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Digital Drawing and Design Programs and Interior Architecture Education Relatıons With the Proffesionals Point of View

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Abstract

Depending on the expectations and requirements of Interior Architecture profession with the fast development of technology and artificial intelligence, digital design and drawing programs frequently updated. These changes must have an effect on curriculum of the departments.
In order to find out whether graduates are ready to use these programs in professional life 9 firms from 3 different work lines was questioned. This investigation would give an insight for the development of the curriculums of Interior architecture Departments with the perspective of digital drawing and design courses.
The result of the investigations was as follows:
There is a gap between the practiced programs level and types in Professional life and graduates.
The investigation also reveals the following facts:

a. *The graduates aren't ready to professional life*
b. *Students weren't furnished with the building materials and detail.*

As a conclusion the universities have to find a method to adapt their curriculum to the technological and digital changes continuously.

Keywords: Interior Architecture and Digital Programmes, Digital Technology, Digital Design and Drawing Programmes, Interior Architecture Education, Interior Design.

1. Introduction

Interior architecture is a profession that carries out studies on interior design. Interior architecture education is an academic undergraduate programme that provides the theoretical and practical knowledge required to practice this profession (Almaz, 2017). In Turkey, interior architecture education is carried out in two different categories: interior architecture departments that take students in numerical score type and interior architecture and environmental design departments that take students in equal weight score type (Eriş & Ağan, 2020). While the education process focuses on the acquisition of professional skills, technical applications, theoretical knowledge, art history and understanding of interior design principles through drawing and model applications (Zhu & Du, 2020), the profession of interior architecture is based on a practice that requires application and experience (Abdallah, 2022). In this case, newly graduated interior architects may experience some problems in the transition process from education to professional life. In general, when an interior design project is taken, different work items are formed at various stages from the beginning to the end of the project. Each of these items may need to be carried out through digital programmes that are synchronised with each other or designed separately.

The working method of the interior architect generally varies according to the size and type of the project and the demands of the employer. However, in general, the working method of interior architects may include the following steps.

a. First Meeting and Needs Analysis
1. Concept Development and Design Process
2. Technical Details and Planning
3. Application and Construction Management
4. Final Inspection and Delivery
5. Customer Relations and Support

In this case, interior architects may need various digital drawing and design programmes, synchronous or asynchronous, in order to increase the efficiency of their work while working together with their colleagues or with different areas of expertise (Gökhan & Kemer, 2021).

This study examines the extent of the current transformation of digital drawing and design programmes used in the interior architecture profession, which is rapidly changing with the developing technology, and provides visual communication between interior architects and employers. Research on the situation of addressing this transformation in undergraduate programmes providing vocational education and analyses on the expectations of company owners from newly graduated interior architects are also within the scope of the study. These analyses are handled within the scope of short interviews with the officials of the company's doing business for the interior architecture profession.

The data obtained from the interviews reveal the general situation of digital drawing and design programmes actively used in the interior architecture profession today. In this context, it is aimed to reveal the results regarding the qualifications such as knowledge of digital programmes etc. that should be present in interior architects preferred by the relevant companies in recruitment. In addition, it is aimed that the data obtained from this study will guide the universities providing interior architecture education in the updates they will make in terms of the content of their courses covering digital drawing and design programmes.

2. General Characteristics of Digital Drawing and Design Programmes Used in the Interior Architecture Profession:

In the profession of interior architecture, the names of some of the tools used in this field from the past to the present and the definitions are as follows. The programmes in the list were prepared in line with the data obtained in the field study conducted for this research.

2.1. 2D, 3D and Visualisation Software:

ACAD: It is used to make 2D and 3D drawings, to create technical details, to provide project documentation (Gao & Lu, 2011).

SketchUp: 3D modelling software. It is used to create visually rich models for space designs (Sitanggang & Luthan, 2020).

3d Studio Max: It is a program designed for the creation of three-dimensional visual designs. Along with rendering engines such as V-Ray, Corona, Mental Ray, it is effective in designing realistic images and animations (Chaudhary & Gawali, 2018).

Adobe Photoshop: It is a graphic design programme for visual presentations and rendering (Asfhari-Jouybari & Farahnaki, 2011).

2.2. Parametric Design Programmes:

Rhinoceros and Grasshopper: Rhino is used for modelling complex geometries (Yong & others, 2019) Grasshopper can help space designers in parametric design and algorithm-based design processes (Fink & Koeing, 2019).

2.3. ERP Programmes:

BIM (Building Information Modelling): The BIM programme ensures the coordination of different programmes that are compatible with it through different work items in the building sector (Karimi & others, 2007). In this way, the coordination problem for joint work in projects is eliminated (Schiavi & others, 2021).

Revit: Developed by 'Revit Technology Corporation' in the early 2000s for building information modelling. This programme is 'Building Information Modelling' (BIM) software (Zotkin & others, 2016). This programme is used for the design and management of projects (Habte & Guyo, 2021).

2.4. Artificial Intelligence and Analytical Tools and Cloud Technology:

It is the general name of technology that gives realistic images and feelings on forms and spaces. With the help of wearable technologies, it has features that enable the capture of a quality that cannot be distinguished from reality in terms of spatial perception. This program has a synchronisation feature that can work in coordination with different systems. AR and VR technologies allow interior designers to make their designs more interactive. Thanks to these programmes, clients can virtually walk around the designed spaces and experience how the spaces will feel in real dimensions (Wang & Huang, 2022).

Extended Reality (XR): XR technology, which is a combination of VR (Virtual Reality) and AR (Augmented Reality) technology, helps interior designers to make space designs more dynamic (Wu & Jeng, 2018).

2.5. Tablets and Digital Drawing Tools:

Along with these mentioned programmes, the programmes supported by artificial intelligence today also direct the profession towards a different dimension.

These digital programmes used in interior architecture are moving towards being more integrated (Wang, 2019), smarter and more interactive in the future (REF). These programmes remove the technical barriers that limit the creativity (Phan & Choo, 2010) of interior architects and allow them to create (Li, 2024) more original and innovative designs (Musa, 2021). In this direction, a field study has been prepared for the research.

Apart from the above-mentioned programmes, there are many different programmes for interior design, especially artificial intelligence supported programmes, and their number is increasing day by day.

3.Methodology

In this article, which was produced from T. Kemer's doctoral thesis, qualitative research method was used for case study purposes. Case study is a method in which a single situation or event is examined in-depth longitudinally, data is collected systematically and what happens in the real environment is examined.

Within the framework of this logic; short recorded interviews were conducted with interior architecture firms that are actively involved in projects for the interior architecture profession today, or firms that employ interior architects and produce projects for the profession. After the contents of the interviews were converted into written text format, they were analysed with the MAXQDA 20 programme used in the analysis of qualitative research methods. The findings were revealed as a result of the data obtained as a result of the analysis.

4. Findings

The findings obtained from the short interviews conducted within the scope of the study are as follows.

4.1. Findings Related to Office Interviews

As a result of the interviews with the offices in the research, the opinions about digital drawing and design programmes were analysed by content analysis. As a result of the analysis, themes, categories and coding's were made. These coding's are shown below.

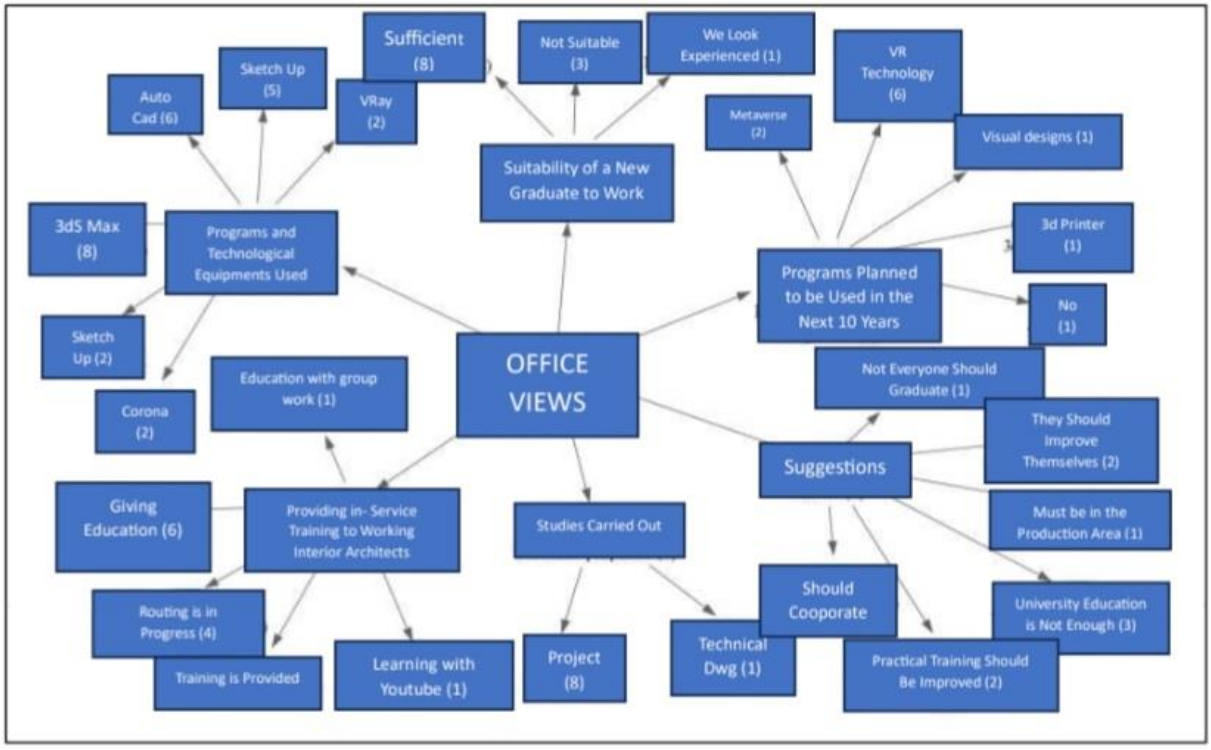

Figure 1. Coding of the digital drawing and design programmes

When the answers given by the participants about digital drawing and design programmes in the interviews about the offices were examined, a theme was formed as office opinions. *Within this theme, categories (10 categories) and codings were made in the following categories: Studies Conducted,*

- Programmes and Technological Equipment Used, Sufficiency of the Programmes Used for the Working Tempo,
- Status of Interior Architects Having Problems in Digital Drawing and Design,
- Programmes Planned to be Used in the Next 10 Years,
- Undergraduate Qualifications of Working Architects,
- Suitability of New Graduates to Work,
- Status of In-Service Training of Working Architects, Programmes that Interior Architects Should Learn in Undergraduate Education and Suggestions.

A total of 44 different codes were created in the data obtained from the interviews and these codes were repeated 119 times.

When the codes created from the answers given by the participants were examined, it was determined that codes were formed as project and technical drawing for the studies carried out, and the programmes used were Pichon, SketchUp, Corona, Vray, Photoshop, Computer, AutoCad, Sketch up, Lumion and 3ds Max.

Among these programmes, AutoCad and 3ds Max were found to be the most frequently used programmes. When the adequacy of the programmes used in terms of working tempo was examined, it was seen that most of the participants stated that they were sufficient.

* Although the participants stated that there were mostly no problems regarding the problems of the interior architects they employ in their businesses, it was determined that there were sometimes problems in 2 different opinions.
* When the opinions of the participants about the programmes planned to be used in the next 10 years were examined, opinions such as No 3D Printer, Metaverse, Visual Designs and VR Technology emerged. Among these, it is seen that the most frequently expressed programme is VR Technology.

* In the evaluations made by the participants regarding the undergraduate qualifications of the working architects, 8 participants stated that the architects were sufficient for undergraduate education, 3 of them stated that they were not suitable and 1 of them stated that they were experienced (not sufficient). In this case, a significant part of the participants reported that the knowledge and skill levels of the graduates after graduating from architecture are not sufficient.
* Regarding the in-service training of architects after undergraduate education and in their enterprises, 6 of the participants stated that no training was given, 1 of them stated that training was given and 1 of them stated that they received training in team work and in-house processes. In this case, it is understood that almost all of the participants do not provide in-service training to architects.
* The participants stated that the programmes that students should have and learn in undergraduate education in terms of the programmes they need in the processes related to businesses are SketchUp, AutoCad, Corona, Vray, 3DS Max.
* When the opinions put forward by the participants as suggestions were analysed, it was determined that the opinions such as 'It should be in the field of production', 'Application Education should be improved', 'Everyone should not be able to graduate', 'They should cooperate', 'They should improve themselves' and 'University Education is not enough' were given. Accordingly, the participants basically stated that university education should be improved and especially the undergraduate graduates should have certain practices.

Table 1. Frekans Testing Results

Code System	**Frekans**
Office Opinions	119
Work in Progress	**0**
Technical Drawing	1
Project	8
Programmes and Technological Equipment	**0**
Pichon	1
SketchUp	2
Corona	2
VRay	2
Photoshop	2
Computer	2
AutoCad	6
Sketch up	5
Lumion	2
3ds Max	8
Sufficiency of the Programmes Used for the Work Tempo	**0**
BIM	1
MS Project	0
Adequate and Up-to-date	6
Problems of Interior Architects in Digital Drawing and Design	**9**
Sometimes It Happens	2

No Problems	7
Programmes planned to be used in the next 10 years	**0**
3d Printer	1
None	1
Metaverse	2
Visual Designs	1
VR Technology	6
Licence Qualifications of Working Architects	**0**
Not Adequate	4
Adequate	3
Some are Adequate	2
Suitability of New Graduate to Work	**0**
Adequate	8
Not Suitable	3
Experienced Recruitment	1
Status of In-Service Training for Employee Architects	**0**
Providing Training	1
Training with Teamwork	1
Routing is in Progress	4
Learning from Youtube	1
No Training	6
Programmes that Interior Architects should learn in undergraduate education	**0**
SketchUp	1
AutoCad	1
Corona	1
VRay	1
3 ds Max	3
Recommendations	**0**
Must be in the Production Area	1
Application Training Should be Improved	2
Not Everyone Should Graduate	1
Co-operate	1
Self-Improvement	2
University Education is Not Sufficient	3

When the opinions of the individuals participating in the research regarding the themes, categories and coding are examined, it is seen that various opinions about digital drawing and design programmes have emerged. In this context, the views of some participants are given in line with the analyses made.

Participants expressed their opinions about the studies carried out

- 'Interior design projects', 'people come with an active project in their hands', 'it is shaped according to the needs of the project. Interior architects in our team are involved in every stage of the project.',
- 'It is agreed upon according to their request and the drawing is made and presented here.' and 'They work on the projects we give them. We generally work with 3dStudioMax. They usually make designs'.
Similarly, regarding the programmes used;
- 'We use Autocad, 3ds Max, lumion, sketch up and all of them are used by interior architects.',
- 'We use Pichon as a digital programme. We draw on Pichon, but usually these plans come to us via AutoCad.
- We transfer AutoCad to Pichon. We can continue in that way.',
- 'In our company, we use 3dStudio Max, AutoCad, SketchUp, and we get our renders from Corona Render.
- These are the programmes that are enough for us for now, but we can also use Rhino, Blender. We can also use these.', and
- 'We are currently using some programmes such as 3dStudio Max, AutoCad, Adobe Photoshop in our company.' The opinions were given as follows.

The participants expressed opinions on the adequacy of the programmes used in terms of working tempo and these opinions were expressed as follows

- 'Obviously, it is enough for us at the moment. ACad is already sufficient in production. We can draw for the masters there, or since it is a universal language, we can use a drawing language in ACad and continue using it. There is no problem with that. For the store, maybe something can be done with the VR glasses we talked about a little while ago or with a newer programme. There is also a drawing programme called BIM. We are just starting to use it upstairs',
- 'The programmes we use for our company are sufficient.', 'I mean, as I said, since we usually work with architects, they solve it themselves. Programmes such as 3dStudio Max, AutoCad are more than enough for us.
- 3dStudio Max is enough for us because we usually design interiors.' and 'It is enough. Because as I said, Pichon is a fast programme, a programme where we can get instant results. Because we are especially busy on weekends. When we sit a customer at the table, when we make a drawing according to his/her measurements, he/she sees it as a plan at first, but then when we move to the next page, we design the three-dimensional version of the same drawing.' It was determined that it was as follows.
As an example of the opinions of the participants about the adequacy of their undergraduate degrees in terms of business administration;
- 'There are those who know very well and those who do not know at all. We have never come across the middle yet.',
- 'It varies according to individuals. In some we find it sufficient, in some we do not find it sufficient.',
- 'We met with many interior architects during the establishment of this business. All of them only knew Sketch up. I think this is a bad situation for them. The school gives them this, or rather. I think they should improve themselves even while studying at school. They should definitely know 3dstudio Max. In 3dStudio Max, other intermediate things like Vray etc. They need to learn the engines together. (Other rendering engines: Vray, Corona, Mental Ray) I am saying this because most new graduates who come here only know Sketch Up. In itself, there were candidates who took courses while studying at school. But I think 3dStudio Max, Corona, AutoCad, they need to know all of these.' and 'I think there is a big lack of 3ds Max now.
- Many interior architects graduate but they are very weak in 3ds Max. I think it is very difficult for them to do business because they only come with their diplomas. If they had developed themselves in 3ds Max, at least when they say they are interior architects, they would show a proper rendering. Most of them cannot show renderings or their renderings are not of good quality. That's why I think they are not preferred.'
As an example of the answers given by the participants in terms of their in-service training status regarding architects;

- 'Well, we have such friends who are new graduates. And there are also those who come part time as students on weekends. And all of them come without knowing Pichon. Here, we teach them at the same time, we have our own trainers. They train them about Pichon and general store training.',
- 'Training was not provided by our company, we provided that training opportunity to our friend who does 3D visualisation. He took it. One of our interior designer friends received the training himself. But in general, we are considering such a training to the team at a point where we can say that this is how we draw projects now.',
- 'They take three dimensional programmes together, but the people who take them are already familiar with ACad and 3dSMax. Therefore, we support them to learn new programmes afterwards. But when they come from scratch, frankly, we expect them to learn outside and come back so that at least we can start somewhere here. Or we expect him to learn at school, frankly. He can't graduate from school anyway because he doesn't know them. That's why we proceed in that way here.',
- 'We do not provide any training, but we update ourselves on Youtube or other channels, we usually always look at them.',
- 'No training was provided by our company, we provided that training opportunity to our friend who does 3d visualisation. He took it. One of our interior architect friends received the training himself. But in general, we are considering such a training for the team at a point where we can say that this is how we draw projects now.' and
- 'It is necessary. But if there is such a demand, we will provide a positive response and support it.'
When the participants' answers about the programmes that interior architects should learn in undergraduate education are examined;
- 'I think there is definitely something to learn and something not to learn. SketchUp is definitely something that should not be learnt. Something that should be learnt is definitely 3dStudio Max, because SketchUp is all about sketching. In general, unqualified people have started to form now. Are there people who do very good work from SketcUp? Yes. But, if a job is being done in our business, for example, we are working completely on 3dStudioMax here. If a person working on SketchUp came, we would not be able to speak the same language with him because all the saved files are very different from each other.',
- 'I think there is a big lack of 3ds Max now. Many interior architects are graduating but they are very weak in 3ds Max. I think it is very difficult for them to do business because they only come with their diplomas. If they had developed themselves in 3ds Max, at least when they say they are interior architects, they would show a proper rendering. Most of them cannot show renderings or their renderings are not of good quality. So I think it is not preferred.',
"3dSMax is very important for every interior designer. A new program comes out every day. Of course, it may not be possible to master all of them, but I think it is necessary to know them in order to have a rough understanding of 3dS Max. But apart from the programs, material knowledge is very important. In general, I think that material information regarding which material is used where and what it is made of (is it used on the wall? What is a ready-made material? What happens when it is coated? What is it? Parquet, wall, etc.) needs to be improved a little more." And
- "I think they should definitely use a program where they can do three-dimensional modeling and design. Among these, I think 3dStudio Max and its auxiliary rendering engine VRay and Corona are quite successful and give good results. Three-dimensional programs are indispensable in our profession. Because of this. Since we design in our minds, we design as interior architects, in order to convey our ideas correctly to the customer, the end user, or to express ourselves correctly, one of our jobs is based on visuality, so an interior architect must know the three-dimensional program. Accordingly, in order to transfer the real-life applicability of these designed three-dimensional programs to the masters or subcontractors doing this work, it is necessary to use AutoCad and similar programs due to our technical drawing needs." Opinions are given as follows.
Examples of suggestions put forward by the participants in line with their knowledge and opinions about architects' digital drawing and design programs
- "They definitely need to be in the production area. Definitely. So they need to see the production. While drawing, he must draw simultaneously with the workshop. So they have to be in the oven of the job.",
- "In my opinion, this is the biggest problem in Siteler. They only give theoretical information to students and do not make them do anything practical. Students are also weak due to this situation.",

- "I also think there is a big difference between school and practice.",
- "Since there is not enough knowledge and no courses are taken, it has to be fed from somewhere. "This becomes one of the nutritions.",
- "So, I don't think interior designers are given enough training in drawing at school. Or I don't think your friends are improving themselves. So currently, people who want a good interior designer are required to have a minimum of 5 years of experience. Because it can only revise itself after 5 years. I think school curricula need to be a little more up-to-date; just as we need to develop programs, I think they need to develop students digitally. "I find their training weak.",
- "So, I don't think interior designers are given enough training in drawing at school. Or I don't think your friends are improving themselves. So currently, people who want a good interior designer are required to have a minimum of 5 years of experience. Because it can only revise itself after 5 years. I think school curricula need to be a little more up-to-date; just as we need to develop programs, I think they need to develop students digitally. "I find their training weak.",
- "As a new graduate, I think there is not much difference. It is shaped by the projects he works on afterwards. As you said in detail, there is not much difference, but ultimately different training is received. In other words, let an architect and an interior designer graduate at the same level. When we go with a project and say we give a piece of land and build a building of this scale and place it on the land, a newly graduated architect will of course do this much more easily because he has always worked at that scale. But when we go to him and ask him to draw a door detail, he will hesitate there, but a graduate of interior architecture will be able to do it more easily. Actually, there are differences between the scales. There may also be differences in approach to the project or perception. I can't spare the attention of knowing the details very well. It differs only depending on the scale of the project. Because they receive that training for four years. Architecture students are looking at projects on a more master plan scale. Interior architecture students are generally given a building and its boundaries are given. You are told to get into this. I think that's the difference. Otherwise, interior architecture graduates see it as a detail of interior architecture because they have received training in that process. Architecture students do not go into that detail during the education process. But once they start working and get involved in a project, of course they learn. "I think that process is a limited process in education life." Opinions are given as follows.

4. Conclusion and Recommendations

As a result of the analyses, it is observed that the problems experienced by the new graduates of the interior architecture profession stem from the fact that the structure of the interior architecture education process is ignored in the professional sector. There are some differences between the practice and education of interior architecture profession. These differences can be minimised within the framework of university-industry cooperation or similar internship practices. In this way, undergraduate students will have experienced the use of digital drawing and design programmes used in the profession in a different dimension on the basis of professionalism.

Another problem may be related to the fact that digital drawing and design programmes, which are not adequately trained during the undergraduate education process, may not be learned sufficiently by the graduates of the department for various reasons.

Today, the professional effectiveness and success of an interior architect who does not have a command of digital drawing and design programmes may be limited in market conditions. Compared to previous years, the profession of interior architecture has become more technology-orientated today and the use of digital tools constitutes an important part of workflows. Some important points about digital programmes are discussed below in five points.

- Design Processes and Efficiency: Digital drawing and design programmes accelerate the design processes of interior architects. Visualisation-oriented studies such as 2D drawings, 3D modelling and rendering processes enable better presentations to employers. In this way, it is possible to make designs more understandable and attractive.
- Communication: Interior architects interact with customers and stakeholders through their projects on digital platforms. Digital drawing and design programmes facilitate communication with different stakeholders and increase the quality of cooperation.

- Adaptation to Developing Technology: The profession of interior architecture should be able to keep up with constantly developing and changing technological developments. For this reason, the competitive capacity of an interior architect who is not sufficiently familiar with digital drawing programmes and technological tools may decrease. This situation may cause difficulties in the professional development and career planning of the individual.
- Client Demands: Customers usually want to examine and see their projects in digital environments. In this case, 2d and 3d digital drawing and design programmes increase customer satisfaction. In this way, it is possible to convey the projects designed by interior architects to the other party more accurately and clearly.
- Sector Standards and Practices: Today, the interior architecture profession is subject to certain standards and practices. The majority of these standards require the use of digital drawing and design programmes.

In addition, inferences regarding the status of the interior architecture profession today and in the future were obtained from the content of the research. These inferences are as follows.

Today, the interior architecture profession, which continues its existence by adapting to artificial intelligence and technological developments in creativity and design, will be affected by different factors such as the change of social needs, the advancement of technology and environmental factors in the future. These factors can be grouped according to the following definitions.

a. Integration of technology into the profession: In the future, interior architects will use digital visualisation and design tools more widely than today. Among these tools, technologies such as virtual reality (VR) and augmented reality (AR), which are the most well-known today, enable more effective presentations to customers and more realistic visualisations (Kaleja & Kozlovska, 2017). As a result of the field study, a small portion of the companies use this technology today. A certain number of companies that do not use these technologies aim to use these technologies in the near future.
b. Sustainability in Space Designs: Factors such as green building certificates, recycled materials and energy efficiency will become more important than today in order to design more environmentally compatible spaces.
c. Multi-purpose and Flexible Designs: With the change in working culture and business world, interior architects will create multi-purpose and more flexible designs.
d. Use of Digital Communication Tools and Collaboration: This situation, which is realised with ERP programmes that are becoming more and more widely used day by day, allows interior architects to work more efficiently with other team members in terms of project management, coordination and follow-up. In addition, thanks to cloud technology, it will become widespread for interior architects to communicate more easily with their clients through digital communication platforms.

The profession of interior architecture is constantly evolving with the impact of social changes and the development of technology. In this case, the future success of interior architects is directly proportional to their ability to adapt to these changes and to offer innovative solutions in designs.

In this case, if the design courses with digital content in the education programmes of universities are not regularly updated, it does not seem possible for graduates to hold on in the sector only by designing and without using any programmes, except in special cases.

As a result, it is understood that knowing digital drawing and design programmes at a professional level in order to be able to do the interior architecture profession today enables the interior architect to do his/her job more effectively. The companies that work professionally in the sector and employ interior architects have stated that new programmes and their updates are actively used at many stages starting from the design of the interior spaces to the completion of the project and that graduates should be familiar with them. In this case, the course contents for digital drawing and design programmes in the curricula of universities providing interior architecture education should be constantly updated to follow the professional practices of the profession.

References

Abdallah, K. (2022). A Strategy for Teaching Interior Design Through Reality-Based Project (An Experiential study). *International Design Journal, Volume 12, Issue 4*, s. 93-104.

Afshari- Jouybari, H., & Farahnaky, A. (2011). Evaluation of Photoshop software potential for food colorimetry. *Journal of Food Engineering, Elsevier*, s. 170-175.

Almaz, A. (2017). The Role of the Digital Revolution in Developing Creativity in the Interior Architecture. *International design Journal, DOI: 10.12816/0044130*, s. 123-135.

Chaudhary, D. G., & Gawali, B. W. (2018). Design and Modeling with Autodesk 3DS Max . *International Journal of Computer Science and Information Security (IJCSIS)*, s. 68-85.

Eriş, E., & Ağan, M. (2020). Türkiye'deki İç Mimarlık Eğitim Programlarının Karşılaştırılmalı Analizi: Mesleki Kimlik Karmaşasının İncelenmesi. *Mimarlık ve Yaşam Dergisi- Journal of Architecture and Life DOI: 10.26835/my.794120*, s. 423-439.

Fink, T., & Koeing, R. (2019). Integrated Parametric Urban Design in Grasshopper /Rhinoceros 3D- Demonstrated on a Master Plan in Vienna. *Data - CITY INFORMATION MODELLING AND GIS - Volume 3*, s. 313-322.

Gao, L., & Lu, T. (2011). Achieving Transparent & Real-time Collaboration in CoAutoCAD Application . *Journal of Universal Computer Science, vol. 17, no. 14*, s. 1887-1912.

Gökhan, Ç. B., & Kemer, T. (2021). İç Mimarların Mesleki Eğilimleri ve Dijitalleşme Çağına Uyumları. *Pandemi Sürecinde Güncel Gelişmeler ve geleceğe Dönük Yaklaşımlar, Tasarım Eğitimi ve Uygulamaları* (s. 124-136). Ankara: Hacettepe Üniversitesi.

Habte, B., & Guyo, E. (2021). APPLICATION OF BIM FOR STRUCTURAL ENGINEERING: A CASE STUDY USING REVIT AND CUSTOMARY STRUCTURAL ANALYSIS AND DESIGN SOFTWARE. *Journal of Information Technology in Construction -ISSN 1874-4753*, s. 1009-1022.

Interior design students' perception for AutoCAD, SketchUp and Rhinoceros software usability. (2019). *ECS United, 247th ECS Meeting* (s. 1-12). Canada: IOP Conference Series: Earth and Environmental Science.

Kaleja, P., & Kozlovská, M. (2017). Virtual Reality as Innovative Approach to the Interior Designing. *SSP - JOURNAL OF CIVIL ENGINEERING Vol. 12, Issue 1, DOI: 10.1515/sspjce-2017-0011*, s. 109-116.

Karimi, J., Somers, T. M., & Bhattacherjee, A. (2007). The Role of Information Systems Resources in ERP Capability Building and Business Process Outcomes. *Journal of Management Information Systems, Volume 24, Issue:2* , s. 221-260.

Li, Z. (2024). The Practice of Virtual Reality Technology in Interior Design Education and the Cultivation of Artistic Design Thinking. *Applied Mathematics and Nonlinear Sciences, 9(1)*, s. 1-15.

Musa, M. (2021). Digital architecture and its impact on modeling of interior design of spaces. *International Journal of Architectural Engineering and Urban Research, Volume 4, Issue 1,*, s. 226-260.

Phan, V. T., & Choo, S. Y. (2010, August). Interior Design in Augmented Reality Environment. *International Journal of Computer Applications (0975 – 8887), Volume 5– No.5*, s. 16-21.

Schiavi, B., Havard, V., Beddiar, K., & Baudry, D. (2021, February). BIM data flow architecture with AR/VR technologies: Use cases in architecture, engineering and construction. *Automation Construction, Volume 134, Elsevier, https://doi.org/10.1016/j.autcon.2021.104054*, s. 1-35.

Sitanggang, N., & Luthan, P. (2020, August 14). The Effect of Google SketchUp and Need for Achievement on the Students' Learning Achievement of Building Interior Design. *İJET Volume 15, ISSN 1863-0383 Publisher: International Journal of Emerging Technology in Learning*, s. 4-19.

Wang, P. (2019). On Defining Artificial Intelligence. *Sciendo, Journal of Artificial General Intelligence 10 (2) DOI: 10.2478/jagi-2019-0002*, s. 1-37.

Wang, R., & Huang, Y. (2022). Application of 3D Software Virtual Reality in Interior Designing. *Hindawi Mobile Information Systems, Volume 2022, Article ID 5315262* , s. 1-8.

Wu, T., & Jeng, T. (2018). A Cloud-based BIM Platform for Interior Design. *Journal of Design, Vol. 23, No.1, Chinese Institue of Design*, s. 43-60.

Zhu, Z., & Du, Y. (2021). Research on Interior Design Optimization based on Virtual Reality Technology . *Journal of Physics: Conference Series, . 1746 012063, MSOTA 2020, IOP Publishing, doi:10.1088/1742-6596/1746/1/012063*, s. 1-4.

Zotkin, S. P., Ignatova, E. V., & Zotkina, I. A. (2016). The Organization of Autodesk Revit Software Interaction with Applications for Structural Analysis. *Science Direct, Procedia Engineering 153*, s. 915 – 919.