Research Article

Universal Design in Interior Architecture Education: The Case of Store Design

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Abstract

Universal design is a user-focused designing approach that involves cultural, physical, mental and dimensional aspects and takes into account the needs of different personal characteristics. This study will analyze the resolutions for different personal characteristics in the design qualities of an apparel store designed by interior architecture students and then utilize the results to make suggestions for curriculum studies in which universal design embedded continuously. In terms of the different user characteristics, the study participants mainly focused on physical and visual disabilities, as well as older people and families with children. According to the participants, the most important issues to be attentive to when making interior space resolutions included reaching the shelves, disabled access ramps at the entrance, size of the circulation area, accessibility of the cashier counter, and size of the changing rooms. Another important issue related to the store design is aesthetic appeal. Serving as an indication of their concern for the commercial success of the store, the participants offered suggestions about the window display and the aesthetic quality of the store.

INTRODUCTION

Universal design (UD) is a design concept which aims to pay attention to different users' characteristics such as cultural, physical, mental and dimensional. The concept is similar meaning to inclusive design or design for all which involves designing spaces capable of being use by everyone regardless of physical or mental or emotional differences (Evcil, 2014; Helvacıoğlu & Karamanoğlu, 2012). To ensure that building interiors take into consideration the different user characteristics, approval of these concepts by institutions providing interior architecture education is necessary. Indeed, besides user characteristics, store design encompasses aesthetic understanding with the functional and commercial performance (Petermans & Van Cleempoel, 2010). Null (2003) introduced four main categories under which the concept of universal design approaches human differences: older adults experiencing age-related changes; adults; children; and people of all ages with disabilities. These categories stand as the starting point for the universal design approach. Mace (1998) said that everybody was going to get old one day, which means, essentially, that everyone will experience the state of being a person with disabilities.

The aim of this study is to examine both, how interior architecture students interpret different human characteristics during their design process and to improve the methodology applied in interior design curricula with the help of these findings. To reach an inclusive world, design related undergraduate curriculum should concern universal design paradigm which is almost scarce in our universities. The study group consisted of third grade interior architecture students from a foundation university in Istanbul. At the beginning of the study, students were asked to write down their initial ideas about how store design could be more inclusive. Next, they were tried to empathetically understand 'different' people's requirements and problems causing disablement with the help of empathy. Finally, students were asked to draw sketches pertaining the process.

The research aims to answer the following questions regarding a good store design for all people: "What suggestions do the interior design students offer for accommodating user-differences in a space?" "How do they apply the principles of interior architecture for store design when suggesting solutions for the differences?" "What kind of studies should be conducted on curricula to facilitate awareness in interior architecture students about human characteristics other than the normal ones ("...to be

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perfect, capable, competent and independent") described by Mace (1998)?"

UNIVERSAL DESIGN IN INTERIOR ARCHITECTURE CURRICULUM

Diversity is a main discourse of our age and it is also popular among designers. Unfortunately, there are still people excluded from designers' considerations whether consciously or unconsciously. This could possibly be related to the conventional approach adopted by some designers wherein Vitruvius' drawing of a white, healthy, adult man serves as the measure by which architectural design based on it. Despite the regulations that have been set in place, our living environment does not concern user differences in terms of physical and/or mental abilities. As is the case in many fields the governing norms are not enough to solve the problem. Rather, there is a need to raise awareness about the value of empathy at the initial stages of design. "Empathy is also linked to spending time with people" (Strickfaden & Devlieger, 2011, p. 225). UD approach tries to consider users' differences in terms of abilities, characteristics and desires on the basis of empathy in all built environments.

Interior architecture undergraduate program is as popular as architecture. This is because; interior architects are one of the indispensable members of the professional team responsible of the built environment. Unfortunately, as it happened in other design based undergraduate curricula, user centered design approach is still scarce in Turkey. UD precepts are introduced mostly in an elective course within the curriculum, but; this is very common in universities all around the world (Manley, 2013). In the USA, they overcome this barrier during the accreditation process. Foundation for Interior Design Education and Research (FIDER), with recognition by the US government's Council on Higher Education Accreditation (CHEA), specify interior architect's qualifications and accredit interior architecture programs in universities in both the US and Canada (Jones, 2001). According to FIDER, interior architecture students' work must demonstrate understanding of UD concepts and principles (Jones, 2001).

WHAT IS UNIVERSAL DESIGN?

Universal design's motto by Ronald Mace -concept creator- "it means the design of products, environments, programs and services to be usable by all people to the greatest extent possible" without the need for adoption or specialized design (Mace, Hardie & Place, 1996, p. 3). It is a new point of view which stops

special or adaptive solutions as it was targetted in barrier free design or accessible design. Universal design evokes the idea of designing for people with disabilities, especially considering that its creator, Mace, is a wheelchair bound architect. This view, however extremely narrows and limits the full breadth of the concept, as "universal design does not mean special products for a certain group of people, but rather good design for all phases and circumstances of life. The term universal design addresses this desire and demands intelligent solutions for every area of life and all age groups" (Herwig, 2008, p. 17).

Universal design, inclusive design or design for all are used interchangeably in different countries of the world. They all refer to a philosophy and design process rather than to a legal code, as it is commonly mistaken for (Kelly et al. 2013).

It is important that interior architect emphasize universal design principles in their proposals for shopping center which is nowadays one of the indispensable social place in urban life. As the focus of these proposals needs to center on making life easier for all citizens: consideration should be directed towards the features and variety of activities constituting the life of shopping center as; access to services, reach shelves, fit costumes, eat and drink with a friend, pay at the cashier to name several. This is also related to the people's quality of life as they concern usability, user friendly and age friendly features, freedom from stigma, market acceptance and joy of use (Herwig, 2008). Designers should also keep in mind that part of the population is getting older. Thus, design must adapt to and simplify the daily living environment. Universal design can achieve this demand given that the concept includes the idea of simplicity and complexity in design for everyone.

Kelly et al. (2013) list the following instrumental activities of daily shopping:
- Lowering or making height adjustable the electronic devices used in typical purchasing transactions (e.g. credit card reader)
- Larger print on signs indicating aisle numbers and locations of goods, and on packaging of items
- Wider aisles
- Automatic powered doors at entrances and exits

Furthermore, universal design approach also benefits older people. In other words, application of universal design to our built environment profits our aging population as well.

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METHOD

The aim of this study is to analyze the approaches used by interior architecture students to meet the diversity of people's needs in the society focusing in a sample design of an apparel store. In this context, the study was conducted with the students who had to have knowledge about the fundamental principles of store design, and have made store designs in their project lesson from the previous semester. The students were not specifically provided with the principles of store design. This study was conducted within the context of an ergonomics lesson taught in one class offered within the Interior Design department. Instruction in the lesson was given under four main titles: anthropometry, ergonomic environmental conditions, accessibility, and universal design. The study was conducted after completion of a 14-week program. Therefore, students have already basic knowledge about UD principles. The study sample included 33 junior-level students (21 females and 11 males). The students were asked to express in writing and sketches the points to be considered when designing a main street apparel store, one that was equipped to accommodate the use of everybody. The main limitations of the study included its small sample size, and the fact that the findings were limited to the examples taken from curriculum studies and universal design research in interior architecture education and therefore cannot be generalized.

FINDINGS

Results from the study showed that the students' solutions for an inclusive store fell under the 9 categories such as interior architecture layout, store entrance, circulation, direction, graphical practices, shape, size and qualities of interior architecture reinforcements, shop windows, restrooms and others (Table 1).

Table 1. The students' suggestions for store design in context of inclusive design

STUDENTS' STORE DESIGN DETAILS		Percent of students who took design detail into considera-tion	Percent of students who did not take design detail into considera-tion	Universal design principles associated by researchers
INTERIOR ARCHITECTURE LAYOUT	Aesthetic concern	56	44	Adding to human delight/Functional and

				aesthetic integration*
	Location of the cashier counter	41	59	Equitable use/Flexibility in use
	Location of the changing rooms	34	66	Equitable use/Flexibility in use
	Place/location of the items on display	31	69	Equitable use/Flexibility in use
	Reinforcement for resting (e.g. armchairs, ottomans)	47	53	Tolerance for error
STORE ENTRANCE	No door sill at the entrance	22	78	Equitable use
	Placement of a disabled access ramp	72	28	Equitable use
	Size of the entrance door-being opened to the outside/using sensor	19	81	Low physical effort/ Size and space for approach and use
CIRCULATION	Wheelchair circulating area	34	66	Low physical effort/ Size and space for approach and use/ Equitable use
	Broadness of the circulation area	72	28	Low physical effort/ Size and space for approach and use/ Equitable use
	Width/height of the steps on the stairs	6	94	Low physical effort/ Size and space for approach and use/ Equitable use
	Handrail for stairs	3	97	Equitable use/Flexibility in use
	Inclusion of an elevator/lift in multi-flat stores	34	66	Equitable use
	Elevator size	9	91	Equitable use/Size and space for approach and use

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	The controls and warnings related to the elevator	3	97	Tolerance for error
DIRECTION	Plaques for the exit, elevator, changing rooms, and product types	31	69	Simple and intuitive use/Perceptible information
	Direction by products	9	91	Simple and intuitive use
	Arranging the products on shelves by category	13	87	Simple and intuitive use
	Direction by floor signs or ceiling hangings	13	87	Simple and intuitive use
GRAPHICICAL PRACTICES	Font size on tags/audio-visual barcodes	16	84	Flexibility in use/Perceptible information
	Using braille alphabet on tags	16	84	Equitable use/Flexibility in use/ Perceptible information
	Usage of magnifiers	0	0	Equitable use/Flexibility in use/ Perceptible information
SHAPE, SIZE, AND QUALITIES OF THE INTERIOR ARCHITECTURE REINFORCE-MENTS	Height/size of the cashier counter	59	41	Flexibility in use/ Size and space for approach and use
	Size of the changing rooms-height of the hangers	59	41	Flexibility in use/ Size and space for approach and use
	Opening mode of the changing room doors	25	75	Low physical effort
	Height-width of the shelves	84	16	Low physical effort/ Equitable use/Flexibility in use
	Shape of the products on display (rounded edge)	9	91	Tolerance for error
	Ventilation	19	81	Functional and aesthetic integration*
	Lighting	47	53	Functional and aesthetic integration*
	Color (walls, floor, ceiling)	19	81	Adding to human delight/Functional and

				aesthetic integration*
	Color (e.g. shelves, armchairs)	6	94	Adding to human delight/Functional and aesthetic integration*
	Safety/fixing the shelves	22	78	Tolerance for error
	Non-slippery floor/tactile paving	22	78	Tolerance for error
SHOP WINDOW	Design and lighting of the shop window	50	50	Equitable use/ Tolerance for error
	Height of the shop window or the product in it	19	81	Equitable use
RESTROOM	Implementing a restroom for the disabled	19	81	Equitable use
	Size of the restroom	3	97	Size and space for approach and use
	Childcare room/restroom	9	91	Equitable use
OTHER	The relation between the brand and the store design	3	97	Functional and aesthetic integration*
	The success in expressing the brand	16	84	Perceptible information
	Playing soothing music	22	78	Adding to human delight*
	Height of the ceiling	3	97	Adding to human delight*
	The assistance of the employees to disabled customers	16	84	Social cohesion and participa-tion*
	Playground for children	3	97	Flexibility in use

* Added principles to main 7 universal design principles.

Interior Architecture Layout

It was observed that the students' suggestions incorporated aesthetic and commercial concerns within the inclusive approach. The students anticipated that customers would first go to the right when entering the store, since almost 90% of the people in Turkish society are right-handed, and they made sure not to place the cashier counter near the entrance, believing, on the basis of

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commercial concerns, that the cashier counter should be located at the rear of the store, where it would be less visible. The consideration for the interior architecture layout was 56% for aesthetic concern, 47% for the necessity of the presence of the reinforcement for having a rest, 41% for the position of the cashier counter, 34% for the position of the changing rooms, and 31% for place/location of the items on display.

Store Entrance
In the study, 72% of the students emphasized the need to have a ramp, along with stairs, at the entrance, 19% expressed that the opening mode of the entrance door should open from the outside or be equipped with sensors for automatic opening, and 22% indicated that there should not be a revolving door at the entrance.

Circulation
The main concern of the students was the broadness of the circulation area in the store (72%), while the turning space for wheelchairs (34%) and the presence of an elevator in multi-flat stores (34%) were their secondary concerns. However, they expressed few opinions about the size of the elevator (9%) or the height and/or width of the steps on the stairs (6%).

Direction
Students suggested the use of plaques, to direct customers to specific areas (e.g. emerging exists, elevators, changing rooms). The breakdown by percentage of the students who offered these suggestions was 31% for the use of plaques to direct customers to emergency exits, elevators, changing rooms or product types, 9% for product placement in directing customers, and 13% for direction by spatial tools, like floor signs or ceiling hangings. The students also suggested that products could be arranged on the shelves by their categories (13%).

Graphical Practices
The students particularly considered visually disabled and older people in addressing the issue of the readability of the instructional use notes and tags on products. However, there were only a few students who expressed opinions about this issue. The usage of the Braille alphabet, enlargement of the font size on the tags, and the application of audio-visual barcodes were suggested by 16% of the students. There were no suggestions, though, for placing magnifiers in the departments.

Shapes, Sizes and Qualities of the Interior Architecture Reinforcements

The highest numbers of suggestions (84%) were addressed to the height and/or width of the shelves, the finding of which is an indication that the students were strongly aware of the potential difficulties certain customers have in accessing the shelves. The second highest number of suggestions for this issue (59%) was related to the height of the cashier counter and the size of the changing rooms. In reference to the changing room, a small number of the students offered suggestions about the height of the hangers. Moreover a few number of students (25%) mentioned about the opening mode of the changing room doors. In the context of inclusiveness, the students also made suggestions about the environmental conditions of the store, specifically focusing on the level of lighting (47%), and, though not as commonly suggested, the colors of the walls, floor and ceiling (19%) and ventilation (19%). In addition to the environmental conditions, some of the students considered security (fixation of the shelves: 22%; non-slippery floor/tactile paving: 22%; display type for products 9%) to be important.

Shop Window

Half of the students (50%) offered suggestion regarding the lighting of the shop window, and they were mainly concerned about the attractiveness of the store and ensuring a good perception of the products on display. Furthermore, 19% of the students talked about the height of the shop window and the window presentation of the products to the public. The findings demonstrated the consideration they gave to making the products visible to people of different body heights and from a variety of distances.

Restrooms

The students offered suggestions about designing a restroom for people with disabilities (19%) and providing a childcare room (9%).

Other

Included under the uncategorized suggestions offered by a lower percentage of the students were playing calming music in the store to foster a peaceful store atmosphere (22%), offering of helpful service by the store workers to the people with disabilities and the older people (16%), and enriching the expression of the brands (16%).

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UNIVERSAL DESIGN PRINCIPLES

The second aim of this paper is to assess students' awareness about universal design principles. For this purpose, 11 universal design principles were classified according to students' suggestions about an inclusive store design. As it is known the first seven principles revealed by Mace (Story, 2001), the other four ones developed respectively by Manley (2000), Degertekin (2010) and Evcil (2014) to generalize the idea of design for all (see details about the principles of UD Evcil, 2014; Manley, 2000). While making this classification, all possible principles that conform to the students' statements (writing and sketches) were listed by the researchers. 13.7 % of the students expressed design details concerning equitable use. Tolerance for error principle is the second mostly covered universal design principles in students' store design (11.3 %). 9 % of the students explained design details concerning both equitable use and flexible in use together. The principle of simple and intuitive use comes after with 6.8 %. In students design details, functional and aesthetic integration was given 6.8 % as the previously mentioned universal design principles. It is also valuable to cite that 3 universal design principles together (low physical efforts, size and space for approach and use, and equitable use) are concerned by students as 6.8 %. Table 2 shows the frequency of universal design principles that students mentioned in their design details. None of the students stated any design details covering renewable energy resources to protect and sustain natural resources and ensure social equity. A few number of students suggested employee's assistance for customer with disabilities during their shopping experience. Though at first glance it may seem like a proposal opposing universal design, we may accept student's suggestion as a Turkish tradition. Helping and assisting to elderly is an old tradition in the society, which is probably related to universal design principle as social cohesion and participation. Indeed, students mentioned more or less other universal design principles in their statements. Therefore, it is pleasing to discover students' intention on different users' needs in design process but, on the other hand, it is also recovered that students cannot adequately adopted universal design principles.

Table 2. Universal design principles overlapping with students' suggestions for store design

Universal design principles	How many times the relevant universal design principle is used in students' suggestions	Percentage
Equitable use	6	13,7
Flexibility in use	1	2,3
Simple and intuitive use	3	6,8
Perceptible information	1	2,3
Tolerance for error	5	11,3
Low physical effort	1	2,3
Size and space for approach and use	1	2,3
Adding to human delight	2	4,5
Functional and aesthetic integration	3	6,8
Social cohesion and participation	1	2,3
Renewable energy resources to protect and sustain natural resources and ensure social equity	0	0
Adding to human delight Functional and aesthetic integration	3	6,8
Equitable use Flexibility in use	4	9
Low physical effort Size and space for approach and use Equitable use	3	6,8
Low physical effort Size and space for approach and use	1	2,3
Simple and intuitive use Perceptible information	1	2,3
Flexibility in use Perceptible information	1	2,3
Equitable use Flexibility in use Perceptible information	2	4,5
Flexibility in use Size and space for approach and use	2	4,5
Low physical effort Equitable use Flexibility in use	1	2,3
Equitable use Tolerance for error	1	2,3
Equitable use Size and space for approach and use	1	2,3
	44 times in total	100%

RESULTS

The case study showed us that interior architecture students have knowledge about UD precepts but according to their choices in the apparel store design, we can say that they are yet on the initial steps. In the study, the interior design students attached the highest importance to factors related to the accessibility of wheelchair users, older people, and persons with physical disabilities, such as the height and width of the shelves (84 %), placement of a disabled access ramp beside the stairs at the entrance (72 %), the size of the circulation area (72 %), height and size of the cashier counter (59 %), and size of the changing rooms and the hanger heights in them (59 %). The students placed a great degree of importance on aesthetic concerns related to the space in question and addressed them within the context of universal design. Their suggestions regarding these concerns included the aesthetic layout of the store, (56 %), the design and lighting of the shop window (50 %), and the use of light to bring greater visibility to the store and the products and thereby make them more attractive (47 %). Piotrowski and Rogers (1999) noted

that store design was highly important in securing commercial success. Today, many companies indicate in their product advertisements that their products are user-friendly, accessible, and of universal design. As an example, the company, VirtACombo, markets their shower/bathtub with statements promoting their "ergonomic usage and universal design line" (Karakoç, 2015).

When considering the users with different needs, the students largely focused on wheelchair users, persons with physical disabilities, visually impaired individuals, older people, and families with children. Their primary suggestions regarding these groups included the provision of broad circulation areas for physically disabled persons, determining suitable width for the ramp and size for the elevator and changing rooms, with suitable hanger heights in the latter, and positioning the cashier counter partly for wheelchair users to enable them accessing and communicating. Only 34 %, however, proposed including an elevator. They also made suggestions addressed to the readability of the price tags for the visually impaired and older adults (using Braille alphabet: 16 %; enlarged font size of the tags/audio and visual barcodes: 16 %) and proposed using non-slippery flooring, as well as tactile paving (22 %). The students attached great importance to including resting areas for older people, especially, to placing armchairs or ottomans for them in the waiting areas in front of changing rooms and cashier counters (47 %).

While the students offered many suggestions about the circulation in the store, they expressed only a few about the automatic opening mode of the door, door size, or the opening direction of the door (19 %). Since the shopping malls in Istanbul are mostly located in the city center and the stores in these areas usually do not have the type of entry-way doors seen in conventional shopping centers, the students presumably had only limited opinions about doors in a study like this, which was conducted in a very short span of time. Shopping streets especially in historical areas need some other design considerations such as new additions to old building etc. are excluded in this study.

Proposals offered by the students on directions included direction plaques (31 %), arrangements of the products by category (13 %), and spatial direction methods, such as floor signage or ceiling hangings (13 %), in addition to the more obvious directions provided by the shop employees and the assistance they give to customers with disabilities in reaching the products (16 %).

Ensuring the psychological comfort of the customers as they shop was another point considered to be important by the students.

Playing soothing music (22 %), securing the privacy of the customers, especially in the placement of the changing rooms (34 %), providing optimal ventilation (19 %), and determining the color of the space (19 %) were the other points that students, rarely though, thought about.

The students were very limited in their suggestions on safety. Their proposals included fixation of the shelves (22 %), non-slippery floor/tactile pavement (22 %), opening direction of the entrance door/motion sensor (19 %), and shape of the display items (rounded edges) (9 %).

Circulation, approaching the cashier counter, reaching the shelves, and size of the changing rooms were the biggest considerations of the students, and they searched solutions that would obey the 'Size and Space for Approach and Use', 'Equitable Use' and 'Low Physical Effort' principles of universal design. With their suggestions of fixation of the shelves and tactile pavement and non-slippery flooring for security within the context of universal design, the students aimed to comply with the principle of 'Tolerance for Error'. Moreover, they applied the 'Flexibility in Use' principle with the suggestions of offering cashier counters with different heights, arranging a suitable height for shelves that could be accessible by everyone, and using the Braille alphabet in product tags. They also suggested different methods such as graphical and spatial solutions, to make product access simple and clear (in context of the principles 'simple and intuitive use' and 'perceptible information').

CONCLUSION

This study has focused on the evaluation of the needs of different users based on store design case, and revealing the approaches of interior design students towards the inclusive design subject. The students expressed opinions in a very short period of time on a wide range of subjects including the size of the circulation area, the music to be played in the interior space, lighting of the shop window, font size of the product tags, ventilation, and the height and fixation of the shelves.

The study concluded that the participants were sensitive about the matters that needed to be considered in meeting the physical and psychological needs of different individuals. It was also determined that although the participants addressed the fundamental human categories prepared by Null (2003) (adults, children, older adults experiencing age-related changes and people of all ages with disabilities), they were unable to go into much details. The participants made their suggestions on the

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assumption that interior architecture design is one of the elements responsible for the commercial success of a store. The points that the students were most sensitive about were circulation and the accessibility of shelves and cashier counters. Their aesthetic concerns about the commercial success and customer appeal of the store were related to shop window design and lighting.

The students were aware of the fact that store design should both satisfy the needs of users and meet the commercial expectations of the client (employer). Briefly, the students demonstrated that not only accessibility and universal design but also aesthetic principles should be followed in the effort to reach customers. Outside of the aesthetic elements that play a role in competition, many commercial companies highlight that their products are user-friendly, that is, can be used by anyone, for the purpose of differentiating their products from others as well as of making their products successful.

Store design is obviously a commercial issue, and to this end, the interior architect is tasked with coming up with a design capable of meeting both the physical and the psychological needs of store employees and customers, in addition to the commercial expectations of the store owner. The architect is also responsible for devising proper ergonomic environmental conditions, which, in satisfying the aesthetic needs, makes use of anthropometric data for the purpose of providing optimal physical and psychological comfort. Other strategies for ensuring the commercial success of a store include positioning the cashier counter in such a way as to present no payment pressure on the store customers, placing the shelves, exhibition tables and other fitments in a proper fashion, and lighting the products correctly. The suggestions made by the students on the type of music to be played in the store can be included in this context.

This study has demonstrated the importance of including an analysis of universal design and different user characteristics as part of the interior architecture curriculum. Moreover, lessons on developing inclusive propositions should not only involve the theoretical dimension, and design lessons (e.g. interior architecture projects, furniture designs) should be directed towards generating solutions to design problems. In 2011, The Turkish Higher Education Council proposed that universal design be taught at the undergraduate level in design, architecture and urban design departments (document date: 09/30/2011; document number 041995), and in 2013, the Accessibility Observation and Supervision Regulation was put into force

(Official Gazette; date 07/20/2013; number: 28713). These two actions serve to demonstrate the importance of this subject and prove the value of training new employees in the areas of design and architecture. As stated by Null (2003), universal design has created new career opportunities for the alumni of design departments. Universal design offers a process wherein user differences are seamlessly incorporated into the structure of society through supportive, adaptable, accessible and safe applications, as expressed by Mace (1998), and supports social sustainability.

Likewise in Yalçın Usal & Evcil's study (2016) there is an immediate need to present students different user needs, wants and abilities not only in one course but also in different courses continuously within the 4 years comprehensive undergraduate program. Interior architecture education is one of the discipline indispensable having the potential to direct the design of products, buildings and environments. Unfortunately, there are very limited examples where UD integrated to interior architecture program seriously and continuously. In this sense, sharing good practice and assessing by a competition could be a motive since both students and tutors had been convinced of the importance of inclusively designed environments. For the last words, "in an ideal world the integration of inclusive design principles would be embedded into the design curriculum" (Manley, 2013:45).

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Resume
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