Examining Technology in the Context of Interior Architecture Education

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Article Info	ABSTRACT
	In the twenty-first century, the rapid development of digital technologies has led to profound transformations in education and directly influenced design studios, which constitute the primary learning environment of the interior architecture discipline. Traditional studio education is being reshaped through computer-aided design software, three-dimensional modeling tools, and virtual and augmented reality applications, thereby providing students with new dimensions in spatial perception, creativity, and problem-solving skills. In this context, the position of technology in interior architecture education and its prospective role have emerged as significant areas of inquiry within the discipline. The aim of this study is to examine the use of technology in design studios within the scope of interior architecture education, to evaluate its contributions to learning processes, and to identify the resulting changes. A quantitative research method was adopted, employing a literature review and content analysis of contemporary applications. Additionally, a survey was administered to undergraduate students of interior architecture and interior architecture and environmental design programs at four public and four foundation universities in Türkiye. The findings indicate that technology accelerates the design process in studios, enhances students' creative thinking skills, and enables a more effective experience of spatial perception in digital environments. However, while online platforms foster collaboration, they do not fully substitute the experiential learning that occurs in face-to-face interaction. The study concludes that technology is an indispensable tool in interior architecture education, yet it should be integrated in a balanced manner with pedagogical approaches. Accordingly, the development of hybrid studio models that provide students with both digital and physical experiences is recommended

Teknolojinin İç Mimarlık Eğitimi Bağlamında İncelenmesi

ÖZET

Yirmi birinci yüzyılda hızla gelişen dijital teknolojiler, eğitim alanında köklü değişimlere yol açmış ve iç mimarlık disiplininin temel öğrenme ortamı olan tasarım stüdyolarını da doğrudan etkilemiştir. Geleneksel yöntemlerle yürütülen stüdyo eğitimi, bilgisayar destekli tasarım yazılımları, üç boyutlu modelleme araçları, sanal ve artırılmış gerçeklik uygulamaları ile dönüşüm geçirmekte; öğrencilerin mekânsal algı, yaratıcılık ve problem çözme becerilerine yeni boyutlar kazandırmaktadır. Bu bağlamda teknolojinin iç mimarlık eğitiminde nasıl konumlandığı ve gelecekteki rolünün ne olacağı diğer alanlarda olduğu gibi iç mimarlık eğitimi alanında da merak kazanan bir araştırma konusu haline gelmiştir. Bu makalenin amacı, teknolojinin iç mimarlık eğitiminde tasarım stüdyoları bağlamında nasıl kullanıldığını incelemek, öğrenme süreçlerine sağladığı katkıları ve ortaya çıkan değişimleri değerlendirmektir. Yöntem olarak ise makalede nicel bir yaklaşım benimsenmiş, literatür taraması ve güncel uygulama örnekleri üzerinden içerik analizi yapılmıştır. Teknolojik araçların (dijital tasarım yazılımları, sanal gerçeklik, artırılmış gerçeklik, çevrimiçi eğitim platformları) eğitim süreçlerindeki işlevleri ve öğrencilerin mesleki becerilerine etkileri araştırılmıştır. Daha sonra Türkiye'de seçilen dört vakıf üniversitesi ve dört devlet üniversitesinde eğitim görmekte olan iç mimarlık ve iç mimarlık çevre tasarımı lisans öğrencilerine anket uygulanmıştır. Elde edilen bulgular ise teknolojinin iç mimarlık stüdyolarında tasarım sürecini hızlandırdığı, öğrencilerin yaratıcı düşünme becerilerini geliştirdiği ve mekânsal algının dijital ortamda daha etkin deneyimlenmesine imkân sağladığını göstermektedir. Ayrıca, çevrimiçi ortamların işbirliğini artırdığı, ancak yüz yüze etkileşimdeki deneysel öğrenmeyi tam olarak karşılamadığı belirlenmiştir. Çalışma sonucunda, teknolojinin iç mimarlık eğitiminde önemli bir araç olduğu, ancak pedagojik yaklaşımlarla dengeli bir şekilde entegre edilmesi gerektiği ortaya çıkmıştır. Öğrencilere hem dijital hem de fiziksel deneyim sağlayacak hibrit stüdyo modellerinin geliştirilmesi önerilmektedir.

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INTRODUCTION

Design studios are the core environments in which professional knowledge is conveyed within interior architecture education. In the first quarter of the twenty-first century, rapidly developing technologies have brought about significant changes in design studios, as in many other disciplines. In Türkiye, the use of digital technologies in interior architecture education began in the 1990s, marking the transition toward a hybrid educational model that combines traditional and digital design approaches (Bardak Denerel & Anil, 2021).

Technological developments have manifested most prominently in interior architecture education through design studios—the primary setting where project-based courses are conducted. Unlike other educational spaces, these studios operate on a learning-by-doing principle, emphasizing hands-on experience and iterative exploration (Kahvecioğlu, 2007). Originating from the Bauhaus movement, the concept of the design studio holds a central place not only in interior architecture education but also across all fields of design (Shiner, 2004).

From the first design project to the final graduation project, the aim of design studios is to facilitate collaboration between instructors and students, enabling the continuous development and refinement of projects (Ayaydin, 2010). These frequently used environments can be described as transitional spaces, where students from diverse *habitus* backgrounds adapt to the design culture and values of their educational institution. This threshold represents not only a transition into the profession but also a shift from one cultural *habitus* to another, in which design knowledge and skills are transmitted.

Furthermore, the dynamics between instructors and students in these studios play a crucial role in conveying the complex systems of professional learning. The physical environment, together with the social and pedagogical interactions it fosters, forms the foundation of interior architecture education (Çil & Demirel-Özer, 2021).

This article will explore the relationship between technology and the practice of interior architecture. First, we will explain interior architecture, its education, and its history. Then, based on a literature review, we will explain how the integration of technology with interior architecture education began, the stages it has reached, and the contributions of digital and traditional methods to studio environments. We will also address the changes that artificial intelligence systems, which are impacting the entire world, will bring to the field of architecture and interior architecture. The results will contribute to interior architecture education by creating a document that will contribute to this education.

THEORETICAL BACKGROUND

At the end of the 19th century, developments related to the field of interior architecture began, led primarily by the United States and the United Kingdom. In response to increasing demand during this period, the first courses on interior decoration were established at the School of Fine Arts in New York. Specifically, the New York School of Applied Fine Arts initiated courses in interior decoration to meet the requests and interests of students at that time (Olcay, 2012) (Figure 1).

Figure 1
New York School of Applied Fine Arts (1908) (URL1)

By the late 17th century, design education had been institutionally established in France and gradually spread to other countries in various forms. By 1919, the Bauhaus school, which would also influence architectural schools in Turkey, had emerged (Özer, 2009). The Bauhaus design schools—addressing all developments in industry, technology, and design within educational institutions—transformed their workshops into design studios (Shiner, 2004). With this movement, design studios became central to the educational processes of disciplines such as architecture, interior architecture, graphic design, and industrial design, and the technological tools of the departments were most frequently utilized in these spaces.

In Turkey, interior architecture, similar to abroad, initially began under the concept of interior decoration. In 1982, the Sanayi-i Nefise Mektebi, now known as Mimar Sinan Fine Arts University, was established; however, the institution first offered interior architecture education in 1925 (Akkaya, 2024) (Figure 2). Following 1930, the education provided in design faculties improved the quality of interior architectural design, making interior decoration a preferred choice for many individuals. Additionally, with the growth of industrial production, the department continued to develop (Uslu, 2008).

Figure 2
Sanayi-i Nefise Mektebi(URL2)

According to Özer Baş and Sayıl Onaran (2020), although interior architecture is a discipline that examines many details within itself, its educational process parallels that of architecture. Therefore, interior architecture education should be researched and analyzed alongside architectural education. For both disciplines, the concept of design holds central importance; as a complex system that requires active engagement of intellect and reasoning, design education carries significant weight (Oxman, 2001).

Historically, this challenging field of study has been examined by numerous researchers and taught in various ways by different institutions. Over time, design education has evolved and been updated in accordance with the conditions of the period, the methods proposed by educators, the characteristics of practitioners, and the specific needs of the era (Senemoğlu, 2020).

An evaluation of the literature conducted within the scope of the research reveals that students emphasize the need for computer technology and software education to be integrated into their courses from the earliest years. Previous studies similar to this study also support the findings, and necessary work will be researched and incorporated into the curriculum.

-The curriculums of the most successful universities offering interior architecture education abroad will be researched and presented as a model to be implemented in our country.

-Furthermore, it is understood that students want to include design programs within their course plans. These results highlight the need to transform the educational infrastructure (academic and technological) of similar faculties to meet these needs. Strengthening the technological infrastructure, in particular, will enable students to train to meet the demands of the private sector. To this end, curriculums, in particular, should align with this type of restructuring.

-It has been observed that students and graduates are particularly abreast of developments in advanced technology, but they largely fail to utilize these technologies in their studies. This result suggests that market demands and financial resources are effective, and it will be emphasized that design students should be provided with opportunities for easy access to PCs.

STUDIES EXAMINING THE RELATIONSHIP BETWEEN INTERIOR ARCHITECTURE EDUCATION AND TECHNOLOGY

Studies conducted in this field can be outlined as follows:

Yıldırım, Yavuz, and İnan (2001) compared traditional and digital visualization technologies used in interior architecture within the context of architectural design education. Their study was a four-semester field research project conducted with students from the Department of Architecture at Gazi University. The study began by categorizing the visualizations used in design studios into two main groups:

1. Traditional Expression Techniques:
   a)Two-dimensional drawings on paper
   b) Three-dimensional drawings and perspectives
   c) Three-dimensional models (physical models)

2. Digital Expression Techniques:
   a) Vector-based software in digital environments
   b) Object-based software in digital environments (object-based drawing, modeling, animation, and photorealistic renderings)

These two main groups were then compared according to nine criteria: production time, space requirements and equipment, precision and quality, photorealistic results, ease of revision, potential for generating new alternatives, archiving convenience, suitability for distance education, and satisfaction of instructors and students. The survey results indicated that digital technologies offer significant advantages over traditional methods. Additionally, among digital techniques, object-based software was found to be superior to vector-based software. These findings suggest that the integration of information technologies into design studios is an inevitable process. Key requirements for this process include:1)Educators providing design education must be proficient in using digital technologies and possess adequate knowledge.2)Educational environments must be equipped with the necessary software and hardware infrastructure.3)Courses within the architectural program should be integrated with computer-based courses.

Yıldırım, Yavuz, and İnan (2010) further emphasized that, despite the adoption of digital visualization technologies, traditional expression techniques remain essential. Consequently, foundational courses in expression techniques, typically offered during the first semester, should be mandatory, and subsequent courses should combine these techniques with computer-based applications.

Denerel and Anıl (2021), in their article *Computer-Aided Drawing Programs in Interior Architecture Education*, examined the computer programs used in the departments of Interior Architecture and Interior Architecture and Environmental Design. The study investigated the curricula of a total of sixty-three departments (31 Interior Architecture and 32 Interior Architecture and Environmental Design) affiliated with the Council of Higher Education (YÖK) in Turkey and the Turkish Republic of Northern Cyprus (TRNC), focusing on which computer-aided design (CAD) programs were used and the specific software employed.

The study began by reviewing the historical framework of interior architecture education and the drawing tools previously utilized. It was emphasized that the widespread adoption of computer-aided programs by universities and companies has led to the gradual obsolescence of traditional drawing tools. Following this review, the study analyzed the CAD courses offered within the investigated departments, detailing the general features of the programs, the software they employ, and the intended applications within the educational context.

Examining the results, it can be observed that ; The sixty-three departments offering computer-aided design (CAD) education primarily provide these courses during the 2nd, 3rd, and 4th semesters. The study revealed significant differences in the preferred software between the two departments. In the Interior Architecture and Environmental Design department, education is delivered using a total of eleven different programs, whereas the Interior Architecture department offers fourteen distinct programs as part of its curriculum. Among these fourteen programs, nine different software types were identified.Currently, AutoCAD, the most widely used CAD program (Bethany, 2017), is included as a mandatory course in the curricula of both departments. The most commonly preferred programs—AutoCAD, ArchiCAD, and 3ds Max—share similar software characteristics, featuring vector-based drawing and modeling capabilities. Two-dimensional programs such as Photoshop possess raster-based functionality, while CorelDRAW and Illustrator are vector-based. SketchUp, frequently used in Interior Architecture departments, is a distinct program focusing solely on modeling. Some departments teach only two-dimensional programs, whereas others integrate three-dimensional modeling and photorealistic rendering programs into their curricula. Given that students in Interior Architecture and Interior Architecture and Environmental Design are expected to address client needs in detail in professional practice, it is necessary to incorporate any missing computer programs into the curriculum to ensure comprehensive proficiency in all relevant technologies.

Yıldırım and Demirarslan (2020), in their study on interior architecture and artificial intelligence, argue that, as in all fields, the use of AI systems in interior architecture has increased alongside technological advancements. Their research evaluated the contributions of AI—which is not expected to design as effectively as humans—to the spatial design process through selected examples. The study examined five AI systems ("AI + Architecture: Towards a New Approach" thesis, "Decision Making in the Architectural Design Process: A Fuzzy Logic-Based Facade Model Proposal," "Evolving Floorplans," the Higharch project, and "A Fuzzy Inference System-Based Model Proposal for Space Analysis in Architecture") and investigated at which of the three core design stages of interior architecture they are effective. These stages, adapted from Mutlu Avinç (2016) in A Study on Computational Design Processes, are: 1) analysis, 2) synthesis, and 3) evaluation.

The selected AI programs were analyzed for their effects on these design stages. The study began by comparing AI with human intelligence, examining the functioning of the human brain. Four commonly used AI techniques—artificial neural networks, fuzzy logic, genetic algorithms, and expert systems—were defined, drawing on Dalgalı's (2001) thesis Artificial Intelligence, Consciousness, and Design.

The findings can be summarized as follows: The first study, AI + Architecture: Towards a New Approach, which utilized a GAN-based neural network system, explored the possibilities AI provides in analyzing and generating floor plans, primarily impacting the synthesis stage. Similarly, the Decision Making in the Architectural Design Process: A Fuzzy Logic-Based Facade Model Proposal study contributed to the synthesis stage, conducting analyses of functional areas in office facades and incorporating lighting, heating, and acoustic values as model inputs. The third study, Evolving Floorplans, aimed to create optimal circulation paths in all spaces using genetic algorithms, thereby contributing to the synthesis stage.

The Higharch project, a web-based home design software operating via a designer-taught algorithm, generates 3D house designs based on user requirements, contributing to both the analysis and synthesis stages. The final AI system examined, A Fuzzy Inference System-Based Model Proposal for Space Analysis in Architecture, argues that traditional 2D visual representations focus primarily on visual perception, whereas spaces are experienced through all senses, thus impacting the analysis stage.

Yıldırım and Demirarslan (2020) concluded that AI systems primarily affect the first two stages of the interior architectural design process and currently cannot replace the designer's role.

Yıldırım (2020), in his article Analysis of Design Education and Digitalization Through a Literature Review of Thesis Studies and Identification of Problems in the Field, argues that the literature on design education remains theoretically limited and primarily consists of studies using qualitative methods. Similarly, in foundational design education, related topics are mostly discussed theoretically, with suggestions regarding digitalization largely remaining as recommendations rather than being implemented in practice. Experimental or application-based studies are scarce. Research on digitalization in the fields of architecture and interior architecture is almost nonexistent, and the few existing studies are generally not connected to educational practices. These gaps in the literature are highlighted as significant deficiencies, and Yıldırım recommends addressing them.

Eriş and Ağan (2020), in their comparative analysis of interior architecture education programs in Turkey, emphasize that to ensure equal competencies among graduates and strengthen the relationship with architecture programs, curricular differences between Interior Architecture Departments and Interior Architecture and Environmental Design Departments should be harmonized. When restructuring curricula, the authors argue that the primary goal should be to maintain the inseparability of architecture and interior architecture professions, whose fundamental purpose is to provide

transdisciplinary solutions to spatial needs. By aligning these programs, graduates of interior architecture will acquire a comprehensive understanding of architectural fundamentals, enabling them to offer holistic design solutions.

Yazıcıoğlu (2011) examines the integration of digital design tools into interior architecture education, noting that such integration facilitates the analytical structuring of design as dynamic systems within computer environments and reshapes both the design process and the understanding of design. The effects of this approach are reflected in produced artifacts, generating new geometric approaches and typologies, and continuously advancing both design outcomes and digital tools. While traditional methods limit a student's ability to fully understand and control all components and parameters, digital tools allow simultaneous management of all data and constraints. Consequently, students can create complex geometries by interconnecting multiple layers of information. Additionally, students are not confined to the limitations of algorithmic and parametric approaches; by employing scripts and algorithms, they can overcome these boundaries and produce original solutions tailored to diverse performance needs. Training future designers under these approaches ensures the development of professionals capable of using and understanding emerging technologies, adopting critical perspectives, and producing innovative, sustainable design.

METHOD

This study aims to examine the relationship between studio classrooms in interior architecture education and technology. Within this context, the interaction between technology and interior architecture students has been analyzed from both technical and perceptual dimensions. The relationship with technology has been categorized under three main headings:

- 1: General Information
- 2: The Role of Technology in Interior Architecture Education, Its Facilitations, and Challenges Encountered
- 3: The Future of Technology in Interior Space Design Education

In this context, during the 2024–2025 academic year, four public universities and four foundation (private) universities in Türkiye were selected, and surveys were administered to undergraduate students enrolled in these institutions. The universities were purposefully selected based on their accessibility for survey implementation and the adequacy of their student population sizes to ensure representativenes. Additionally, the survey was administered not only to interior architecture students but also to practicing interior architects within the scope of the doctoral study. However, this article includes only the data and findings obtained from the interior architecture students .The selected universities and departments are as follows: Necmettin Erbakan University, Department of Interior Architecture and Environmental Design; Selçuk University, Department of Interior Architecture; Hacettepe University, Departments of Interior Architecture and Environmental Design; Konya Technical University, Department of Interior Architecture; Konya Food and Agriculture University, Department of Interior Architecture; TOBB University, Department of Interior Architecture and Environmental Design; Bilkent University, Department of Interior Architecture and Environmental Design; Özyeğin University, Department of Interior Architecture and Environmental Design.

The survey questions were designed under the three main headings mentioned above to measure the role, expectations, and challenges of technology in students' education. The evaluation of the survey conducted with 481 students is presented in the Findings section.

General information about the survey participants is provided in Table 1.

Table 1
Participant Profile

| GENDER		UNIVERSITY TYPE		TECHNOLOGY PROFICIENCY LEVEL				
FEMALE	MALE	PUBLIC (STATE)	FOUNDATION (PRIVATE)	PROFESSIONAL	VERY GOOD	GOOD	AVERAGE	POOR
359	128	337	148	9	33	79	147	225

FINDINGS

The results obtained from the survey clearly demonstrate the role of technology in the education of interior architecture students. The vast majority of students reported actively using digital software (AutoCAD, SketchUp, 3ds Max, etc.) in design studios. However, notably, students have not completely abandoned hand drawing and model making. This indicates that a hybrid learning approach is naturally embraced among students.

Students particularly find technology useful for visualization, accelerating project preparation, and presenting their work. Additionally, it was observed that emerging tools such as virtual reality (VR) and augmented reality (AR) contribute to a better spatial understanding and improvement of their designs. Nevertheless, some students noted that excessive reliance on technology might limit creativity and make the design process more mechanical.

One of the main issues regarding access to technology is the cost of hardware and software. Students without powerful computers or access to expensive software reported experiencing disadvantages during studio work. This highlights that, alongside the opportunities technology provides in education, it can also introduce certain inequalities.
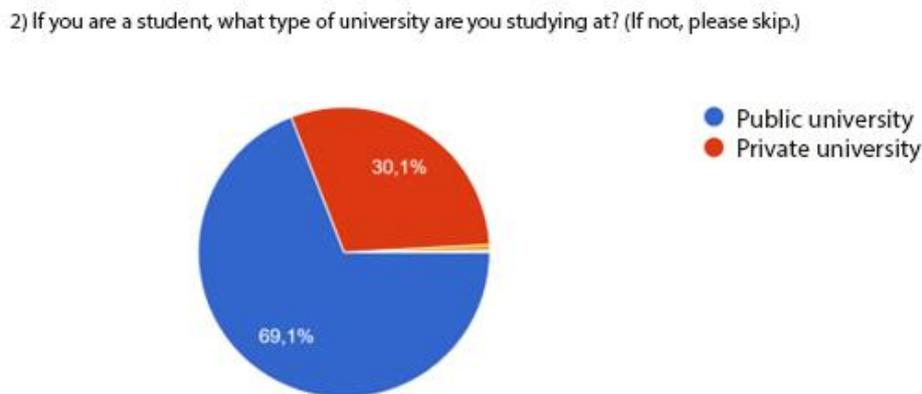
The findings also reveal that design studios are not merely spaces where lessons are conducted; they are social environments where students from diverse backgrounds step into a shared professional culture. While technology plays a facilitative role in this transition, students emphasized that face-to-face interaction and studio culture remain indispensable. In conclusion, technology integration enriches students' experiences, but it yields the most effective results when combined with traditional methods. The survey questions posed to the students and their responses are as follows.

Figure 3
Responses to Question 1

1)"What is your role in the interior space?"

STUDENT
EDUCATOR
PROFESSIONEL

97,7%
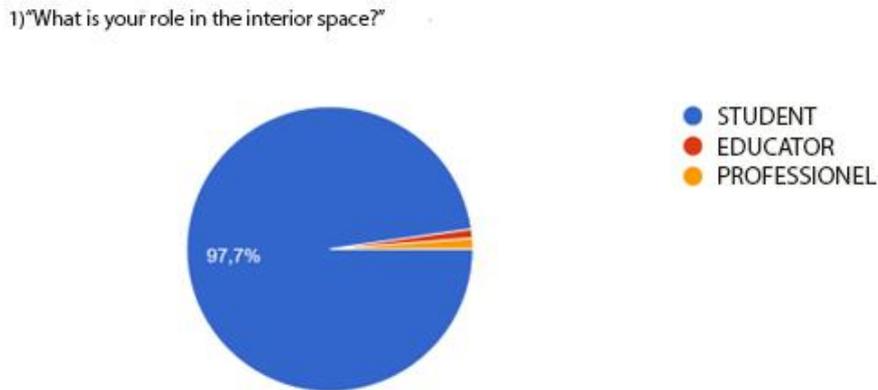
This pie chart illustrates the roles of participants in interior design based on a total of 487 responses. As shown in the chart, roles other than "Student" account for only 2.3% of the total (i.e., 100% − 97.7%). This small proportion is distributed between "Instructor" (orange) and "Professional" (yellow), respectively.

Figure 4
Responses   to   Question   2

2) If you are a student, what type of university are you studying at? (If not, please skip.)

Public university
Private university

30,1%

69,1%

This figure presents the responses to the question, "If you are a student, what type of university do you attend?" among participants who identified themselves as students. Approximately two-thirds of the surveyed students (69.1%) are enrolled in public universities, while the remaining portion (30.1%) attend foundation (private) universities.

Figure 5
Responses to Question 3

3)"What is your level of proficiency in the computer programs used in interior design?"
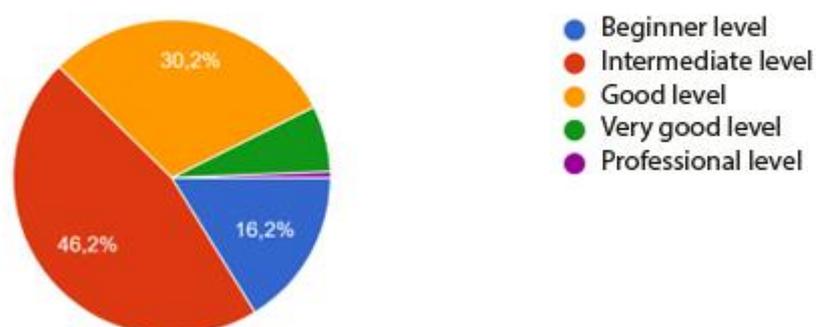

Figure 5 illustrates that participants' software proficiency levels are concentrated at intermediate and above levels.

Concentrated Levels:

1. Intermediate (Red): Represents the largest share, accounting for nearly half of all responses (46.2%). This indicates that the most common level among participants is the ability to use basic programs.

2. Good (Orange): Represents the second largest group (30.2%). When considered together with the intermediate level, 76.4% of participants demonstrate intermediate or good software proficiency.

Low and Advanced Levels:

- Poor (Blue): A notable portion of participants (16.2%) reported their software proficiency as poor.

- Very Good (Green): This level constitutes a smaller share (5.6%) of the total.

- Professional (Purple): Representing the highest proficiency level, this category accounts for only a very small fraction (1.8%) and is barely visible in the chart.

Figure 6
Responses to Question 4

4)"What is your level of knowledge about the current technological tools used in interior design?"
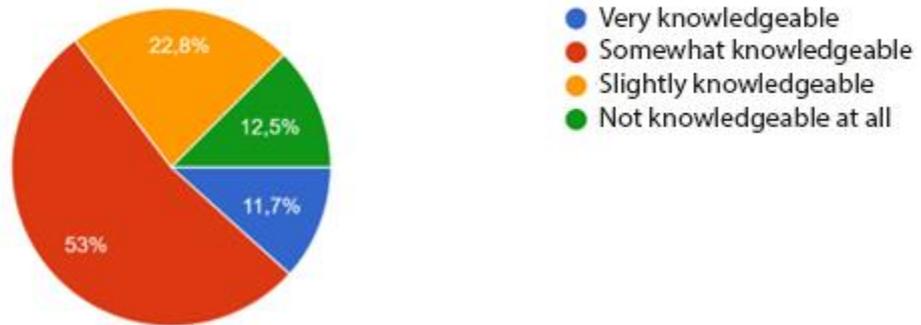
Among the participants, having only a superficial knowledge of emerging technologies used in interior design (e.g., VR, AR) is predominant. However, the fact that more than one-third of participants have little or no knowledge in these areas indicates a high need for education or awareness in this field.

Figure 7
Responses to Question 5

5)"Which software programs have you studied or will you study in your interior architecture curriculum? (You may select more than one.)"
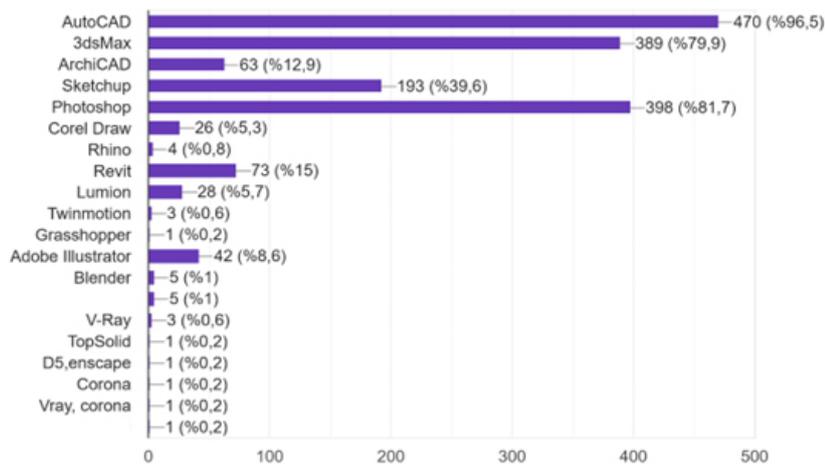
The bar chart, based on 487 responses, presents the software programs that participants have taken or are expected to take within interior architecture curricula. Multiple selections were allowed in the survey, providing a broader view of the software diversity within educational programs. The analysis reveals a predominant focus on standard and foundational design tools, whereas the integration of advanced or specialized software remains relatively limited.

A substantial majority of participants reported exposure to the core software programs of interior
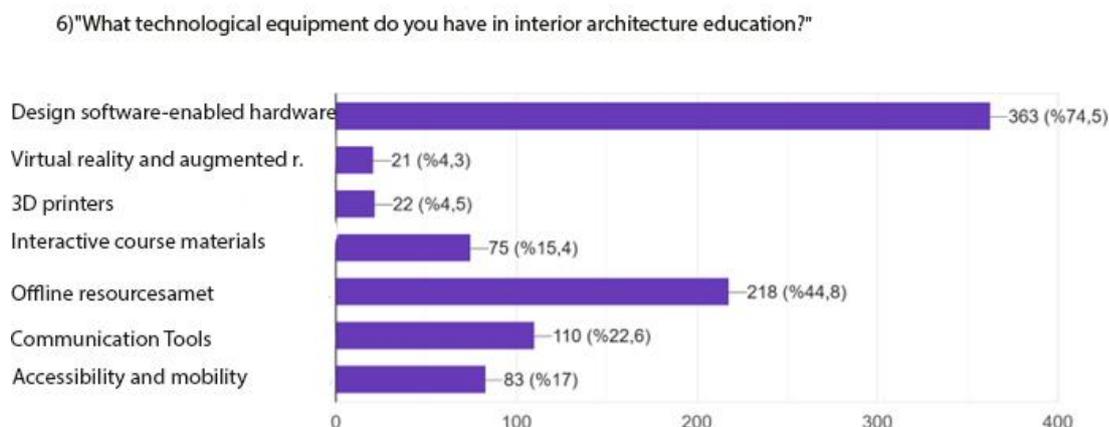
architecture education—AutoCAD (96.5%), Photoshop (81.7%), and 3ds Max (79.9%). These programs are widely recognized as essential tools for technical drawing, visualization, and presentation within the discipline. SketchUp (39.6%) follows as a popular rapid modeling software, yet it remains secondary to the main trio.

In contrast, the inclusion rates of advanced or specialized programs demonstrate a significant decline. Building Information Modeling (BIM) tools such as Revit (15%) and ArchiCAD (12.9%) are represented by a considerably smaller proportion of students, indicating that BIM-based digital design technologies have not yet achieved widespread adoption in interior architecture education in Turkey. Similarly, visualization and rendering software such as Lumion (5.7%) and V-Ray (0.6%) show relatively low representation.

Additionally, parametric and free-form modeling tools like Rhino (0.8%), Grasshopper (0.2%), and Blender (1%) appear in only a minimal number of curricula. Overall, AutoCAD, Photoshop, and 3ds Max dominate interior architecture education, reaching the majority of students, whereas advanced digital tools—particularly BIM and visualization software—remain marginal. These findings suggest a potential gap between educational content and professional practice, highlighting the need for supplementary software training outside the formal curriculum to enhance graduates' competitiveness in the evolving design industry.

Figure 8
Responses to Question 6

6)"What technological equipment do you have in interior architecture education?"

Design software-enabled hardware — 363 (%74,5)
Virtual reality and augmented r. — 21 (%4,3)
3D printers — 22 (%4,5)
Interactive course materials — 75 (%15,4)
Offline resourcesamet — 218 (%44,8)
Communication Tools — 110 (%22,6)
Accessibility and mobility — 83 (%17)

This question examined the types of technological equipment that students possess or use within interior architecture education (N=487). According to the results, the most prevalent category consists of equipment supporting design software (74.5%). This finding indicates that computer-aided design (CAD) programs have become a fundamental component of interior architecture education and an indispensable tool for the vast majority of students.

The second most common element is the use of online resources and educational materials (44.8%). This suggests that students are increasingly oriented toward digital content and online learning environments, which play a significant role in supporting theoretical knowledge.

Approximately one-fourth of the students (22.6%) reported using communication and collaboration tools (e.g., video conferencing systems, online project platforms). This implies that collaborative learning processes and group projects are increasingly shifting toward digital environments.
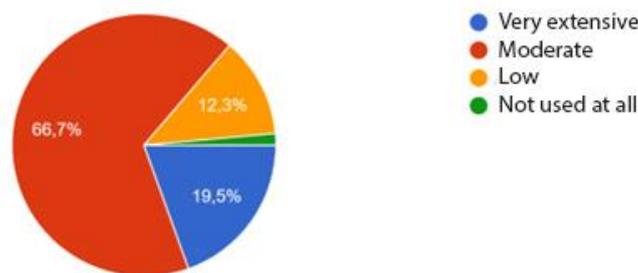
Lower proportions were observed for accessibility and mobility tools (17%) and interactive learning materials (15.4%). These findings point to the fact that student-centered and interactive learning methods are still in the process of becoming widespread.

The lowest rates were recorded for innovative technologies: 3D printers (4.5%) and virtual/augmented reality applications (4.3%). Although these technologies are still used to a limited extent in interior architecture education, they hold significant potential to transform design processes in the future.

Overall, interior architecture education remains largely centered around traditional digital tools such as design software and online resources. However, greater integration of next-generation technologies into educational programs could provide students with more experiential, innovative, and practice-oriented learning environments.

Figure 9
Responses to Question 7

According to the findings, the majority of participants (66.7%) reported that digital tools are used at a moderate level within interior architecture education. This proportion indicates that while digital technologies have been incorporated into educational practices, full integration has not yet been achieved.

Additionally, 19.5% of participants stated that digital tools are used extensively, whereas 12.3% reported a low level of use. Only 1% of respondents indicated that digital tools are not utilized at all.

In conclusion, digital technologies hold a significant presence within interior design curricula; however, their application remains largely at an intermediate level. This suggests that curricula require further development toward a more advanced and comprehensive integration of digital technologies.

Figure 10
Responses to Question 8

8)How effective do you think these technologies are in improving your design skills and understanding?
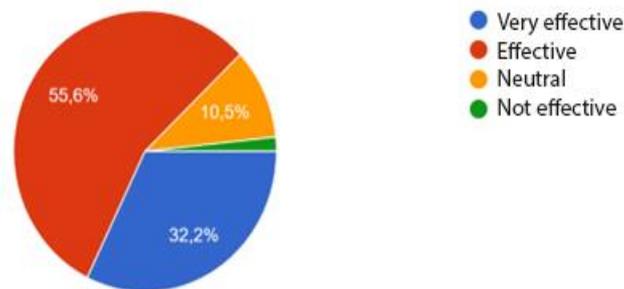

The majority of participants evaluated these technologies positively. Specifically, 55.6% stated that digital technologies are effective, while 32.2% considered them to be highly effective. These results indicate that approximately 88% of students believe digital technologies contribute positively to design education. In contrast, a smaller proportion of participants (10.5%) reported a neutral perception, and only about 1% considered these technologies ineffective.

Overall, the findings reveal that digital technologies are perceived as highly valuable in enhancing students' understanding and skills within the design process. This suggests that digital tools are regarded not merely as technical support instruments but also as pedagogically powerful components that enrich learning experiences in interior architecture education.
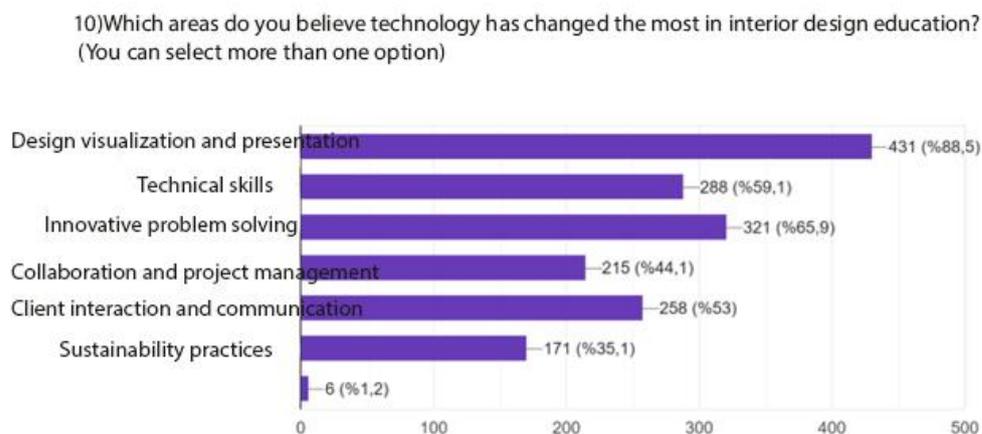
Figure 11
Responses to Question 9

9)How do you evaluate the impact of technology on the quality of education in interior design?
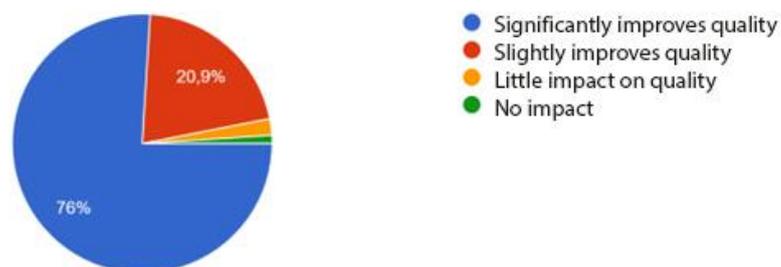
These data indicate the presence of a strong academic consensus within the field of interior design education regarding the critical and central role of technology in enhancing the quality of instruction. Tools such as Computer-Aided Design (CAD), 3D modeling, and Virtual/Augmented Reality (VR/AR) are widely acknowledged to significantly improve students' spatial perception, visualization skills, and professional competencies. It can be stated that both academics and students now view technology not as a supplementary component, but as an integral and quality-enhancing element of design education.

Figure 12

Responses to Question 10

10)Which areas do you believe technology has changed the most in interior design education? (You can select more than one option)

- Design visualization and presentation — 431 (%88,5)
- Technical skills — 288 (%59,1)
- Innovative problem solving — 321 (%65,9)
- Collaboration and project management — 215 (%44,1)
- Client interaction and communication — 258 (%53)
- Sustainability practices — 171 (%35,1)
- — 6 (%1,2)

This chart indicates that the role of technology in interior design education is predominantly oriented toward visual and creative outputs. From an academic perspective, it is critically important for future curricula to extend beyond this strong foundation of visualization and incorporate technological integrations that foster more holistic and interdisciplinary competencies—such as project management and environmental impact analysis. Such an evolution would contribute to cultivating a more comprehensive and future-ready model of interior design education.

Figure 13
Responses to Question 11

11)To what extent would you recommend greater integration of technology into the curriculum?

● Highly recommend
● Somewhat recommend
● Neutral
● Would not recommend

21,6%

73,1%
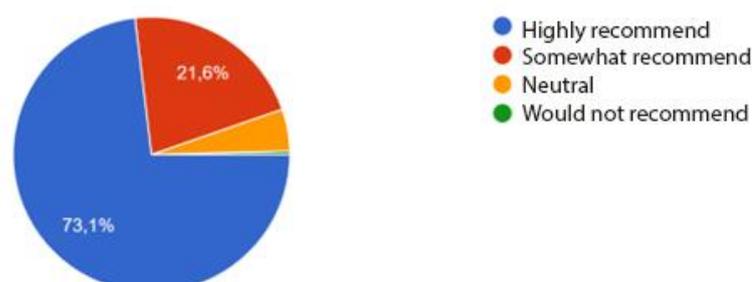
This analysis serves as a clear call to action that reinforces the findings of the first two charts—namely, that technology enhances educational quality and plays a crucial role in visualization within interior design education.

• Need for Proactive Curriculum Revision:

For educators and academic administrators, these results imply a strong demand among students and participants for a more technology-oriented education. There is increasing pressure for curricula to move beyond maintaining the status quo and to integrate emerging technologies—such as AI-assisted design tools, advanced VR/AR applications, and Building Information Modeling (BIM)—as core and compulsory components of the educational framework.

• "Technology is Inevitable" Perception:

The high recommendation rate suggests that participants no longer view technology as a privilege within the design profession, but rather as a fundamental necessity for maintaining competitiveness and professional competence.

• Educational Strategy:

Universities and professional training institutions should not be limited to teaching basic software skills. Instead, they should invest in pedagogical strategies that embed technology into every stage of the design process—from conceptualization and analysis to presentation and project management.

Figure 14
Responses to Question 12

12)Which traditional design method do you use in your department?
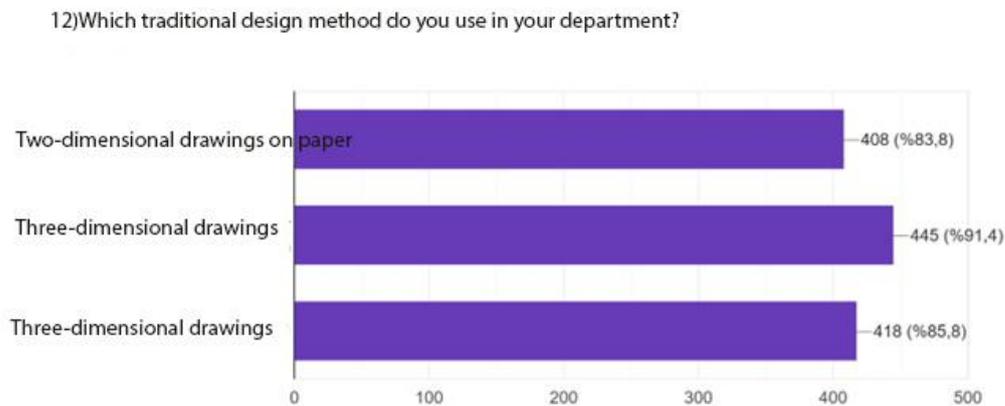
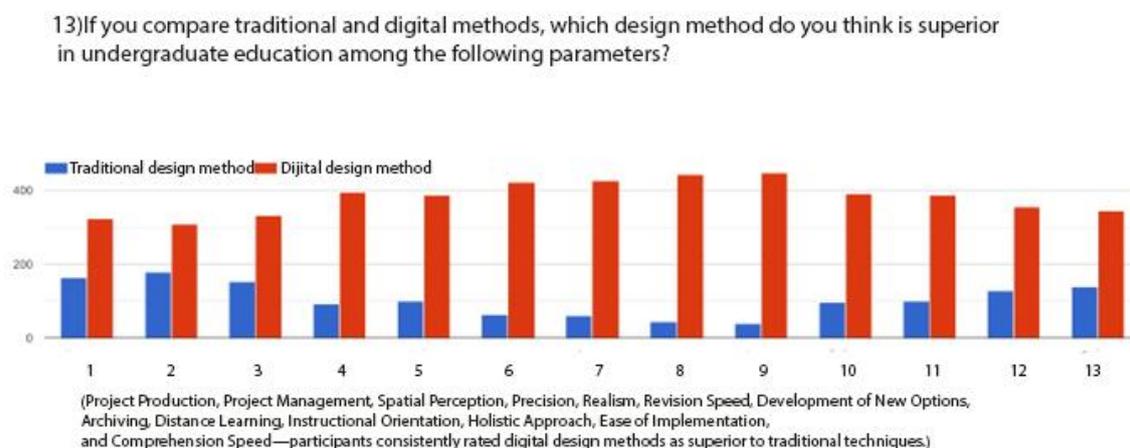The responses to Question 12 reveal the following primary findings:

• Dominance of Perspective Drawings: Three-dimensional drawings (perspectives) were reported as being used by 91.4% of participants (445 responses), representing the highest adoption rate.

• Permanence of Physical Models: Three-dimensional models (physical models) ranked second, with 85.8% of participants (418 responses) indicating their use.

• Continued Relevance of Basic Drawings: Two-dimensional drawings on paper, although ranked last in the list, were still widely utilized, with 83.8% of participants (408 responses) reporting their use.

These findings indicate that while advanced 3D visualization tools dominate, traditional 2D drawing techniques remain a fundamental component of interior design education.

Figure 15
Responses to Question 13

13)If you compare traditional and digital methods, which design method do you think is superior in undergraduate education among the following parameters?

(Project Production, Project Management, Spatial Perception, Precision, Realism, Revision Speed, Development of New Options, Archiving, Distance Learning, Instructional Orientation, Holistic Approach, Ease of Implementation, and Comprehension Speed—participants consistently rated digital design methods as superior to traditional techniques.)

This multi-parameter comparative bar chart demonstrates a clear academic and professional consensus that digital design methods hold a significant advantage over traditional approaches in undergraduate interior design education. Across all 12 parameters represented in the chart—Project Production, Project Management, Spatial Perception, Precision, Realism, Revision Speed, Development of New Options, Archiving, Distance Learning, Instructional Orientation, Holistic Approach, Ease of Implementation, and Comprehension Speed—participants consistently rated digital design methods as superior to traditional techniques.

Notably, in technical and operational domains such as Archiving, Distance Learning, Precision, and Revision Speed, the advantages of digital methods are particularly pronounced. This finding underscores that academic programs view digital transformation not merely as an option but as a necessity, given its potential to enhance efficiency, accessibility, and technical competency. While traditional methods continue to contribute to foundational conceptual development, these data confirm the absolute predominance of digital tools in preparing students for professional practice within the field of interior design.Additionally, it is observed that the reason digital methods are less frequently perceived yet more highly preferred by students compared to traditional methods is that, in the nine-item comparison, the advantages of digital methods outweigh those of traditional ones.

DISCUSSION AND RESULTS

The findings of this study reveal that digital technologies have become indispensable components of interior architecture education, particularly within design studio environments. Students perceive technology primarily as a tool that enhances presentation quality, accelerates project development, and enables more detailed spatial visualization. These results support previous studies (Yıldırım & Demirarslan, 2020; Bardak Denerel & Anıl, 2021), which emphasize that digital tools improve cognitive and visual thinking processes and contribute to the accuracy and realism of design outputs. However, although students benefit significantly from digital software, they do not entirely abandon traditional methods, indicating a natural transition toward hybrid learning approaches. This confirms earlier findings suggesting that hand drawing and physical model-making still foster creativity, conceptual thinking, and tactile learning (Oxman, 2001; Ayaydin, 2010).

While technology improves efficiency and operational processes, students expressed concerns about its potential to limit creativity when overused. Excessive reliance on software may make the design process more mechanical and reduce critical thinking and emotional engagement, which are essential in the creative process. This aligns with Yazıcıoğlu's (2011) argument that digital tools should not replace design thinking but rather support it. Similarly, the insufficient availability of advanced technologies such as VR, AR, AI, and BIM in many academic programs highlights a gap between educational practices and industry expectations. This suggests that current curricula may be technologically outdated and insufficiently aligned with professional competencies.

Another key finding from the study is the significant inequality in access to technological infrastructure. Students from universities with limited hardware or unlicensed software resources reported challenges, such as longer project preparation times and reduced performance in studio courses. This implies that technological advancement alone is not sufficient; institutional support, training, and equal access are critical to ensure fair learning experiences for all students.

From a pedagogical standpoint, the findings indicate that technology should not only be taught as standalone software programs but integrated holistically into the design process. Current educational practices often emphasize technical proficiency without adequately connecting digital tools to conceptual, analytical, or spatial decision-making stages. This gap highlights the need for new pedagogical models that embed technology within the core of design education rather than treating it as

supplementary.

Another important dimension emerging from the findings is related to the cultural and collaborative nature of studio environments. While digital platforms support remote learning and collaborative project development, students still consider face-to-face studio interaction essential for receiving feedback, engaging in peer learning, and experiencing the social dynamics of design culture. This confirms the argument by Çil and Demirel-Özer (2021) that studio environments are not only technical workspaces but also social learning ecosystems where design identity and professional culture are shaped.

In light of the results, it can be argued that the most effective educational approach for interior architecture lies in the development of hybrid studio models that combine physical and digital learning experiences. Such models would allow students to leverage the benefits of online collaboration, digital visualization, and real-time simulation while maintaining the creative, experiential, and interactive qualities of traditional studio settings

Bu Interior design students, as future designers, should be prepared to engage with the technologies that will shape the profession. This requires that students remain informed about the latest technological developments and become proficient in design programs that are increasingly technology-driven.

In this study, research examining the impact of design and technology on interior architecture programs was reviewed, with the aim of developing a comprehensive document addressing interior design education within the context of technology. Computer-assisted education is one of the oldest concepts in the use of computers for instructional purposes. Consequently, even when employed for different objectives, the use of computers in educational settings is generally referred to as computer-assisted learning. The growing number of university students, limited time, increasing information volume, complexity of content, insufficient number of faculty members, and the growing importance of individual abilities and differences have collectively increased the demand for computer utilization in education (Yanpar, 2006).

The literature reveals several gaps in the study of design education: research on the subject remains largely theoretical, and most studies employ qualitative methods. Similarly, while topics within foundational design education have been explored, recommendations related to digital integration largely remain theoretical and lack application-oriented or experimental studies. Studies addressing digitalization in architecture and interior architecture are almost nonexistent, and existing works are rarely linked explicitly to educational practice. These gaps highlight the need for targeted research and practical proposals.
Accordingly, the following recommendations are proposed:

- Digitalization in Design Education: The impact of digitalization on education, particularly foundational design education, is minimal. The necessity and scope of digital integration can be assessed based on the perspectives of students and instructors. Where deemed necessary, a system designed to meet these expectations could be implemented using experimental methods, with measurable outcomes such as efficiency, impact, and feedback.

- Integration Beyond Software Instruction: The relationship between technology and design education should not be reduced to including programs such as AutoCAD or 3ds Max in the curriculum. Instead, consideration should be given to how technology can be leveraged in alignment with the content and requirements of each course. This approach should be applied first within fundamental design studios and subsequently extended to project studios, which

form the backbone of design education.

Given the importance of this topic, this research is significant both nationally and internationally, as it analyzes current trends in education. The study may provide valuable insights for researchers seeking to conduct further investigations or propose interventions in this area and contributes to the literature on technology integration in interior design education.

Ethical Statement

This study was derived from the doctoral dissertation titled "An Investigation of the Integration of Technology in Interior Architecture Education" conducted under the supervision of Prof. Dr. Güzin Demirkan Türel.

Author Contributions

Research Design (CRediT 1) Author 1 (%50) – Author 2 (%50)

Data Collection (CRediT 2) Author 1 (%90) – Author 2 (%10)

Research - Data Analysis - Validation (CRediT 3-4-6-11) Author 1 (%80) – Author 2 (%20)

Writing the Article (CRediT 12-13) Author 1 (%80) – Author 2 (%20)

Revision and Improvement of the Text (CRediT 14) Author 1 (%90) – Author 2 (%10)

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Conflict of Interest

The authors declare no conflict of interest.

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