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Technological Skills Implications: Identification of the Gap Between Architectural Education Curricula and Practices in Architecture Firms in Pakistan

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Abstract: Numerous architecture graduates entering the job market often encounter a significant gap between their education and the practical demands of their professional careers in Pakistan. The increased demand for advanced technological skills in design firms and the lack of such skills amongst young graduates have prompted the need to investigate the gap between the curriculum and architectural practices in the field. Therefore, this study aimed to review the current curricula of different institutes in terms of offered computer courses and identify the gap between architectural practices and computer courses curricula offered by architectural institutes. Data was collected from professionals, and fresh graduates of the architectural field by using a questionnaire survey. Six educational institutions were selected as a case study.; A Pearson correlation test using a statistical package for social sciences (SPSS) was employed to understand the relationship between the variables. The results indicated that the curriculum design is not fully efficient in meeting the current skill set needed by architectural practices. The study concluded that there is a need to integrate updated advanced technical courses to cover the gap between the curricula and the required skill set of architectural practices. The study concluded that there is a need to integrate updated advanced technical courses to cover the gap between the curriculum and the required skill set of the architectural field. The study is beneficial for program administrators and instructors to make up-to-date choices, as well as for accreditation bodies to understand where and how they can begin to help in the application of the integration of architectural education with different technologies and collaboration to support them.

Keywords: Architecture Curriculum, Technological skills, Architectural education, Architecture practices.

1. Introduction

A teacher's role, as outlined in the study of Anwar and Ijie (2023), encompasses motivating students to achieve their best potential. Throughout this process, it is expected that the teacher addresses the unique needs of each student to ensure universal success. The specified learning goals are typically outlined in the curriculum for each course. Educational curricula in Pakistan are designed to impart students with practical knowledge and skills to meet their future skill set. Architectural institutes instill skills, experiences, and knowledge in students.

In Pakistan, the architectural curriculum is a fusion of requirements from the Higher Education

Commission (HEC) and the Pakistan Council of Architects and Town Planners (PCATP), aiming to align with professional demands. While the content for each course is explicitly defined, its application in the classroom hinges on the interpretation of individual lecturers. In simpler terms, the execution depends on how each lecturer chooses to utilize the curriculum.

However, whether the skills, knowledge, and experiences that are being transferred to the students are sufficient for their career growth still remains a point of concern. Architectural institutes in Pakistan follow various approaches to prepare students for the job market. Many institutes are more inclined toward a theoretical approach. Others follow a mix of career and practical approaches and design their curriculum accordingly. However, different studies indicated that both approaches are not in line with the job conditions of the architectural field. For instance, according to Hejazi and Shafaei (2021), the challenges within the architectural education system, leading to a disconnect between architectural education and the professional realm, as well as the suboptimal performance of architecture graduates in professional settings, span the entire trail from student admission to post-graduation. Key issues include the method of student admission, an excessive influx of students in some institutes, the misalignment of educational content with industry needs, the detachment of universities from society, a lack of training in professional ethics, insufficient development of interactive skills, the limited professional experience of professors, and broader societal problems, including economic issues. Furthermore, according to the PCATP report (2020), approximately 155 participants emphasized the importance of establishing connections between education and practical application. They identified a deficiency in curriculum development as a significant challenge confronting their professional education within the nation (PCATP, 2020). Consequently, essential attributes for successful architecture graduates in a professional context encompass a profound understanding of market-relevant topics, proficiency in various architectural software, adherence to professional ethics, and effective interactive skills (Hejazi and Shafaei, 2021).

Hence, in the job market, the need for technical and digital skills is high in the architectural field.

The field demands an advanced digital skill set from the graduates. However, the fresh graduates have failed to some extent to fulfill that demand. Due to this, many graduates remain unemployed or are employed on a pay scale that is not market-competitive. To resolve this issue, it is necessary to investigate where the gap exists. Identifying the gap can help educational institutions design a curriculum that can prepare fresh graduates with the skills set as per the needs of the market. Therefore, the main aim of this research is to identify the gap that exists in academia and the architectural profession.

2. Literature Review

In the era of technological advancement, development in curricula is required generally in all fields, and more specifically in the field of architecture. "Technological advancement" refers to a wide range of innovations, including improvements in digital design tools and building information modeling (BIM) software, sustainable building materials and methods, and new technologies like artificial intelligence (AI) and augmented reality (AR). These technological advancements are completely transforming the way architects conceptualize, design, and create buildings, necessitating the acquisition of new skills and competencies by professionals in the field. In this context, curriculum development for architecture is crucial to guaranteeing that schools stay current and adaptable to the ever-evolving demands of the profession.

In recent years, in Pakistan, the number of educational institutes that are offering offer architectural education have increased. Still, despite the increased numbers, the social needs of the students in terms of technological advancement have not been fulfilled (Iqbal et al., 2023). Architectural education is being offered on campuses via online training and distant education facilities. Although this portrays the use of new technologies in architectural education to an extent, in reality, it is the lack of technology integration in architectural discourse (Abdulla and Hassanpour, 2021).

Technology serves dual roles within architectural education, functioning both as a methodology and a tool. The former emphasizes optimizing course structures and instructional materials, while the latter serves as a medium for students to explore and articulate their ideas (Hassanpour and Şahin, 2021). Mondragón-

del-Ángel et al. (2023) assert that integrating technology and software positively impacts the teaching-learning process in architecture education. This integration enhances skill development, fosters sustainable design and project outcomes, facilitates knowledge acquisition, improves academic performance, motivates and engages students, introduces novel design approaches, and aids in idea visualization. Moreover, they argue that architecture schools that strategically incorporate technology and software demonstrate varying degrees of proficiency in computer-based courses aimed at equipping students with technological competencies. Consequently, there is a difference in the existing structures of architecture education curricula in numerous surveyed institutions that imbalances the situation, causing a gap in addressing the innovative challenges and societal needs of architecture in the digital era (see Table 1).

Table 1 presents a breakdown of computer application courses within the architectural curriculum across the six institutes. At Mehran University of Engineering and Technology, Jamshoro, three computer application courses offer a well-rounded blend of technical and design-oriented subjects. In the curriculum of the National College of Arts (NCA) Lahore, five computer application courses are included. Here, students delve into digital sculpting, animation, multimedia presentations, and architectural drafting and modeling software. At Shaheed Allah Buksh Soomro University of Art, Design, and Heritage, Jamshoro, Sindh, the focus on art, design, and heritage influences the selection of three digital tools for architects, in contrast to NCA Lahore. Balochistan University of Information Technology, Engineering, and Management Sciences (BUITEMS) offers three computer application courses, including GIS, catering to the market demand for this software. Meanwhile, at NED University, known for its engineering prominence, students engage in four comprehensive computer application courses. CECOS University of IT and Emerging Sciences, Peshawar, also provides three computer application courses, allowing students to explore design and its technicalities by using different software. Hence, it is clear that NCA Lahore is offering more computer-based courses than the other institutes. Therefore, considering the current difference in the curriculum, there is a need to highlight the problem in the field of architectural education and the underlying pathology due to the limited number of technological courses. The second problematic area that has been observed in the course descriptions of most of the institutes is that they are still the same as they were a decade ago. Nothing has been introduced over the years that can teach the students about the advancement of architectural education. Under the current situation, the course description of computer-based courses requires restructuring (Khodeir and Nessim, 2020). Considering the modern-day requirement of devotion and modern values, all architecture schools should consider architecture training digital courses as an important element of their degree program. Saghafi (2015) and Rodgiguez et al. (2018) have mentioned in their work that architecture schools should integrate the combination of virtual design ateliers and in-person learning ateliers. They are of the view that a combination of both can help increase the motivation level of students. This can also help them to get themselves equipped with the virtual skills that are needed in modern times (Saghafi, 2015; Rodgiguez et al., 2018). Sardashti et al. (2020) proposed that integrating a critical approach into the curriculum is also essential. The critical approach not only enhances the motivational level of students but also enables them to learn social skills, improve their quality and speed of design processing, enhance vitality and diversity, and also contribute towards reducing students' stress (Sardashti et al., 2020).

According to the work of Rifaat (2019), architectural schools should increase their emphasis on instilling spatial and aesthetic aspects of architectural designs in students. This will be backed by modern technology like artificial intelligence. He mentioned that the disciplines that can help students learn about the construction and design of real projects should be included in the curriculum. This can help teach the students about the complexities underlying real design, and this, in hindsight, can help them in their journey of creativity. He suggested that a multidisciplinary approach to architecture education can bridge the gap between the demands of the profession and the architectural curriculum (Rifaat, 2019). Mahdavinejad et al. (2012) believe that universities should work hard to impart to students the skills that can help them in their professional careers. The formal education that is currently being offered in architectural institutes is not sufficient to prepare the students for the professional field. This is because the technical courses that are offered in most universities are not very effective in terms

Table (1). Computer based digital courses offered in six architectural schools

S.No.	Semester	Course name	Credit hours	Total credit hours of 5 years program	University name
1.	3rd semester	Computer Aided Design-I	0+2	**172** (out of 172, 12 hours are for software courses) **12*100/ 172= 07%**	**Mehran University of Engineering and Technology, Jamshoro, Pakistan** (https://www.muet.edu.pk/departments/architecture)
2.	4th semester	Computer Aided Design-II	0+2		
3.	5th semester	Computer Aided Design-III	0+2		
4.	6th semester	Working Drawings & Details-I	0+3		
5.	7th semester	Working Drawings & Details-II	0+3		
			0+12		
1.	3rd semester	Computer Application-I	0+2	**172** (out of 172, 10 hours are for software courses) **10*100/ 172= 06%**	**National College of Arts, Lahore** *(https://arch.uol.edu.pk/course/bachelor-of-architecture/)*
2.	4th semester	Computer Application-II	0+2		
3.	5th semester	Computer Application-III	0+2		
4.	6th semester	Computer Application-IV	0+2		
5.	8th semester	Computer Application-V	0+2		
			0+10		
1.	4th semester	Digital Tools for Architects-I	0+2	**180** (out of 180, 06 hours are for software courses) **06*100/ 180= 03%**	**SABS University of Art, Design and Heritages Jamshoro** *(https://rev.sabsu.edu.pk/department-of-architecture-and-planning/)*
2.	5th semester	Digital Tools for Architects-II	0+2		
3.	6th semester	Digital Tools for Architects-III	0+2		
			0+6		
1.	4th semester	Computer Applications in Architecture-I	0+2	**173** (out of 173, 07 hours are for software courses) **7*100/ 173= 04%**	**BUITEMS- Balochistan University of Information Technology, Engineering and Management Sciences** *https://www.buitms.edu.pk/Architecture*
2.	5th semester	Computer Applications in Architecture-II	0+2		
3.	7th semester	GIS for Architects	1+2		
			1+6=7		
1.	3rd semester	Communication and Skills-III (AutoCAD, Adobe Photoshop, Sketch-up)	1+2	**183** (out of 183, 12 hours are for software courses) **12*100/ 183= 07%**	**NED University of Engineering and Technology** *https://ard.neduet.edu.pk/sites/default/files/myfiles/pdf/Detailed%20Syllabi-B.Arch.pdf*
2.	4th semester	Communication and Skills-IV	1+2		
3.	6th semester	Communication and Skills-V	1+2		
4.	7th semester	Communication and Allied Skills-VI	1+2		
			4+8= 12		
1.	4th semester	Digital Tools for Architects–I	0+2	**172** (out of 172, 06 hours are for software courses) **06*100/ 172= 3.49%**	**CECOS University of IT and Emerging Sciences-Peshawar** https://cecos.edu.pk/wp-content/uploads/2022/08/BS-Prospectus-2022.pdf
2.	5th semester	Digital Tools for Architects–II	0+2		
3.	6th semester	Advance Computer Application for Architects	0+2		
			0+6		

of the requirements of the field (Mahdavinejad et al., 2012). Therefore, to enhance the overall level of architecture education, three areas should be incorporated into the curriculum. This includes integrating emerging technologies into the courses, eliminating unnecessary theories and content, and encouraging the students to acquire the skills through self-learning (Leathem et al., 2020).

Ulusoy and Yalcin (2015) have suggested that architectural institutes should prepare the students with some of the skills to prepare them for the field. These skills include encouraging the students to take part in training courses, learning BIM, AutoCAD, and other software that is in high demand in the market, taking classes that can enhance their design abilities, and developing skills that can help in enhancing self-expression in terms of design and techniques (Ulusoy and Yalcin, 2015). Leading architectural firms are increasingly adopting digital design strategies to broaden their design horizons and navigate the intricate complexities inherent in the discipline (Abdullah and Hassanpour, 2021). The incorporation of more skills-based courses can help the students equip themselves with the skills that are needed in the market. This will also help in covering the gap that exists in the curriculum and the architectural profession. Hence, Abdullah and Hassanpour (2021) propose a curriculum reassessment and advocate for of integrating digital design applications into architecture education.

3. Research Approach

Two closed-ended questionnaires were used as the main tool for collecting the data from the participants. The target population included undergraduate architecture students from six universities in Pakistan: (1) Balochistan University of Information Technology, Engineering, and Management Sciences; (2) NED University of Engineering and Technology Karachi; (3) Shaheed Allah Buksh Soomro University of Art, Design, and Heritage, Jamshoro, Sindh; (4) CECOS University of IT and Emerging Sciences, Peshawar; (5) NCA Lahore, and (6) Mehran University of Engineering and Technology, Jamshoro. There are two primary reasons for selecting the above institutes: 1) recognition of institutes them for their reputable architecture programs and accreditation status, and 2) practical factors, including the universities' willingness to participate in the study and their accessibility.

Further, professional architects with managerial roles in architectural companies were selected. The criteria for selecting architects were based on their experience, years of work, involvement in significant projects, and awards received.

Firstly, one online survey form was distributed via a Google Forms link across various social media

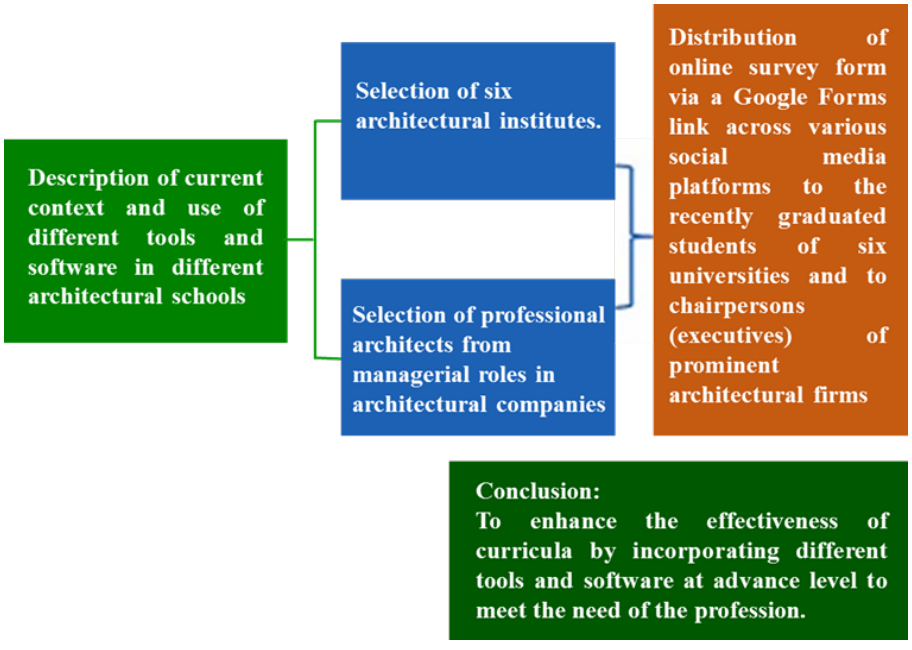

Figure (1). Research methodology flowchart

platforms to the recently graduated students of six universities, resulting in 92 completed surveys by students. Then 25 survey forms were sent to the specific executives to be filled out. The research focused primarily on recently graduated students, with approximately one-third of the total sample size (92 students) drawn from this group. Additionally, the questionnaire was distributed to chairpersons (executives) of prominent architectural firms in Karachi and Lahore; therefore, this sample size is small. However, it is worth noting that the survey did not include all registered architects.

The survey consisted of 25 closed-ended questions categorized into three main sections: demographic information, the perspectives of students and professionals about architectural study, and the needs of the market. The results were summarized in the pie chart to depict the participants' responses. Further, a Pearson correlation test is used using SPSS to understand the relationship between the current implications of digital tools in architecture versus various indicators (Table 3).

4. Results and descriptive statistics

Figure 2 shows students' responses (N=92) about the issues they encounter after getting jobs as a fresher. 71% of the survey participants revealed a concern regarding the field experience, which is one of the bigger issues they are facing in the field. In addition, 16% reported having skills issues like designing and manually representing their ideas to people. In comparison, 16% of the participants indicated that a lack of digital knowledge is one of the problems they face in the practical field (Figure 2). This implies that, in the field, preference is given to field experience instead of considering that the fresh graduates do not have field experience. These results align with the study of Humburg and Van der Velden (2015), which indicated that the level of professional expertise and interpersonal skills of graduates are the factors that influence the hiring decisions of employers. However, many schools are trying to cope with this issue by enforcing internships at different levels during graduation studies. However, the results indicated that, in the hiring process, preference is not given to digital tools compared to field knowledge and experience.

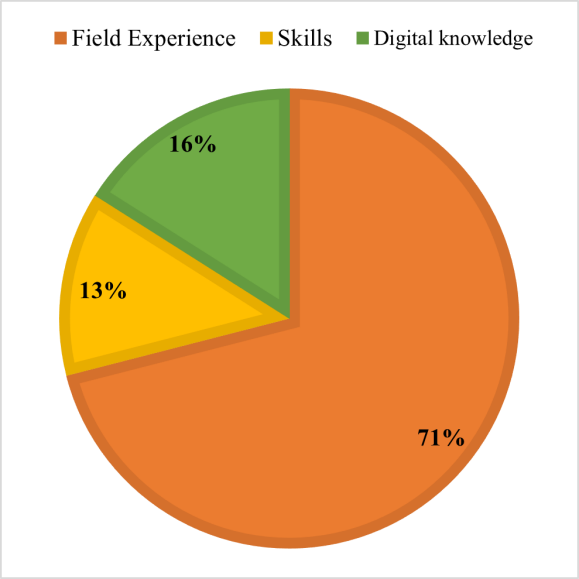

Figure (2). Challenges faced after entering in professional field (Student's Response)

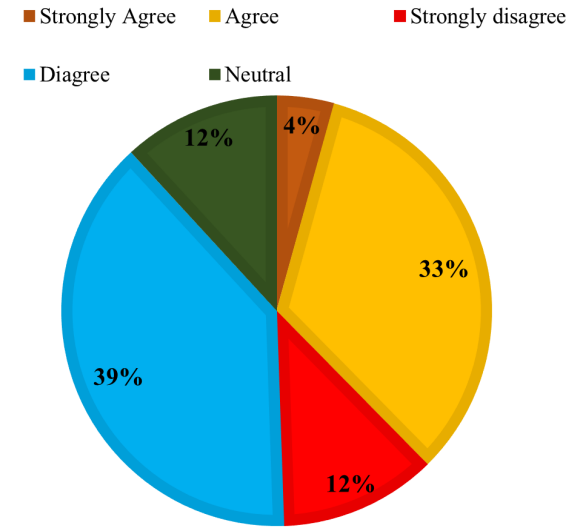

Figure (3). Does the curriculum design addresses the needs of professional field (Professionals' Response)

In figure 3, an investigation was carried out with the professionals working in the architectural field to understand that the curriculum design addresses the needs of the professional field (N=25). 4% of people responded that they strongly agree that the graduates are fueled by the requirements of

the professional field, and 31% agree with the same scenario. However, 11% and 36% of the survey participants strongly disagreed and disagreed, respectively. On the other hand, 18% of respondents were neutral on this query. This indicated that the majority of the professionals have experienced a deficiency in the curriculum in the architecture schools. These findings corroborate previous findings by Becerik-Gerber et al. (2011) who found a knowledge gap in the highly constrained curricula and emphasized the need to incorporate new knowledge areas to enhance the expertise.

The responses to the question about what skills are expected of a fresh architectural graduate are relevant when it comes to acquiring a job (Table 2). In addition, Table 3 shows the relationship between various indicators related to the need for and implications of digital education in the architectural field. In the freshly graduated response category, the correlation between the fresh graduates' knowledge of digital tools and the expectations of the employers shows a positive correlation (.730**, p-value =.000). Similarly, the correlation of the same variables in the professional's response category shows a positive response (.495*, p-value =.012). This outcome indicates that the freshly graduated are equipped with knowledge of different digital tools. However, there are few expectations according to the perspective of fresh graduates and employers (Table 2).

The tool of AutoCAD is considered to be important for both graduates (35%) and professionals (30%). In addition, the most important tool demanded in the market is 3D visualization, as indicated by the people's responses. 55% of graduates and 50% of professionals emphasized learning 3D visualization. The use of 3D modeling is a necessity, as it helps to understand the design information. These results are supported by the study of Painuly (2019), who suggested that the use of AutoCAD allows for more compareddesign options than manual drafting and is an important tool in architectural education.

In addition, the correlation between the fresh graduates' knowledge of digital tools and which software demands more in architectural practice these days shows a positive correlation for both categories (.839**, p-value =.000) and (.357, p-value =.080). This outcome indicates that the freshly graduated have command of the market-demanding software. However, both graduates and professionals indicate that market demand is high for some software. Like many graduates (28%) and professionals (35%) said that the demand for Autodesk AutoCAD is higher than the other software. Most professionals (30%) required Autodesk Revit experts in the field, while 11% of graduates thought it was important software.

Considering GIS is a new trend and is being used in different research; however, according to the survey, this tool is currently not in use in Pakistani firms. According to 16% of graduates, VRAY is needed to fulfill the current market need; however, only 5% of professionals require these skills. It is clear from the results that, with the advancement of technology, new software is being introduced in the architecture field. These results align with the previous study by Basheer and Kazimi (2016), which shows the integration of different software in the different stages of the design process to enhance architectural education.

On the other hand, taking into consideration the opinion of the need for BIM to enhance digital architectural education, in Table 3, a positive correlation (.486**, p-value =.000) and (.170, p-value =.416) indicated that BIM is an important tool in the field is architecture.

The findings are in line with the study of Hu et al. (2022), which demonstrated that BIM technology is a significant trend within the construction industry, offering the potential to enhance production capacity.

To understand the importance of digital architectural education in Pakistan for academic excellence, the correlation results indicated a positive relationship (.690**, p-value =.000), and (.129, p-value =.540). This implies that to achieve more excellence in academia, more digital tools must be introduced to the curriculum. Therefore, it is urgent to give importance to digital architectural education to not only enhance architectural education but also to make graduates able to flourish in the market. These results are supported by the study of Doyle and Senske (2017), which suggested recognizing the importance of digital design skills and delivering them more than technical proficiency. However, they also suggested that there is a need to understand the difference between teaching students to use technology and teaching students to design with technology.

Table (2). Identification of architectural education and market demand

Descriptive Statistics					
Indicators	Responses	Percentages	Mean	Std. Deviation	Respondents' Category
1-Skills expected of a fresh architectural graduate?	Good designing skills	05%	3.43	.775	Freshly graduate's Response (N=92)
	Manual Drafting skills	05%			
	AutoCAD	35%			
	3D Visualization	55%			
2-Which software demands more in architectural practice now days?	Autodesk auto cad	28%	8.00	2.199	
	Sketch up	12%			
	Autodesk 3D-Studio Max	14%			
	Autodesk Revit	11%			
	Adobe Photoshop	17%			
	GIS	2%			
	V-Ray	16%			
3-Fresh Graduates' Knowledge in digital tools	Yes	28%	12.72	.453	
	No	72%			
4-Do you think (BIM) building information modeling will add in digital architectural education.	Yes	60%	14.68	.889	
	No	10%			
	Do not know	30%			
5-Digital Architectural Education in Pakistan gives more privilege to academic excellence.	Agree	44%	18.05	.965	
	Disagree	8%			
	Neutral	48%			
6-Skills expected of a fresh architectural graduate?	Good designing skills	20%	2.32	.802	Professional's Response (N=25)
	Manual Drafting skills	0%			
	AutoCAD	30%			
	3D Visualization	50%			
7-Which software demands more in architectural practice now days?	Autodesk auto cad	35%	6.08	1.754	
	Sketch up	5%			
	Autodesk 3D-Studio Max	5%			
	Autodesk Revit	30%			
	Adobe Photoshop	20%			
	GIS	0%			
	V-Ray	5%			
8- Fresh Graduates' Knowledge in digital tools	Yes	8%	12.92	.277	
	No	92%			
9- Do you think (BIM) building information modeling will add in digital architectural education.	Yes	72%	14.40	.707	
	No	16%			
	Do not know	12%			
10- Digital Architectural Education in Pakistan gives more privilege to academic excellence.	Agree	84%	17.16	.374	
	Disagree	16%			
	Neutral	0%			

Table (3). Correlation between the variables

		A1	A2	A3	A4	A5	*Respondents' category*
1	Pearson Correlation	1	.730**	.839**	.486**	.690**	Freshly graduate's Response (N=92)
	Significance (2-tailed)		.000	.000	.000	.000	
	N	92	92	92	92	92	
2	Pearson Correlation	1	.495*	.357	.170	.129	Professional's Response (N=25)
	Significance (2-tailed)		.012	.080	.416	.540	
		25	25	25	25	25	
*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).							
A1—What is the knowledge of fresh Graduates in digital tools? A2—What skills are expected of a fresh architectural graduate? A3—Which software is more demanded in architectural practice now days? A4—Do you think building information modeling (BIM) will add to digital architectural education? A5—Digital Architectural Education in Pakistan gives more privilege to academic excellence.							

5. Discussion

As per the results of the survey, it is noted that there is room for improvement between the architectural curriculum design and the architectural field demand. The curriculum offered in most of the architectural institutes is less focused on digital courses. As per the responses, it can be concluded that the biggest challenge students face in the professional field is a lack of field experience, which they are now trying to overcome by implementing internship policies in schools. The second biggest challenge that students face when they enter the field is the lack of digital knowledge and skills.

The responses have indicated that the skills most demanded in the architecture profession include 3D visualizer skills and AutoCAD. While the universities do offer such courses, the content is limited, with less practical exposure. The responses also indicated that most fresh graduates do not meet the knowledge criteria required for implementing and utilizing BIM.

It was also observed that most of the participants agreed that the architectural schools in Pakistan emphasized digital education. However, detailed knowledge is required. On the other hand, the results of SPSS indicated that the curriculum offered by architecture institutes is equipped with knowledge and skills; however, the current demand for the architect profession is changing at a fast pace, so there is a need to update curricula. Due to this lack, most of the fresh graduates fail to become competent professionals in using advanced digital tools, and therefore, the majority cannot get their dream job. The responses also indicated that there is minimal interaction between architectural firms and architectural institutes. The academics are also not fully aware of the skills demanded by the market; therefore, their focus is mainly on the traditional curriculum.

Thus, the above results and responses suggest that in architectural institutes, more importance is given to the theoretical and academic aspects and less to the digital courses. The responses, therefore, indicate a gap in the curriculum and architectural practice. However, this gap can be reduced by integrating more technology-based and advanced digital courses into the curriculum of some institutes.

6. Conclusion

The extent to which students are exposed to different software tools can significantly influence their preparedness for entering professional practice and their ability to adapt to the evolving technological landscape within the architecture field. This study discussed the gap and pathways to improve architectural education for best practices. Digitization has become an important factor in all educational disciplines in general, especially in architectural education. In general, although each of the six institutes included computer application courses in their architectural curriculum however, the particular emphasis, extent, and variety of

software covered might differ depending on institutional preferences, available resources, and industry requirements. However, the study has indicated that there is a gap in the curriculum and architectural practice within the institutes. The gap is mainly due to problems in implementing digital skills and knowledge in architecture education and underlying pathology. This gap is a key barrier to successful progress in architectural education. Thus, to cover the gap, educational institutes should invest efforts to integrate more advanced digital and practical-based courses into their curriculum to help the students get themselves equipped with the skills that are needed in the architecture profession. In addition, there is a need to introduce digital tools for 3 years (2nd to 4th year/3rd semester to 8th semester). To improve their technological skills, students must be allowed to use emerging technologies like Artificial Intelligence (AI) and Virtual Reality (VR) in the studios. The use of AI must be integrated during the process of design development. Students might be asked to bring a minimum of ten design ideas for their project from AI, and in the later stage, they must develop one idea after analyzing the ideas generated by AI. Further, in the process of curriculum development, it is crucial to take into the loop various stakeholders, such as government entities, employers, training organizations, educators, and students, to ensure comprehensive alignment and effectiveness.

However, the translation of the curriculum into effective learning practices requires the utilization of suitable pedagogical methods and practical applications to meet the diverse learning needs of the students; therefore, further investigation into practical applications and pedagogical approaches is required in the future to delve into these aspects in more detail.

Abbreviations

BIM: Building Information Modeling
CAD: Computer-Aided Design
GIS: Geographic Information System
ICT: Information Communication Technology

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الآثار المترتبة على المهارات التكنولوجية: تحديد الفجوة بين مناهج التعليم المعماري والممارسات في شركات الهندسة المعمارية في باكستان

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ملخص البحث. غالباً ما يواجه العديد من خريجي الهندسة المعمارية الذين يدخلون سوق العمل فجوة كبيرة بين تعليمهم والمتطلبات العملية لحياتهم المهنية في باكستان. أدى الطلب المتزايد على المهارات التكنولوجية المتقدمة في شركات التصميم وعدم توافر هذه المهارات بين الخريجين الشباب؛ إلى الحاجة إلى دراسة الفجوة بين المناهج الدراسية والممارسات المعمارية في هذا المجال.ولذلك، هدفت هذه الدراسة إلى مراجعة المناهج الحالية للمعاهد المختلفة من حيث دورات الكمبيوتر المقدمة، وتحديد الفجوة الموجودة بين الممارسات المعمارية ومناهج دورات الكمبيوتر التي تقدمها المعاهد المعمارية.تم جمع البيانات من المهنيين والخريجين الجدد في المجال المعماري باستخدام استبيان.وقد تم اختيار ست مؤسسات تعليمية كدراسة حالة؛ وتم استخدام اختبار مربع كاي باستخدام الحزمة الإحصائية للعلوم الاجتماعية (SPSS) لفهم العلاقة بين المتغيرات.أشارت النتائج إلى أن تصميم المناهج الدراسية ليس فعالاً بشكل كامل لتلبية الاحتياجات الحالية من المهارات للممارسات المعمارية.وخلصت الدراسة إلى أن هناك حاجة إلى دمج الدورات الفنية المتقدمة المحدثة، لتغطية الفجوة بين المناهج الدراسية ومجموعة المهارات المطلوبة للممارسات المعمارية.وخلصت الدراسة إلى أن هناك حاجة إلى دمج المقررات التقنية المتقدمة المحدثة، لتغطية الفجوة بين المنهج الدراسي ومجموعة المهارات المطلوبة في المجال المعماري. تعتبر الدراسة مفيدة لمديري البرامج والمدرسين لاتخاذ خيارات حديثة، وكذلك لهيئات الاعتماد لفهم أين وكيف يمكنهم البدء بالمساعدة في تطبيق تكامل التعليم المعماري مع التقنيات المختلفة والتعاون لدعمهم.

الكلمات المفتاحية: مناهج العمارة، المهارات التكنولوجية، التعليم المعماري، الممارسات المعمارية.