

# An Investigation on the Use of Virtual Reality Applications in Interior Architecture Design Studio

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**Abstract** – Today, there is an ever-increasing use of digital tools in design processes. Markedly, Virtual Reality (VR) applications have secured a prominent place in the interior architecture industry. The potential use of digital tools in the scope interior architecture education, how the same can be used especially in studio environment, and their respective impact on design processes have been a matter of curiosity. Nevertheless, a literature review and preliminary field research for the present study suggested that the potential uses of digital tools were not yet well known and put in place in the field of interior architecture education. Accordingly, the present study focused on the potential contribution of VR use to interior architecture education. The study was designed as experimental research with semi-structured interviews, and a studio-based practical application accompanied the literature review. In the context thereof, the Design Studios available in the Semesters 3 and 5 curricula of Istanbul Aydın University Department of Interior Architecture were taken as the study area, and semi-structured interviews were held with 42 individuals, including project tutors and students, following the VR training. The results were indicative of the fact that the use of VR technology in interior architecture design studios increased students' creative thinking skills, could help them with making correct and effective decisions in design processes, and significantly contributed to transferring the design skills of master instructors to students and increasing the level of design-based communication with their students.

**Keywords** – Interior architecture education, Interior architecture design studio, Virtual reality practices, Virtual reality technology, Interior architecture design process.

## I. INTRODUCTION

The design studio in interior architecture education is an important learning medium, which aims to help the students with acquiring practical experience in interior design. These studios are generally envisaged as practical courses, where multiple groups of students work on a specific interior design project and improve their creative design skills. These studios can increase students' critical thinking abilities and help them manage design processes more effectively.

A review of the historical evolution of design studio indicated that the educational model was based on a master-apprentice relationship during the early periods. Subsequently, the Ecole Des Beaux Art movement, an influential approach in architectural education, contributed to the educational understanding, which formed the basis of today's design studios [1]. This educational approach was marked with jury assessments and the design studio convention, which emerged for the first time and played an important role in design education.

This educational model was replaced by the Bauhaus approach with the popularization of the modernist movement. Studio education in the scope the Bauhaus model placed great emphasis on a free and effective working environment for students and masters with an aim to stimulate students' creativity. In this working environment, masters, students, and tutors have assumed close and guiding roles with respect to each other [2]. Both Beaux Arts and Bauhaus educational

models promoted practical learning, especially in design studios. Therefore, it was aimed to increase students' awareness, improve their comprehension skills, and help them acquire practical skills.

Design education also aims to provide students with flexible thinking skills as opposed to simple reiteration of the knowledge they have previously learned. The most significant setting for learning in design education is considered the design studios.

Design studios in interior architecture education serve as a platform for critical review and discussion. The students are required to critically review and receive criticism about their work at every stage of the design process. Therefore, students' works are critically reviewed by studio tutors at regular intervals in design studios.

Another objective of the design studio model is to help students acquire the skills to present their projects effectively. Accordingly, it is aimed ensure that the students develop professional presentation skills. The aforementioned presentation skills are critical for success of design students in their professional life, and such skills they acquire during their education are tailored so as to help them with making a difference in future design projects and work environments [3].

Visual presentations, which are developed with an aim to effectively learn and apply the design process and convey the resultant design to relevant individuals are considered among

the cornerstones of interior architecture studio courses. It is of great importance for students to visually express their designs, ideas, and projects in order to be successful in the realm of design. Therefore, presentation techniques should be taught to students in detail and put into practice in interior architecture design studio courses.

The methods of presentation may vary in the scope of the interior design studio courses. While the traditional presentation techniques are associated with basic tools, including hand drawings and models, digital presentation methods as a result of technological advancements provided unprecedented opportunities. Students are also required to learn how to use modern technologies, including computer-aided design (CAD) software, and 3D modeling and visualization tools. It is important to teach students both the traditional and innovative presentation methods in interior design studio courses. This will help students develop both the core skills and the ability to keep up with future design trends.

Examples of different presentation techniques include two-dimensional drawings, three-dimensional drawings (perspectives), mood boards, three-dimensional models (scale models), 3D models, photo-realistic visuals (renderings), animations, and 360-degree videos. One of the above presentation methods is the virtual reality, which is among the recent technological innovations in the interior architecture education during the digital age.

Virtual Reality (VR) is a technology that introduces the user a completely virtual environment with a feeling of reality. VR provides users with a rich experience in visual and auditory terms and the ability to interact in the virtual world.

There are different definitions for VR in the relevant literature. The definitions by Stone [4] and Oppenheim [5] summarize the first definitions provided in the history of virtual reality. Stone suggests that virtual reality is the multiple environments that appeal to human senses, created to improve communication between machines and people. Oppenheim, on the other hand, defines virtual reality as a technology intended to increase machine-human interaction through sensation not merely relying upon visual and auditory communication.

VR is a tool allowing users to interact directly with the computer to solve complex problems, and the most important feature of virtual reality is considered the fact that it mimics real environments [6]. Sanchez-Vives and Slater [7] define VR technology as the feeling of being physically in a place, which is different than where you are actually in. Similarly, Fuchs, Moreau, and Guitton [8] define VR technology as an environment created by a combination of fiction and reality. In this case, either produced in a kind of imaginary way or built as a reproduction of the real world, VR is a technology, which provides a simulation-based immersion in space [9].

VR has become one of the important tools of interior design, especially in the recent years. VR technology allows users to experience the design prior to the implementation phase. This helps to see the defined space in the virtual environment, regardless of whether the very space actually exists or not. This technology can be used to more effectively visualize, present, and review workshops and projects in interior design education. Notwithstanding above, a literature review and preliminary field research for the present study suggested that the potential uses of digital tools were not yet well known and put in place in the field of interior architecture education.

This study focused on VR applications in interior architecture education, and sought an answer to the question,

“What could be the possible contributions of this technology to interior architecture education, in both theoretical and practical terms, in a scientific framework?” The main objectives of the study included discovering the potential of using VR in interior architecture education and understanding the positive contributions of this technology in the feedback of students and instructors.

## II. MATERIALS AND METHOD

In the present study an experimental research method was used, which included the consecutive stages of identifying participants, forming groups, carrying out the application, collecting and analyzing data, and comparing and reviewing the results. Subsequently semi-structured interviews were held with the participants.

The study participants were limited to the students and instructors of the Interior Architecture Studio courses (IMT201 and IMT301), respectively, in the Semesters 3 and 5 curriculum of Istanbul Aydin University, Department of Interior Architecture. The first reason to select the aforementioned studios, which were included in the first semester curriculum of the second and third years, was that the students had already taken digital technology-based courses, including modeling software such as AutoCAD, Sketchup, and Autodesk 3ds Max, and rendering software such as V-ray, Lumion, etc. Therefore, the students had already achieved adequate levels of competency in technology courses so as to allow them to easily learn/use VR technologies. Another reason for the aforementioned selection was that the student projects in the relevant design studios were larger in scale compared to the first two semesters.

### A. Application of the Method

The square meters and subjects were different in both groups included in the study. There were four project tutors in the IMT 201 Studio. The tutors gave the students a grid system prepared on the AutoCAD platform, which they could work on between 650 and 850 square meters. The tutors determined three different project topics in this studio: patisserie, pop-up store, and library. Only one topic was assigned to each student. Students studied on the assigned topic on this grid system.

Three project tutors were on duty in the IMT 301 Design Studio. For this studio, the tutors identified an existing building with a confined area of 1552 square meters to be repurposed as a nursery, restaurant, or health center. Again, only one topic was assigned to each student in this studio as well.

In the course of the projects in question, jury assessments were held in the fourth, seventh, and thirteenth weeks, respectively, and finally presentations were made within the fifteenth week. In the first phase of the study, the studio students, who voluntarily participated in the study voluntarily, received a one-hour training on virtual reality and rendering methods, which could be integrated into virtual reality technology and the use of the 3DVista program. Subsequent to the training, the students moved their projects to the virtual reality environment and then implemented their projects in the virtual environment using virtual reality glasses.

The students' projects were later collected via a drive address and uploaded to the virtual reality glasses. Thereafter, the project tutors reviewed the students' work and observed the effects of virtual reality technology in education.

Semi-structured interviews were held during the second phase of the study. At this stage, the students were first asked about their pre- and post-experience opinions, and secondly, a similar interview was held with the instructors.

Based on the above interviews, it was possible to investigate the effects the use of virtual reality technology in interior architecture education both project tutors and students and its contributions it made as well as the challenges in the course thereof.

In the final stage of the study, the data collected by means of the interviews were analyzed and the findings were presented in both written and visual terms.

### III. RESULTS

Application study of virtual reality technologies for interior architecture education with students and project tutors from the Department of Interior Architecture, Faculty of Architecture and Design, Istanbul Aydın University included a total of 42 individuals, with 14 students and 4 project tutors from IMT201 Studio, and 21 students and 3 project tutors from IMT301 Studio. Participant groups and number of participants in the implementation study are given in Table 1:

Table 1. Number of field study participants table

Participant Group	Number of Participants
IMT201 Students	14
IMT301 Students	21
IMT201 Project Tutor	4
IMT301 Project Tutor	3
Total	42

The questions included in the semi-structured interviews with the students and the respective percentages of the responses are itemized below:

- First, the following question was addressed in order to investigate whether the student had previous experience and, if so, the effect of the said experience on the study: "Was the VR technology new to you?" Do you have any previous experience?". It was seen the rate of students without previous experience in the IMT 201 and IMT 301 Studios was 64% and 71%, respectively.
- The following question was addressed in order to identify the potential difficulties encountered by students during the process, which spanned from VR education to its use, and to investigate the impact of these difficulties on its use in interior architecture education: "What are the difficulties you encounter when using virtual reality technology (For example, hardware, software, training process, etc.)?". While 41% of IMT 201 students did not report any difficulties, 29% experienced problems with the program, 18% with the equipment, and 12% issues associated with health status. On the other hand, 45% of IMT 301 students responded that they did not have any difficulties, where 30% reported problems with the program, 10% with the equipment, and 15% with health status.
- The following question was addressed in order to investigate the advantages and disadvantages of the use of VR technology in interior architecture education by interior architecture students: "Can you explain the

advantages and disadvantages that VR technology has provided you in the course of application?". 52% of IMT 201 students responded that this technology was advantageous in terms of presenting realistic images, where 33% reported advantages associated with developing the project, and 15% with teaching a presentation method. Furthermore, only one student reported that this technology might be disadvantageous in terms of health, because that student experienced problems such as headache and dizziness. 48% of IMT 301 students responded that this technology was advantageous in terms of presenting realistic images, where 33% reported advantages associated with developing the project, and 19% with teaching a presentation method. This group reported no disadvantages.

- The following question was addressed in order to understand the possible contributions of VR technology to creativity and thinking skills of the students: "Do you think virtual reality applications contribute to improving your creative thinking skills?". Both groups responded affirmatively. 50% of IMT 201 students and 41% of IMT 301 students reported contributions associated with reality and realization actions, where 30% of IMT 201 students and 33% of IMT 301 students reported contributions with regard to developing the project, and 20% of IMT 201 students and 26% IMT 301 students with regard to spatial perception.
- The following question was addressed in order to understand the changes in students' abilities to solve design problems: "Do you think VR technology increases your abilities to solve design problems?". Both groups responded affirmatively, except for one student in the IMT 301 group.
- The following question was addressed in order to understand students' experiences in expressing their projects better: "Do you think that VR applications contribute/make it easier for you to better express your designs to your project tutors?". Both groups responded to this question affirmatively.
- The following question was addressed in order to understand students' views on the increased use of VR technology in interior architecture education and the possible suggestions they may offer: "Do you want VR technology to be used more comprehensively in interior architecture education?" If your answer is 'yes', in what type of courses or applications would you prefer it to be used?". Both groups suggested that 62% of VR technology should be used in project courses, 32% in other studio-based courses, and 8% in theoretical courses.

The questions included in the semi-structured interviews with the project tutors and the respective percentages of the responses are itemized below:

- The following question was addressed in order to investigate whether the project tutors had previous experience in the field of virtual reality technology and, if so, the impact of their experience on the work: "Was VR technology new to you?" Do you have any previous experience?". It was seen that 57% of all project tutors had no previous VR experience.
- The following question was addressed to the project tutors in order to investigate whether the students'

presentation of their designs with VR technology contributed to the students after the experience and to get an answer to the question of what the possible contributions were: "Do you think that the students' presentation of their designs with VR technology contributed to them?" If your answer is 'yes', what kind of contributions do you think it has made?". The tutors from both groups responded affirmatively to this question. Tutors reported that it contributed to the students in terms of perceiving the project better, developing the project, understanding the reality of the project, developing creative design skills, and being able to express the project better.

- The following question was addressed in order to collect the opinions of the project tutors for the greater use of VR technology in interior architecture education: "Do you want VR technology to be used more comprehensively in interior architecture education?" If your answer is 'yes', in what type of courses or applications would you prefer it to be used?". The common opinion of project tutors from both groups was that VR should be used in studio-based courses and other program courses as well as project courses.

#### IV. CONCLUSION AND RECOMMENDATIONS

The present study focused on interior architecture education and VR, one of the technological innovations of the digital age. Accordingly, a field study was carried out on the use of VR applications in interior architecture design studios, given that VR was considered to have a significant potential both in the sector and in interior architecture education. This study aimed to investigate the possible contributions and/or challenges that VR applications could provide in design studios, and it was shaped on the basis of two research questions below: "What are the advantages and disadvantages of using virtual reality application in interior architecture education?" and "Does the use of virtual reality technology make a difference in the feedback from the students and project tutors?".

The design studios included in the Semesters 3 and 5 curriculum of the Department of Interior Architecture, Istanbul Aydin University, were taken as the study area, and in this context thereof, semi-structured interviews were held with a total of 42 individuals, including 7 project tutors and 35 students.

The results were indicative of the fact that the integration of VR technology into the interior architecture design studio provided students with a number of benefits. The most important of these benefits included more effective work in the design process and the development of creative thinking skills. VR offers students with the opportunity to experience their designs in a three-dimensional environment, giving them the ability to navigate the space and observe the details. In this context, students reported that they were able to review their designs in a more realistic and detailed manner and provide faster and more effective solutions to the design problems they encountered. In that regard, VR provided students a multidimensional and deeper perspective, as they could have interacted with spatial design in a virtual environment and review their designs in real time.

Another result was that VR helped students with better expressing their designs. For example, it was seen that with this technology, which was considered beyond conventional presentation means of traditional rendering and drawings, students acquired the ability to present their designs like an expert. As a matter of fact, both the students and the project tutors responded with positive opinions parallel to above results. This benefit would also allow them to communicate more effectively in their future professional lives.

The majority of the students responded in the interviews that VR technology had a positive impact on the design process. In particular, it was seen that the opportunity to navigate three-dimensional spaces and reviews their designs in detail improved students' design skills. Furthermore, it was found that VR applications helped students encounter different design problems and produce creative solutions to these problems. Besides, the presentations by the students using the VR technology were considered more effective and successful by both the students and the tutors. In particular, project tutors reported that VR applications provided the students with the opportunity to explain and review their designs more effectively.

Furthermore, although the results showed that VR technology had a positive effect on interior design education, it must be said that there were some disadvantages. For example, some technical problems might arise because the technology is not yet fully mature, and that issues associated with issues hardware and software can adversely impact the VR experiences of the students and tutors.

The cost of VR applications is considered another important factor. The cost of the equipment required to use this technology can be high, limiting access by educational institutions and students. Furthermore, updating and maintaining this technology may inflict additional costs.

It is necessary and important that the aforementioned adverse factors are taken into consideration by educational institutions and design instructors. Accordingly educational institutions should provide an adequate infrastructure in support of this technology. Naturally, as this technology develops and becomes more accessible, its role in interior architecture education may increase even further in the future. As a matter of fact, the role of technology in interior architecture education has been constantly evolving, with the potential to influence design processes and offer students a different perspective. As an important part of this evolution, VR technology has the potential to make the design process a more effective and learning-based experience for the interior design students and project tutors, or other instructors.

Various suggestions are required to more effectively and sustainably accommodate this technology in interior architecture education. The following suggestions can be made in order to use VR technology more effectively in interior architecture education vis-a-vis developing technology.

It is of great importance that educational institutions to strengthen their infrastructure with an aim to more effectively use virtual reality technology in interior architecture education. Accordingly, here are the two basic

issues that educational institutions should take into consideration in order to strengthen their infrastructure:

- **Infrastructure and Technology Development for VR:** In order to ensure effective use of VR technology in interior architecture education, first, the required infrastructure and technology must be made available. Schools and universities should make investments in the necessary hardware and software to make sure that VR applications run smoothly. This may provide an adequate setting for instructors to use this technology effectively along with providing students with a higher quality VR experience. Furthermore, regular refreshing courses and training should be organized for students and instructors on technology development with an aim to help users with taking advantage of the technology in the most efficient way. Therefore, a continuous improvement process for VR technology in interior architecture education can be introduced. To make this technological infrastructure available will provide students and instructors with the necessary tools to more creatively and effectively realize their designs.
- **VR Courses and/or Workshops:** It is a critical step to provide courses and workshops to help develop skills in understanding and using this technology to ensure effective use of VR technology in interior architecture education. Accordingly, courses intended to provide students with opportunities to create spaces in VR, integrate design processes with this technology, and develop effective communication skills in virtual environments will help students with the effective use of this technology. Furthermore, VR workshops can provide students with the opportunity to experience VR applications in actual design scenarios, providing them with the opportunity to translate their theoretical knowledge into practice. In this context, including courses titled as "Virtual Reality in Interior Architecture" or alike into the curricula of interior architecture departments or incorporating VR technologies in the software courses can help the students with acquiring the necessary set of skills to more effectively manage their interior architecture design processes and express their projects more comprehensively. This can prove to be an important step in improving both theoretical knowledge and practical skills.

#### STATEMENT

This study is derived from the master's thesis titled "An Investigation on the Use of Virtual Reality Applications in the Interior Architectural Design Studio" submitted to the Department of Architecture and supervised by Assoc. Prof. Dilek Yasar, Istanbul Aydın University Post-Graduate Studies Institute.

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