çevrim içi ortamda gerçekleştirilmiştir. Grup görüşmeleri ve tasarım sürecindeki konuşmaları içeren video kayıtlarından elde edilen dökümler, tematik olarak analiz edilmiştir. Sonuçlar empatik tasarım sürecinin, öğrencilerin öğrenme deneyimleri ve tasarım çıktılarındaki olumlu yansımalarını, öz farkındalık ve tasarım farkındalıklarının artışı

olarak göstermektedir. Öğrenciler önceki ders bilgilerini ve bireysel empatik tasarım tekniği deneyimlerini, evrensel tasarım çözümlerini üretirken hatırlamışlardır. Üç empatik tasarım tekniği öğrencilerin tasarım odaklı düşünme yaklaşımını farklılaştırdığı için, öğrencilerin evrensel tasarım çözümleri üzerinde olumlu etkisi olmuştur. Tasarım çözümleri önerirken, Grup A kullanıcı merkezliydi, Grup B empati haritalarını hatırladı, Grup C aktivite tabanlıydı ama Grup D kararsızdı ve çizimlerini tamamlamak için fazladan zamana gereksinim duydu. Her bir empatik tasarım tekniği, öğrenme alanını desteklemeye yardımcı olmuştur, ancak rol alma tekniği diğer tekniklere kıyasla empati seviyesini artırma ve evrensel tasarım çözümleri bulma konusunda daha etkili olmuştur.

REFLECTION OF EMPATHIC DESIGN PROCESS ON INTERIOR ARCHITECTURE STUDENTS' UNIVERSAL DESIGN SOLUTIONS

Most interior architecture students encounter challenges in reflecting the universal design (UD) approach and applying human factors and ergonomics (HF/E) principles in their design projects. In design education, as students' empathic ability develops, their UD understanding enhances, and they can design more accessible, usable, and universal products or environments. This study explores the reflections of empathic design (ED) techniques on students' UD solutions in the design process. Twelve second-year (except control group, Group D, n=3) interior architecture undergraduate students experienced an ED technique (Group A, direct contact with the user, Group B, obtaining indirect information about the user and attending a lecture, Group C, role-playing) as a learning method to collect data about the user (with a broken arm), then all participated students (n=12) redesigned the existing kitchen of the user and reflected their learning and design outcomes. The case study was conducted virtually because of the Covid-19 pandemic. The transcripts from video recordings, including the data collected from group interviews and design conversations, are analyzed thematically. The results demonstrated that experiencing ED is positively reflected in students' perceptions of their learning experiences and outcomes with an increase in self-awareness and design awareness. Students remembered their prior courses' knowledge and their individual ED experiences to produce UD solutions. Three ED techniques positively influence students' UD solutions since they change students' design thinking approach. Group A was user-centered, Group B recalled their EM, and Group C was activity-based while proposing design solutions. However, Group D was indecisive and needed extra time to complete the requirements. Each ED technique is particularly helpful in supporting the learning domain, but the role-playing technique is found to be more effective in increasing empathy levels and finding UD solutions compared to the others.

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