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Addressing the Gap: A Review of Egyptian Graduate Skills and Career Readiness in Online Architectural Education

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***Abstract*- The efficiency of online learning in suitably preparing graduates for the workforce is still a major concern, especially in careers like architecture, where specialized practical skills and teamwork are essential. In order to determine the gaps between the skills learned through digital platforms and those that employers require, this study attempts to address the urgent need to evaluate how well graduates of online architectural education are prepared for professional practice. The research challenge focuses on addressing the possible gap between the workforce market's demands and outcomes of online education, particularly in the context of the COVID19 pandemic's rapid transition to distance learning. Through an online survey, the primary objective is to obtain a clear, trustworthy, and extremely helpful assessment of the present and future skill demands in the architectural business, rather than concentrating on academic understanding or fresh professional insights. Even though online learning provides flexibility and access to new resources, problems like less social interaction and practical experience may make graduates less marketable. This study addresses these concerns to evaluate whether current online learning methods work and suggest changes that will help graduates transition smoothly into the workforce.**

***Keywords*- COVID-19; Architectural Online Education; Graduates; Workforce; Labor-Market Outcomes; Career Readiness**

1. INTRODUCTION

Online education has become widespread since COVID19 very quickly. This transition worked well for many subjects, but it was challenging for fields like architecture. They rely on hands-on experience, collaboration, and being in the same space. As a "signature methodology," architectural education revolves around the physical design studio, where students and teachers work together and critique in real time (Shulman, 2005). The shift to online learning caused the loss of this essential element. The inability to provide prompt, useful feedback on physical models and sketches, as well as the unpredictability and informal learning that occur in a studio setting, proved to be significant challenges. Online architectural education was found to be stressful and ineffective for practical courses, negatively affecting feedback and learning outcomes (Al-Alwan & Al-Khafaji, 2023). The situation also highlighted issues of digital inequality, as not all students had access to the high-performance computers, specialized software, and reliable internet needed for architectural work (Hsin et al., 2022). The experience showed that online resources cannot fully replace the tactile and social aspects of architectural design education, even though they can support some theoretical components.

1.1. PROBLEM DEFINITION

The issue is that there may be a discrepancy between the skills that students in online architectural education programs learn and the practical competencies needed by the architecture industry. It may have an effect on the employability and professional readiness of graduates. The following queries can be used to define this issue: What specific competencies and practical skills are required of entry-level professionals by companies and architectural firms? How do the curricula and

pedagogical practices of online architecture education programs adhere to or depart from these industry standards? How ready are recent graduates of online architecture programs, in the opinion of businesses, to enter the workforce? What possible effects might this skills gap have on online graduates' career paths and the Caliber of architectural projects?

1.2. Research Objectives

Sort the essential practical skills that the architectural labor market values, such as project management, on-site problem-solving, and software expertise.
Survey and interview Career experts to determine the degree of the skill gap between the necessary skills and those gained. Make suggestions for enhancing online architecture education programs to better equip students for the demands of the field.

1.3. Significance of the Study

This study is important because it checks if graduates are truly ready for jobs. It looks at what the job market and the architecture field want, instead of just focusing on classroom stuff. It accomplishes this through the use of surveys intended to elicit detailed viewpoints from participants in the broader labor market. Since the main objective of this study is to develop explicit mechanisms intended to help close the gap between the outputs of online architectural education and the competencies graduates gain and the actual requirements of the job market as perceived by industry representatives, this multifaceted approach aims to provide valuable insights into the evolving educational environment and the alignment between academic training and industry needs.

2. Literature Review

Online architecture education has both potential and challenges, according to recent research, especially when it comes to preparing graduates for the demands of the workforce. The COVID-19 pandemic prompted a shift to virtual design studios, which facilitated digital collaboration but also raised concerns regarding the development of fundamental design and construction skills (Metinal, Y. B, 2022). Employers have voiced differing opinions, valuing digital skills but doubting practical preparedness (Briant, S.,2024). Although some contend that, with proper structure, online education can increase flexibility and expand access without sacrificing quality, concerns regarding licensure and practical experience still exist (Anderson, T., 2021). (Süner-Pla-Cerdà, S., 2024). Ultimately, how well online architectural education strikes a balance between theoretical understanding, real-world application, and digital competencies determines how effective it is. Graduate skill sets have been drastically altered by online architecture education, which has also promoted digital. In general, how well online architectural education strikes a balance between theoretical understanding, real-world application, and digital competencies determines how effective it is. Graduate skill sets have been drastically altered by online architecture education, which has promoted digital competency and self-directed learning. However, it has frequently cut down on practical construction experience, spatial awareness, and interpersonal teamwork (Chantzaras, C.222). Employers commonly report gaps in real-world competencies like site work, teamwork, and client interaction, despite graduates' proficiency with design software and remote communication (Shannon, S. J, 2012). Online-trained graduates' flexibility and technological know-how are valued by some employers, but many doubt their general workforce preparedness. According to the study, a more thorough approach to skill development in architectural education may be offered by hybrid educational models that combine online flexibility with in-person studio work (Ozorhon, G., 2021).

2.1. The Traditional Architectural Studio

The Traditional Architectural Studio The architectural studio's critical significance as a locus of architectural education is already established in literature. Known for its capacity to nurture collaboration, skill, and critical reflection, the studio

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model has its roots in the traditions of the Bauhaus and the École des Beaux-Arts.

2.1.1. Employability Skills and Practical Education

A dynamic and networking environment is made possible by the studio's open and interactive design (Lueth, 2008). As they worked alongside each other, students were encouraged to assess one another, exchange expertise, and have casual discussions. They were able to acquire the communication and teamwork abilities necessary for professional practice as a result of this ongoing involvement [McAra & Ross, 2020]. A key element of this collaborative method is the feedback loop that occurs in the studio between instructors and peers, which fosters a deeper comprehension of design principles (Demirbas & Demirkan, 2012).

2.1.2. Interaction and Education of Colleagues

A dynamic and networking environment is made possible by the studio's open and interactive design [Lueth, 2008]. As they worked alongside each other, students were encouraged to assess one another, exchange expertise, and have casual discussions. They were able to acquire the communication and teamwork abilities necessary for professional practice as a result of this ongoing involvement [McAra & Ross, 2020]. A key element of this collaborative method is the feedback loop that occurs in the studio between instructors and peers, which fosters a deeper comprehension of design principles (Demirbas & Demirkan, 2012).

2.1.3. Critical thinking and "reflection-in-action":

The design critique, or "pin-up," is the main educational tool used in the studio and is where critical thinking is most actively developed. The process supports "reflection-in-action," where students must defend and explain their design decisions in front of classmates and teachers (Schön, 1987). Honestly, it's not just about ticking off technical skills—this whole thing pushes students to actually use their brains, question their decisions, and, yeah, screw up and figure things out on the fly. You get this loop: make something, get told what's wrong with it, tweak it, repeat. That's how you end up with designers who don't fold at the first sign of trouble and actually know how to think things through. Therefore, the studio is not only a location for making things but also a place for continuous intellectual development and discovery (Salama, 2010).

2.2. Post-COVID Era Online Architectural Education

Growing interest has been shown in the shift to online architecture education, with studies showing both important advantages and noteworthy drawbacks. Global events have accelerated the change, which has led to a reassessment of conventional studio-based learning models (El-Adly, M., 2020).

2.2.1. Benefits of online Architectural Education

Allowing students to establish their own timetables and work at their own pace is one of its main benefits (Guimarães, L., et al., 2021). Students who are not typical or who have varied obligations will particularly benefit from this flexibility. Another noteworthy advantage is the improved availability of resources. Students have immediate access to a variety of digital resources that may not be readily available in a physical context thanks to online platforms including virtual building tours, architectural software tutorials, and online publications (Chan, F., & Ng, J., 2020). Additionally, by democratizing access to advanced architectural programs for students who reside far away or have mobility challenges, online learning can foster a more inclusive learning environment (Khorshidi, M., 2021). The digital nature of the medium also allows for the easy sharing and critique of work in progress and facilitates collaboration with peers from different parts of the world (Kvan, T., & Jia, J., 2020).

2.2.2. The Difficulties of Architecture Distance Learning

Despite the benefits, several challenges have been identified. Lack of practical, real-world experience is one of the primary

problems. In a purely online environment, it is difficult to duplicate the tactile experience of design, material research, and physical model-making all crucial elements of traditional architectural education (Al-Adhami, M., 2021). This can hinder students' understanding of materials, scale, and structural stability (Taha, D., & Hassan, S., 2020). Low communication signals may affect the quality of the education system. The sensitive, informal interactions that occur in a real design studio are often absent from online learning, making it difficult for teachers to provide students with timely, constructive feedback on their work (El-Ghorab, M., 2021). A weaker studio culture and a sense of loneliness may result from this (Guimarães, L., et al, 2021). The traditional academic model of architecture, which is social and collaborative by default, is also challenged by the change (Al-Adhami, M., 2021). Peer-to-peer learning, which is crucial to architectural education, can be weakened online, and it is challenging to replicate the impromptu, serendipitous learning that takes place when students work side by side in a studio (Taha, D., & Hassan, S., 2020).

2.2.3. Professional skills and architectural knowledge

These recommendations' recommended knowledge and skill components influence students' perceptions of themselves as aspiring professionals (Sancar, F. H., 1998). To be effective in a challenging environment, one must acquire new knowledge and abilities. For example, a designer's ability to bargain could affect the outcome of a project. Design is primarily a social science that entails "making sense together in practical conversations." Students' views of themselves as future professionals are significantly impacted by the knowledge and skill components that these recommendations support. One's professional obligations, anticipated activities, and design methodologies are influenced and motivated by their self-concept. Less experienced designers are then taught these (Sancar, F. H, 1998).

Fig.1 Architect Knowledge and professional skills, Authur

2.2.4. Evaluating the Effects on the Labor Market and Career Readiness

The growth of online education will significantly affect the training of our nation's workforce (Streich, F. E., 2014). Evaluating how well graduates of online architecture programs are prepared for professional practice is crucial given the trend toward online learning, which has been made worse by the COVID-19 pandemic. Employers in the architectural field may have particular requirements for graduates' skills, such as mastery of design software, knowledge of construction codes, and the capacity for collaborative work. The employability and success of architecture graduates in the job market may be significantly impacted if online education is not successfully foster these skills (Ozturk, Z, 2020).

2.3. Literature Review Findings

Since they are closely linked to the purpose of the study, the two primary components needed for observation and analysis are the professional skills and Knowledge Aspects of Architects In contemporary practice, professional competency and effect are based on architectural knowledge, a complex construct that combines technical expertise, creative vision, and societal awareness. Advanced architectural knowledge includes a thorough comprehension of regulatory frameworks, environmental sustainability, and historical-cultural narratives

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in addition to expertise in design principles, material technologies, and structural systems (A. M. Salama, 2016). due to digital technology, interdisciplinary collaboration, and participatory procedures all contribute to the continuous evolution of architectural knowledge, architects must also be flexible and thoughtful in their approach. To help architects become leaders in their field, it's also critical to comprehend their individual identities and competencies. This study looks at how distance learning affects architects' professional and cognitive skills, using insights from representatives of engineering and business firms. Professional skills in architecture include a mix of technical, management, and interpersonal skills needed to work in a diverse environment. These skills go beyond just creative design. As the field becomes more digital and collaborative, architects need to be skilled in design software, project management methods, and coordination across different sectors (Cuff, D., 1992). To deal with uncertainties in construction, client interactions, and regulations, architects must quickly solve problems, negotiate well, and manage their time effectively (Emmitt, S., 2014). Experts in architecture are concerned about the practical experience of graduates. This worry focuses on problem-solving, professional communication, and collaborative design thinking. The rise of remote and distance learning in architectural education adds to this concern (Grover, R., 2023). Architecture education needs to adopt a more integrated approach (The American Institute of Architects, 2013). It is essential to gain new professional skills that require flexibility and adaptability. With technology changing quickly, workplace flexibility is necessary. It also involves sharing knowledge across different fields.

2.4. Conclusion of Literature Review

Although it provides resources and flexibility, online architecture education cannot take the place of the cooperative studio setting that is necessary for skill development. The COVID-19 pandemic hastened the adoption of new teaching strategies. Poor communication and less peer engagement, particularly for new students, are major disadvantages. One urgent concern is how prepared online architecture program graduates are for the workforce. Candidates with construction codes, design software, and interpersonal skills are sought after by employers. To solve these problems, online design studios require digital libraries, updated digital materials, group projects, collaborative platforms, improved digital tools, structured critiques, and more social interaction. One urgent concern is how prepared online architecture program graduates are for the workforce. Candidates with construction codes, design software, and interpersonal skills are sought after by employers. Hybrid digital technologies can improve design thinking and creativity. There are technical challenges and a need for skilled workers. The goal is to ensure graduates have the essential knowledge and skills. This can be achieved by linking online education with the real demands of the job market.

3. Survey For Engineering Companies' Representatives:

3.1. Method of Approach

An interview guide was followed to develop interview and survey questions based on the current literature (Kallio et al., 2016). Possible follow-up questions and prompts were included in each interview to keep the discussion focused on the research goal (Crone & Lozano-Sufrategui, 2018; Kallio et al., 2016). This survey is designed to gather insights from Private engineering companies' representatives on the preparedness of architects educated through different educational formats, regarding that the questions are directed specifically at graduates who completed their studies three or more years ago. This will allow the evaluation to be based on standardized criteria regarding their work duration, experience, and knowledge gained from interacting with them over a suitable period. The survey compares online and in-person models to determine which approach best prepares architects for successful project execution and collaboration.

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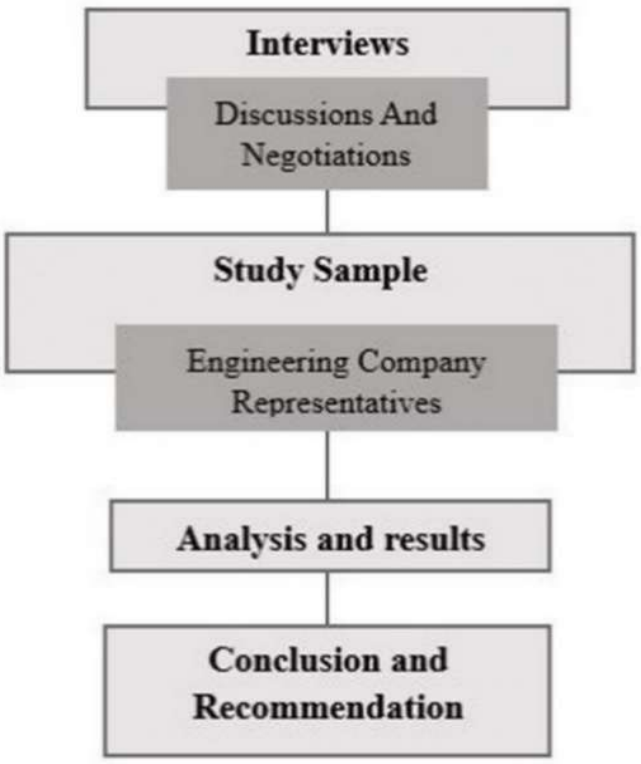

Fig.2 The structure of the research methodology

The research decision to only sample industry stakeholders while purposefully excluding students and recent graduates is a sound methodological choice when the primary objective is to obtain a direct, authoritative, and highly practical understanding of the skill requirements of the architectural profession today and in the future. This method guarantees that the information acquired is based on practical experience, strategic vision, and the current needs of the sector rather than on academic understanding or emerging professional viewpoints. The study optimizes the relevance, trustworthiness, and depth of its results regarding the changing competencies necessary for architects by concentrating on those who are actively influencing and engaging in the industry.

3.2. Design Survey Interviews

Ten participants were interviewed in order to design this survey: two practitioners with prior experience serving on jury panels at different universities during the pandemic semester, four supervisors of graduation projects, and four representatives from architectural firms. The survey's design was informed by the insights gained from these conversations, particularly with regard to how well various educational formats were thought to develop critical skills for architects. This synthesis of scholarly and applied viewpoints provides a thorough grasp of the state of architecture education today.

3.3. Study sample

This study includes a diverse group of engineering companies' representatives in Tanta city, totalling 35 participants (n=23) from various firms, because the research problem aims to assess the effectiveness of online architectural education in preparing graduates for the workforce by analysing the alignment between online education outcomes and labor market demands. To comprehensively address this, insights from various roles within engineering companies are crucial to understanding employers' expectations regarding graduates' competencies and to identify any existing skill gaps. Specifically, the sample includes:

- Senior Project Managers (7): These individuals are included to assess views on project management and coordination skills.
- Senior Design Engineers (12): Their inclusion is to provide insights into design principles and technical proficiency.
- Senior Site Engineers (10): These representatives are vital to evaluating professional skills needed on construction sites.
- Human Resources Managers (6): Their role in the sample is to understand the skills prioritized when hiring architects. This directly addresses the research problem's focus on labor market outcomes and workforce readiness, providing insight into the direct demands of employers.

This diverse composition aims to capture a comprehensive perspective on how well different educational formats prepare architects with the necessary knowledge and skills for the industry.

3.4. Questionnaire Sections

The survey is divided into two key sections aimed at evaluating the competencies of architects.

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Section 1: Architect Knowledge Aspects focuses on assessing perceptions of architects' understanding in essential areas such as design principles, building codes, materials, architectural history, sustainability, structural systems, and cultural context. Meanwhile

Section 2: Architect Professional Skills evaluates vital professional skills, including design abilities, technical proficiency, project management, problem-solving, teamwork, negotiation skills, time management, and coordination with other professionals.

3.5. Survey results Overview

Section 1

As shown in Table 1, for practical courses like Design Principles or Materials and Construction Methods, being there in person is way better. Since architecture is hands-on, learning design basics usually means doing studio work, checking out sites, and getting feedback right away – so that makes sense.

But when it comes to theory and courses that involve research, like history and architecture theory, online learning can work out great. Students can learn from books, clips, and online stuff that can be just as good as going to a lecture, or maybe even better. The even distribution in areas such as Environmental Sustainability and Cultural and Social Context is fascinating. These disciplines are multidisciplinary and will require students to have both practical knowledge and a sound theoretical background. This may suggest that students require the flexibility of online resources to learn theory, while clearly needing the opportunity for real-world engagement that only in-person education provides.

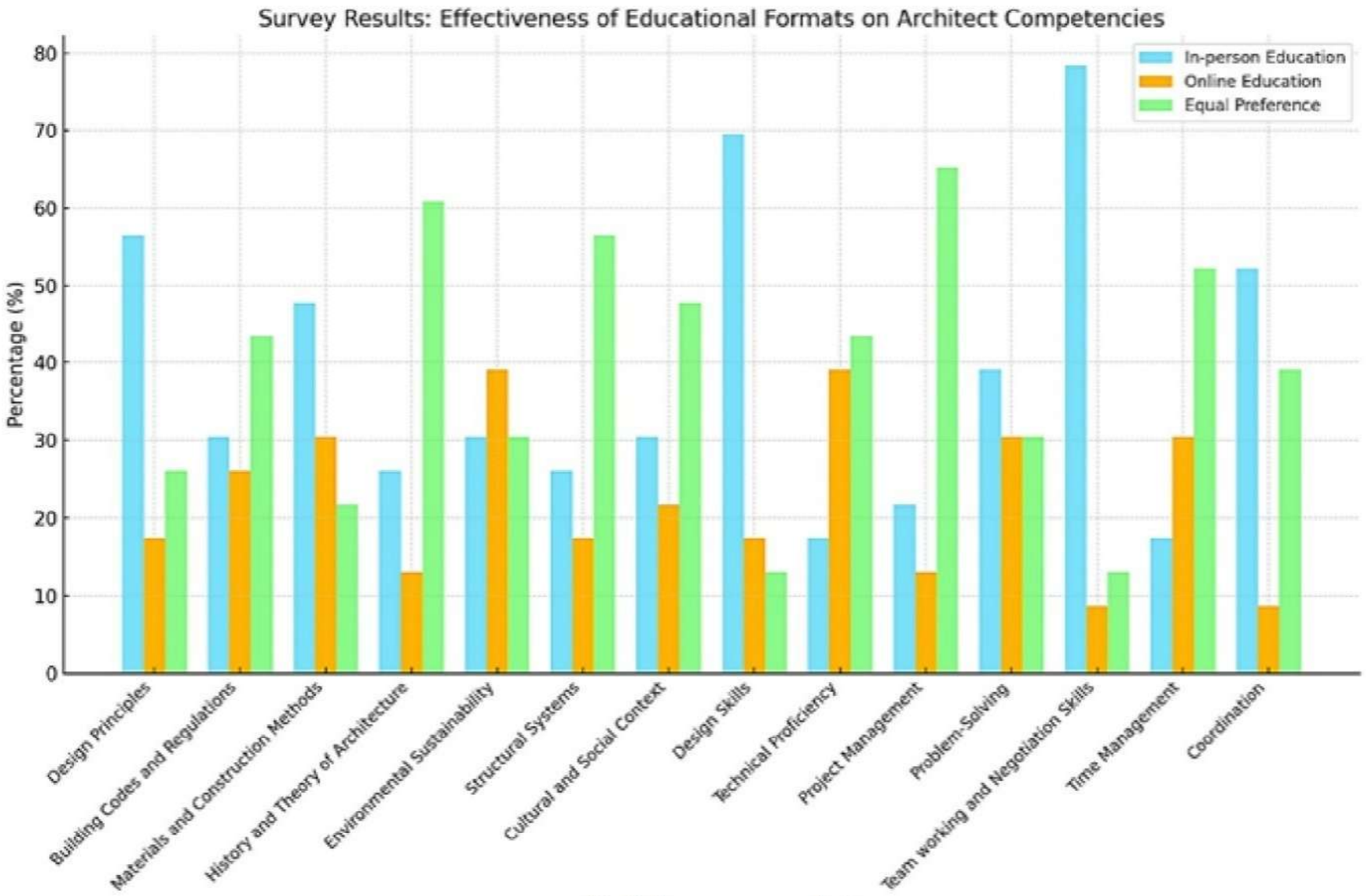

Fig.3 shows survey analysis

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Table 1: Section1 analysis.

Section 1: Architect Knowledge Aspects

Qn		(IE)	(OE)	(E)
1	Design Principles	56.5%	17.4%	26.1%
2	Building Codes and Regulations	30.4%	26.1%	43.5%
3	Materials and Construction Methods	47.8%	30.4%	21.7%
4	History and Theory of Architecture	26.1%	13.0%	60.9%
5	Environmental Sustainability	30.4%	39.1%	30.4%
6	Structural Systems	26.1%	17.4%	56.5%
7	Cultural and Social Context	30.4%	21.7%	47.8%
In-person education: IE		Online education: OE		Equal: E

Table 2: Section1 analysis.

Section 2: Architect Professional Skills

		Percentage %		
Qn		IE	OE	El
1	Design Skills	69.6	17.4	13.0
2	Technical Proficiency	17.4	39.1	43.5
3	Project Management	21.7	13.0	65.2
4	Problem-Solving	39.1	30.4	30.4
5	Teamwork and Negotiation Skills	78.3	8.7	13.0
6	Time Management	17.4	30.4	52.2
7	Coordination	52.2	8.7	39.1
In-person education: IE		Online education: OE		Equal: E

Section 2

As shown in Table 2, this section highlights that professional skills in architecture are largely shaped by real-world interaction and experience, particularly in areas requiring teamwork, design, and coordination. On the other hand, technical skills (like proficiency in software) and some aspects of management can be effectively learned through online resources, providing flexibility and access to tools that may not be feasible in a traditional classroom.

3.6. Analysis of survey results

• In-person Education Dominates: For a majority of competencies, "In-person Education" was perceived as the most effective format. This is highest for " Design Principles," "Design Skills," "Technical Ability," "Problem Solving" and "Team working and Negotiation Skills" - where it always scored highest.

• Online Education has a Niche: "Online Education" scored lower percentages compared to in-person, but it does show some competitive preference with

" Environmental Sustainability" and "Project Management." Equal Preference means people think both design styles work just as well. Lots of folks picked this for topics like Building rules, Construction stuff, Being eco-friendly, Culture and society, and How to run a project. Seems like education on both styles is pretty balanced.

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3.7. Detailed Competency Analysis

• Design Skills (Principles & Skills):

- People really seem to prefer learning design principles (over 55%) and Skills (almost 70%) in person. This shows that face-to-face learning is seen as important for these skills. Online learning isn't as liked.

• Technical Skills (Codes, Materials, Structures):

- For Building Codes and Materials, most people think both online and in-person work equally well (around 43% and 60%). So things that are fact-based can be taught either way.
- Structural Systems is the same story - most likely a mix of both (over 55%).

• Theoretical (History & Culture):

- When it comes to History, opinions are split. Around 22% like both options, and 26% prefer in-person, but online is the least liked.
- Culture is similar, with many liking both (around 48%) or in-person (around 30%).

• Soft Skills (Sustainability, Projects, Teams, Time):

- Environmental Sustainability is different. Online learning is actually more popular (around 39%) than in-person (around 30%), but most still suggest both ways (around 60%). Maybe it's because it uses research and data that work well online.
- For Project Management, online (around 39%) and both (around 43%) are popular, because it can be done both ways.
- Problem-solving and teamwork are better face-to-face (around 65% and almost 80%). Being in person is key to thinking together.
- Time Management is best learned either way (around 52%) or in person (around 18%). For Coordination, opinions are the same.

• In-person is still seen as best for learning design and people skills.

• For rules, materials, systems, and context, people either like both options or in-person better.

• Online learning is good for Sustainability and project management because it has to do with organizing.

• The best way to teach depends on the skill. Don't use the same method for everything.

4. Core Concepts for Addressing the Gap

• For fundamental architectural design and social skills, traditional in-person instruction is still thought to be the most successful.

• The skills related to rules, materials, systems, and broader contexts show a strong preference for either "Equal Preference" or "In-person Education." This suggests that these areas may be more flexible, or that a mixed approach is favoured.

• Even though it is less popular overall, online learning performs well in "Environmental Sustainability" and competes effectively in "Project Management." This indicates that it might offer specific organizational or knowledge-related skills.

• The information indicates that the particular architect competency under consideration has a significant impact on the "effectiveness" of an instructional approach. It may be best to use a variety of delivery techniques for architectural education rather than a one-size-fits-all strategy.

5. Proposed Interventions to Meet Business Owners' Needs in the Labor Market

Based on the literature review and survey analysis, the following interventions are designed to address the identified gaps and challenges faced by business owners in the labor market, drawing insights from established theoretical frameworks and the specific findings of the questionnaire.

5.1. Architects' Knowledge Aspects

This section evaluates architects' understanding of foundational knowledge areas. The findings reveal distinct patterns in the suitability of educational formats:

5.1.1 Strengths of In-Person Education:

Design Principles (56.5%) and Materials and Construction Methods (47.8%): These topics benefit from hands-on engagement and real-time feedback, aligning with studies emphasizing experiential learning (Kolb, A, 2018). The physicality of studio environments and direct mentor critiques are instrumental for skill acquisition in these areas.

Structural Systems (26.1%): While not overwhelmingly dominant, in-person education's advantage reflects the need for tactile demonstrations and field-based learning (Schön, D. A, 1987).

5.1.2 Strengths of Online Education

History and Theory of Architecture (13%) and Environmental Sustainability (39.1%): Theoretical and research-oriented topics are well-suited to asynchronous learning modes, which allow flexibility for independent exploration (Means, B, 2009).

5.1.3 Suggested Balanced Hybrid Approach for Architects' Knowledge Aspects

Equal preference for Building Codes (43.5%) and Cultural Context (47.8%) highlights the importance of integrating both formats. This supports hybrid education models, which provide theoretical content online while offering contextual learning through site visits or workshops (Garrison, D. R, 2008).

According to the findings, it is essential to modify teaching methods to meet the cognitive needs of the subject. In-person training provides a tactile experience that is important in subjects that call for practical activities. On the other hand, internet platforms can effectively promote theoretical learning.

5.2. Architects' Professional Skills

This section assesses key professional competencies, offering insights into skill-specific educational needs:

5.2.1 In-person Education Strengths

Design Skills (69.6%), Teamwork and Negotiation (78.3%), and Coordination (52.2%): Collaboration-intensive skills necessitate dynamic, face-to-face interactions. Constructivist theories state that group activities improve teamwork and communication skills. In-person education plays a key role in these areas, as architects need to work with complex, multidisciplinary teams.

5.2.2 Online Education Strengths

Technical Proficiency (39.1%): Online platforms excel in delivering software-based skills, leveraging digital simulations and tutorials. Research indicates that e-learning tools can enhance proficiency by enabling repeated practice and self-paced learning (Fiorella, L, 2016).

5.2.3 Suggested Balanced Approach for Architects' Professional Skills:

Skills such as problem-solving (30.4%) and project management (65.2%) demonstrate comparable efficacy across formats. These findings show the flexible nature of these skills. They gain from online theories and hands-on experience in person. The results point to a two-pronged approach for skill development. Soft skills, like teamwork and coordination, depend on personal interaction. On the other hand, technical skills do better in tech-supported settings.

Cross-Sectional Observations: Synergistic Value of Hybrid Models

Equal distribution in multiple areas suggests that hybrid learning approaches can optimize skill development. Studies have shown that blended formats improve retention and engagement by catering to diverse learning preferences (Boelens, R, 2017).

Companies like courses that mix basic info with teamwork and skills you can actually use. The results show that it's super important for architecture schools to have things like site visits, internships, and group projects.

6. Results

This study investigated the effectiveness of online education in preparing architecture graduates for the workforce, specifically examining its impact on their competencies and labor market demands.

The findings indicate a clear distinction in the efficacy of different educational modalities for specific skills and knowledge sets:

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• In-person education was found to be essential for developing hands-on skills, including design principles, materials and construction methods, and teamwork. These areas necessitate direct interaction and real-time feedback for effective acquisition.

• Online education proved effective for theoretical topics such as architectural history, theory, and environmental sustainability, offering flexibility and access to digital resources. It was also well-suited for developing technical skills, particularly proficiency in design software.

• The research highlights the importance of hybrid educational models that combine the strengths of both in-person and online learning.

• This balanced approach is crucial for ensuring graduates are well-equipped with both technical and interpersonal skills, thereby enhancing their preparedness for the demands of the architectural profession.

• The study suggests that continuous adaptation of educational strategies is necessary to meet the evolving needs of both students and employers in the field.

7. Recommendations

The study's findings highlight the need for a multifaceted approach to architectural education to better prepare graduates for workforce demands. The following recommendations are proposed:

• Use Hybrid Educational Models:

The best strategy, according to the research, is a combination of online and in-person instruction. Programs in architecture should create and implement hybrid curricula that capitalize on each modality's advantages.

- For Practical and Teamwork skills: Priority: In-person training should be emphasized once you start building instructional capacity for competencies such as: design skills, design principles, materials and construction techniques, coordination, teamwork, and negotiation.
- A range of methods should be included in any program for education that promotes learning, including: studio work, site visits, in-person critiques, and group projects.
- For Technical and Theoretical Skills: Take advantage of online learning resources for the more theoretically based content material, such as: environmental sustainability, building codes and regulations, architectural history and theory, and technical capability (i.e., design software). Online learning offers the flexibility and availability of digital resources for these topics and will suit the needs of online learners.

• Improve Online Design Studio Pedagogy: To better reflect the collaborative in-person environment, online design studios need specific improvements, especially given the rising popularity of online learning. This includes incorporating:

- Collaborative online platforms
- Updated course materials suited for digital learning
- Digital libraries with design resources and guidelines
- Group assignments to foster teamwork and reduce isolation
- Adapted design tools for digital drawing
- Structured online critiques and presentations
- Enhanced social interaction through social media and virtual events

• Incorporate Opportunities for Practical Experience: Architectural programs ought to more formally incorporate opportunities for practical experience into their curricula to fill the documented gaps in practical experience and real-world competencies. This could include:

- Mandatory internships or apprenticeships
- More frequent and structured site visits, learning from projects that replicate difficult collaboration and real-world client interactions

• Career readiness-focused curriculum design: Experts advise routinely evaluating and revising the curriculum to reflect the evolving demands of the labor market. Graduates who know

building codes, workflow, and use organization design tools, and collaborate effectively, contribute to that process.

• Invest in online learning staff development: Address technical issues and make sure that staff can teach online. Educators should have training to effectively present the material and encourage engagement in online and hybrid learning environments.

• Encourage the growth of adaptive competence. This includes managing changing technology, working well in interdisciplinary teams, and sharing information in various situations. This shows how professional development and architectural education must be combined.

8. Future Research

• Perform longitudinal studies to evaluate the long-term effects of various educational formats on professional success and career advancement. Future research should include a wider range of participant demographics to give the results more detail.

• Carry out further research on AI's potential to fill skill gaps in architects: Examine how AI can be used to evaluate, pinpoint, and close the skill gaps that architects will face in the labor market of the future. Create training and educational initiatives that take advantage of AI's capabilities.

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