COMPARATIVE ANALYSIS OF ARCHITECTURAL EDUCATION METHODOLOGY DURING THE CORONAVIRUS PANDEMIC

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ABSTRACT

The COVID-19 pandemic has led to radical changes in various aspects of life, including education. Educational institutions were forced to adopt new teaching methods, such as distance learning and hybrid education, which raised questions about the effectiveness of these methods compared to traditional approaches.

This study aims to provide a comparative analysis of the architectural education methodology during the COVID-19 pandemic, focusing on the strengths and weaknesses of both the traditional and new approaches. It seeks to evaluate the alternative methods adopted in teaching, learning, communication, assignments, and assessment, and their effectiveness in continuous improvement or integration into the educational process. The study also expresses a point of view on the suitability of online education for architectural education in Egypt, based on the experiences of students and teachers during the pandemic.

An online survey was conducted to obtain preliminary data from teachers and students in the Department of Architecture at Al-Azhar University. The survey questions focused on aspects of the transition, whether platform or information technology and internet tools, the effectiveness of online teaching and learning, and the hybrid learning path.

Educational institutions successfully transitioned to online teaching, but faced some challenges. The results showed the need for professional training and feedback from students. Approximately one-third of the participants expressed satisfaction with online teaching, although the level of satisfaction with the effectiveness of online design studio teaching was lower. The results indicated the need for further integration with digital tools and visualization software on integrated platforms. The study found consensus on the future potential of hybrid learning and calls for the development of an integrated framework and curriculum for architectural education in Egypt.

This study collected different perspectives on online teaching and learning in architectural programs during the pandemic from the perspective of teachers and students. The study aims to evaluate the positive and negative impacts of face-to-face, online, and hybrid education systems on architectural education, in the Department of Architecture at Al-Azhar University. To identify and develop recommendations for the ideal architectural education system in the future.

The study recommends providing professional training programs for teachers on the use of online teaching tools and technologies. Developing an integrated framework and curriculum for architectural education that integrates the best practices of traditional and distance learning. Providing integrated educational platforms that include digital tools and visualization software. Encourage hybrid learning as an effective educational model for the future.

KEYWORDS:
Distance learning, Hybrid learning, COVID-19 pandemic, Architectural education.

دراسة تحليلية مقارنه لمنهجية التعليم المعمارى أثناء جائحة كورونا

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الملخص

أدت جائحة كورونا إلى تغييرات جذرية في مختلف مجالات الحياة، بما في ذلك التعليم. فقد أجبرت المؤسسات التعليمية على تبني أساليب تدريس جديدة، مثل التعليم عن بعد والتعليم الهجين، مما أثار تساؤلات حول مدى فاعلية هذه الأساليب مقارنة بالطرق التقليدية.

وتهدف هذه الدراسة إلى تقديم تحليل مقارن لمنهجية التعليم المعماري خلال جائحة كورونا، مع التركيز على نقاط القوة والضعف لكل من النهج التقليدي والنهج الجديد. وتهدف إلى تقييم الأساليب البديلة المعتمدة في التدريس والتعلم والتواصل والأعمال والتقييم، وفعاليتها في سبيل الارتقاء المستمر أو دمجها في العملية التعليمية. كما تعبر الدراسة عن وجهة نظر حول مدى ملاءمة التعليم عبر الإنترنت لتعليم الهندسة المعمارية في مصر، استنادًا إلى تجارب الطلاب والمعلمين خلال الجائحة.

تم إجراء مسح عبر الإنترنت للحصول على بيانات أولية من المعلمين والطلاب بقسم الهندسة المعمارية بجامعة الأزهر. ركزت أسئلة المسح على جوانب عملية الانتقال سواء كانت منصة أوأدوات تكنولوجيا المعلومات والإنترنت، وفعالية التدريس والتعلم عبر الإنترنت، ومسار التعلم الهجين.

نجحت المؤسسات التعليمية في الانتقال إلى التدريس عبر الإنترنت، ولكن واجهت بعض الصعوبات. وأظهرت النتائج الحاجة إلى تدريب مهني وتغذية راجعة من الطلاب. وعبّر ثلث المشاركين تقريباً عن رضاهم عن التدريس عبر الإنترنت، على الرغم من انخفاض مستوى الرضا عن فعالية تدريس استوديو التصميم عبر الإنترنت. وأشارت النتائج إلى الحاجة إلى مزيد من الاندماج مع الأدوات الرقمية وبرامج التمثيل التصويري على منصات متكاملة. ووجدت الدراسة توافقًا على الإمكانات المستقبلية للتعلم الهجين، وتدعو إلى تطوير إطار ومنهج دراسي متكامل لتعليم الهندسة المعمارية في مصر.

جمعت هذه الدراسة وجهات نظر مختلفة حول التدريس والتعلم عبر الإنترنت في برامج الهندسة المعمارية في خضم الجائحة من منظور المعلمين والطلاب. حيث تهدف الدراسة إلى تقييم التأثيرات الإيجابية والسلبية لأنظمة التعليم وجهاً لوجه وعبر الإنترنت والهجين على التعليم المعماري، وذلك في قسم الهندسة المعمارية بجامعة الأزهر وتحديد ووضع توصيات لنظام تعليم الهندسة المعمارية المثالي في المستقبل.

وتوصي الدراسة بتوفير برامج تدريبية مهنية للمعلمين على استخدام أدوات وتقنيات التعليم عبر الإنترنت. وتطوير إطار ومنهج دراسي متكامل لتعليم الهندسة المعمارية يدمج أفضل ممارسات التعليم التقليدي والتعليم عن بعد. وتوفير منصات تعليمية متكاملة تتضمن أدوات رقمية وبرامج محاكاة. وتشجيع التعلم الهجين كنموذج تعليمي فعال في المستقبل.

الكلمات المفتاحية : التعليم عن بعد ، التعليم الهجين ، جائحة كورونا ، التعليم المعمارى.

1. Introduction

Natural disasters, chemical disasters and wars have far-reaching impacts on lifestyles, forcing us to ask questions about how best to move forward. These events have local impacts at different levels, but they also provoke global reactions at the level of thought and humanitarian action.

The coronavirus pandemic has had a significant impact on large geographical areas around the world, with "viral" infections effectively halting life in many places. Although countries have recorded millions of COVID-19 infections and deaths, and climate change is expected to have catastrophic consequences in the future, these events have not yet disrupted life on such a large and sustainable scale as the COVID-19 pandemic.

The pandemic has forced human endeavours into alternative models, and this current shift heralds the emergence of a "new normal" way of life. Almost all sectors associated with human activity, such as business and commerce, health and social welfare, tourism and travel, and education and research, react skeptically to the current epidemic situation, but at the same time have difficulty dealing with the current epidemic situation. decision-making time. On the other

hand, in a post-epidemic scenario. Most of these activities are closely related to the built operational environment and also affect the degree of safety and vulnerability of operations during the pandemic [1]. The aspects of the role of the engineering and urban sectors in creating a safe and healthy environment will be developed based on the emerging multidisciplinary framework in the case of the epidemic [2].

From this perspective, this study examines the direct impact of the COVID-19 pandemic on architectural education in Egyptian universities and predicts its long-term impact in the post-pandemic scenario.

The COVID-19 pandemic has forced a dramatic shift off-campus to off-campus digital learning patterns that were not possible under normal circumstances. Its near-universal adoption has raised concerns about the effectiveness of online education and prompted research into educational problems that may arise in such situations [3].These include unfavourable attitudes towards online education due to the digital divide, lack of inclusion, inequality, and access to and value of online education. However, ironically, online education is also claimed to be a panacea for these same problems [4,5]

It is important to distinguish between regular distance learning and online off-campus learning in response to COVID-19. This type of education is also called different names, such as "distance education in crisis", "distance education in emergency situations" or "transitional emergency model" [6,7,8].

In the area of global architectural education, efforts have been made to assess educational institutions' post-epidemic response and the impact of such adjustments on educational and academic activities, and to identify the long-term impact in academia. In a landmark interview, academic leaders from American architecture groups praised the academic community's ingenuity in adapting to distance e-learning. The sustainability of e-learning environments for architecture courses is strongly supported, as richer online motor experiences can be recreated. And because it provides opportunities through a combination of simultaneous/asynchronous learning and in-person learning [9]. While there was consensus that digital education was here to stay, participants also clearly stressed the importance of creating actual studios to teach architecture. The Academy leaders unanimously predicted a future course for the transition to mixed coordination in delivering content, evaluation and other academic aspects in the post-pandemic scenario. It is widely recognized that integrating online education into blended learning as an educational tool opens up great opportunities to enrich higher architectural education [10]. Due to the widespread adoption of online teaching patterns in response to the COVID-19 pandemic, this study examined the views of faculty and students regarding their impact on architectural education at Egyptian universities. This study provides teachers' and students' perspectives on the effectiveness and quality of teaching based on post-pandemic online learning experiences to determine the potential role of mixed learning in post-pandemic architectural education. Preliminary data for this study was collected through an online survey between faculty members involved in architecture education at Al-Azhar University and students of different courses within the department..

2. The research problem

The COVID-19 pandemic and the development of digital education made it necessary to use distance learning in architectural education. However, it was found that distance learning does not meet all the requirements of architectural education, especially in specialized courses such as

architectural design, architectural construction, and executive drawings. Therefore, it was necessary to find a way to protect the safety of students and teachers, while at the same time ensuring the continuity of the educational process in a sound manner and raising the quality of architectural education. However, due to the lack of preparation of many students to deal with distance learning methods, several problems arose, especially in specialized courses. Therefore, it was necessary to find a way to integrate traditional education and distance learning, and hence the concept of hybrid education emerged.

The research problem can be formulated in two points:

- Difficulty in achieving the integration of the educational process in light of the inputs of distance learning and precautionary measures.
- The lack of an integrated educational mechanism for distance learning that is compatible with the targeted architectural education outcomes.

3. The research hypothesis

Architectural education aims to graduate creative architects who are able to achieve a distinguished level that keeps pace with the global development in the field of architecture. In light of the above, we will study the hypothesis that hybrid education is the appropriate mechanism that suits and helps to achieve the targeted architectural education outcomes that are required to be achieved in the graduate of an architecture student, which is in line with the requirements of the labor market.

This will be achieved through an analysis of the perspectives of students and teachers on teaching methods in architectural programs, and a comparison of these models from all aspects.

4. Objectives of the research

This research aims to increase the effectiveness of the development and application of distance learning models and hybrid education in the field of architectural education, as well as to present a proposal for the development of architectural education practices. To make the educational process more efficient in order to prepare for pandemics and potential disasters, this research aims to:

1. Highlighting the impact of the COVID-19 pandemic on architecture education.
2. Discuss the advantages and disadvantages of online and hybrid education in this area.
3. Make recommendations to improve architecture education in crisis situations.

5. Methodology and limitations of the study

5.1. Study tool

The An online survey was sent to students and teachers involved in teaching architecture at Al-Azhar University. The electronic medium was adopted due to its suitability in collecting the required information and its wide scope. Accordingly, the survey was designed concisely to extract online responses with the following objectives:

- Gather specific information on the impact of COVID-19 disruptions on regular face-to-face teaching and learning processes and patterns.
- Determine the extent of institutional adaptation, and the main platforms/tools of information technology/internet that have been adopted in them.

- Evaluate the effectiveness of online teaching and learning processes from the perspective of teachers and students.
- To know the positive and negative aspects of each educational system, and the most effective educational system for them.
- Obtain faculty perspectives on the future path of online/hybrid education for the undergraduate architecture program.

5.2. Methodology

- The phenomenological approach was used as one of the qualitative research methods.
- The data obtained was evaluated using the descriptive analysis method.

5.3. Limitations of the study

This study is limited to students and teachers of the Department of Architecture, Faculty of Engineering, Al-Azhar University. Since first, second, and third-year students have not experienced the distance learning experience, the data that will be obtained will not be reliable. Accordingly, the study was conducted with fourth-year students and recent graduates of the Department of Architecture at Al-Azhar University.

6. What is Architectural Education?

The American Institute of Architects (AIA) defines architectural education as "the process of learning and developing the skills and knowledge necessary to practice the profession of architecture. It includes the study of the fundamentals of architecture, such as design, construction, materials, and modern technologies. It also includes the study of the social, cultural, and economic aspects that influence the design process."

Therefore, an architectural education program can be defined as "an integrated program of architectural education within an academic teaching unit at the level of higher education and grants a Bachelor of Architecture degree."

Architectural education is the process of providing students with the skills and knowledge necessary to practice the profession of architecture. It requires direct interaction between the student and the instructor as shown in **Fig.1**.

Fig. 1 Is a picture that illustrates the direct interaction between the student and the teacher in architectural

6.1. Traditional Education (Face-to-Face) Model in Architectural Education:

Architectural education is a unique educational system that combines theoretical and practical lessons, aiming to teach the skills of space design. This system relies on the interaction between the student and the teacher, where this interaction helps in completing architectural projects.

Origin of Architectural Education:

Initially, architecture was seen as a craft and was not taught in schools, but rather transferred through the master-apprentice relationship.

Later, the first school of architecture was opened by the French Royal Academy, where theoretical information was taught in the school, while practical education was provided by assigning students to design in the offices of teachers [11].

The Emergence of the Design Studio:

- The design studio first appeared in 1819 at the Ecole des Beaux-Arts.
- This studio formed the basis for the pedagogy of modern architectural education.
- During this period, student work also began to be evaluated by a jury [12].
- The way of working in the design studio showed that students experience design through discussion and brainstorming about the design problem with each other and with the teachers [13].

Bauhaus School:

- The Bauhaus School emerged in 1919 as an alternative to the Ecole des Beaux-Arts tradition.
- The school offered an educational model that focused on creativity rather than imitating previous architectural works [14].
- It aimed to highlight imagination and individual expression, and focused on teaching an approach and methodology for solving problems rather than simply transferring knowledge and skills.
- The design studios that originated with the Bauhaus School have continued to this day and form the basis for the pedagogy of architectural education [15].

Impact of the COVID-19 Pandemic:

The COVID-19 pandemic has disrupted face-to-face education in architectural education. Although online and hybrid education models have been implemented, it has been observed that these models are inadequate in developing practical skills.

6.2. Distance Education Model in Architectural Education:

Distance learning can be defined as an interactive educational system that is delivered to learners using information and communication technologies. [16,17]

Although the origins of distance education are not well-defined, they can be summarized as follows:

- The late 19th century: The first architectural courses were offered through the mail in the United States. In 1887, the University of Missouri began offering architectural courses through the mail, and in 1893, Cornell University began offering similar courses.

- The early 20th century: Wireless media, such as radio and television, began to be used in architectural education. In 1925, Ohio University began offering architectural courses through radio, and in 1955, Stanford University began offering similar courses through television.

- The late 20th century: The advent of the internet led to a significant increase in the use of distance education in architectural education. In 1996, the University of California, Berkeley, offered the first fully online architectural program, and in 2000, the University of Colorado began offering a similar program **Fig.2** shows the Digital Transformation of Education.
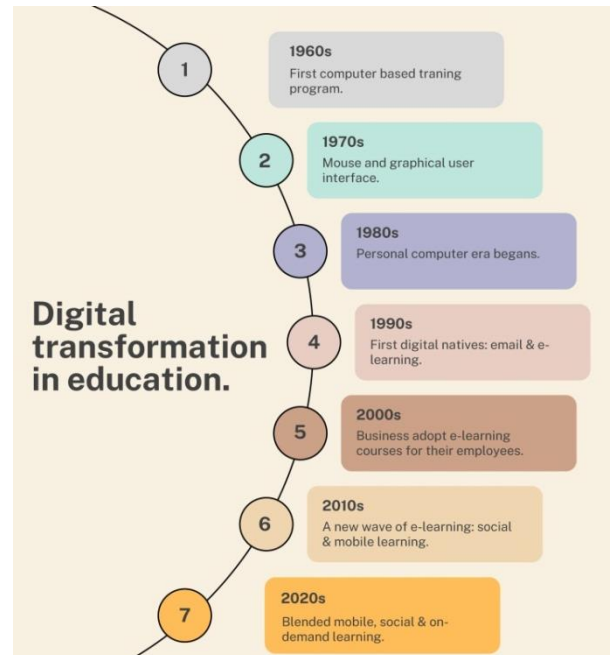

Fig. 2 The Digital Transformation of Education [18]

- Although online education existed before the COVID-19 pandemic, it became more prevalent during this period.

- Universities that relied on the face-to-face education model were forced to switch to online education to ensure the continuity of the educational process.

- Online education systems were activated in all Egyptian universities, and many theoretical classes continued online.

6.3. Hybrid Learning Model in Architectural Education:

6.3.1. Definition of Hybrid Learning:

- Hybrid learning is an educational system that combines traditional face-to-face instruction with online education.
- It is also known by other names such as blended learning, mixed learning, and hybrid learning.
- In hybrid learning, online and face-to-face instruction are not delivered independently, but rather the two are integrated together.
- the transfer of learning to the classroom environment in hybrid learning defined as the "flipped classroom." [19].

6.3.2. Application of Hybrid Learning in Architectural Education:

- In the hybrid learning model in architectural education, theoretical lessons are delivered online, while practical lessons are delivered face-to-face.
- Theoretical lessons can be delivered online synchronously or asynchronously to improve the efficiency of hybrid learning.
- All synchronous and asynchronous communication tools are used in hybrid learning.

- Because the process in hybrid learning continues face-to-face and online, and because the boundaries disappear, it has an integrative and effective power for the teacher and the student.
- Hybrid learning has more advantages than face-to-face and online-only education systems.
- Hybrid learning gives teachers and students freedom of place and time.

7. Results of the study

7.1. Teacher Survey Analysis

7.1.1. Shift to online teaching in bachelor's programs for architecture:

7.1.1.1. Transition from face-to-face teaching:

Survey answers showed that about 34% of them were already using online teaching in some form. However, in response to the COVID-19 pandemic, all institutions have shifted without exception from traditional face-to-face teaching to online teaching. Nearly 60% of institutions switched to online teaching within a week, while after institutions they took more than a month. About 53% of participants saw the transition to an online teaching environment as easy. However, the data does not reflect any direct links between the degree of ease/discomfort with the faculty, or the life of the institution.

7.1.1.2 Tools and platforms:

For online teaching, most institutions have relied mainly on video conferencing and screen sharing for simultaneous lectures (simultaneously taking place on all parties), while some have resorted to recording lectures as an asynchronous alternative (they can be viewed at any time). Zoom and Microsoft Teams are at the top of the list as the most commonly used for lectures, introducing students to tasks and feedback, short tests and exams, with WhatsApp emerging as the best way to share academic information within batch/course groups.

Participants reported increased reliance on video content/presentations available online on sites such as "YouTube" and "Slideshare" to support the teaching process. The pandemic has also seen a significant jump in the number of specialized webinars that can complement content delivery, apparently due to their ease of use and low cost.

7.1.2. Ease and effectiveness of online teaching compared to face-to-face teaching in architectural education programs:

7.1.2.1. Easy Transition to Online Teaching:

About 53% of participants indicated that the shift to online teaching was very easy/easy, while only 14% of participants found it difficult. The data does not reflect a direct correlation between the ease of teaching and the teacher's experience or competence.

Furthermore, the survey also drew varied answers about the ease of transition in different aspects of teaching such as: (1) teaching, (2) drafting duties, (3) continuous evaluation, and finally (4) achieving learning goals. It is important to note that 35% of participants think transmission is very easy/easy, while 29% think it is very difficult/very difficult. More importantly, while only 21% of participants saw that moving to online teaching made achieving learning goals very easy/easy, 34% responded that moving is very difficult/difficult.

The data assessment reveals a discrepancy between the overall perception of the transition to online teaching as easy/very easy (53%) and a more accurate perception demonstrated by the answers to different aspects of teaching **Table 1 .**

An accurate assessment of the data in **Table 1** reveals that when considering the different aspects of teaching, only 40% of participants felt that moving to an online teaching environment was very easy/easy for the drafting of duties, while only 33% felt that the ongoing evaluation was very easy/easy

7.1.2.2. Effectiveness of online education in achieving learning goals:

A large number of survey respondents (34%) show a perception of the difficulty of achieving learning outcomes, while a small percentage (21%) think it's easy/very easy in online teaching mode. Given the importance of achieving learning goals in student-focused learning, additional questions were included in the survey form to see how easily learning goals can be achieved in online teaching mode based on: (1) self-assessment of students' work, and (2) student opinions. The results obtained can provide faculty members with different perspectives on the perceived difficulty of achieving learning goals through an online learning environment.

Although the technical aspects of moving to online teaching seem easy, important inputs to enhance the effectiveness of all aspects of online education will be urgently needed to improve education during the COVID-19 pandemic crisis. To gain a deeper understanding of the educational effectiveness of online education in Egypt's bachelor's program for architecture during the COVID-19 pandemic, the research gathers information about the effectiveness of online teaching of subjects included in the curriculum. Accordingly, information is collected through the inclusion of relevant questions in the organized survey.

Table 1. Ease of transition to online teaching

Sr. No	Activities	Very difficult	Difficult	Average	Easy	Very easy
1	Teaching	7%	22%	36%	32%	3%
2	Framing assignments	3%	15%	42%	30%	10%
3	Continuous assessment/evaluation	7%	29%	31%	25%	8%
4	Achievement of learning objectives	12%	21%	45%	18%	3%

7.1.3. Effectiveness of online teaching in bachelor's courses for architecture:

Since vocational courses are the most important component of the curriculum, and the methodology of other subjects also depends on them, the effectiveness observations of vocational courses will be a very important indicator for assessing the effectiveness of the curriculum. For Architecture Design Studio (within professional courses), 61% of participants found the online teaching medium to be somewhat ineffective/ineffective at all, while only 8% found it to be highly effective/very effective compared to traditional face-to-face education indicating a high level of dissatisfaction with online teaching for Design Studio.

For design/architecture-based courses, 41% of participants found online teaching to be somewhat ineffective/totally ineffective **Table 2**. Although online teaching of construction science and applied engineering courses was relatively more effective than professional courses, only 13% of participants felt that online teaching of construction materials and building technology courses was very effective/very effective

Unlike professional courses, construction science and applied engineering, only 12% of participants considered the shift to online teaching of theoretical subjects to be somewhat ineffective/ineffective at all. However, 48% of participants believed that online distance education was a very effective/very effective means of teaching besides face-to-face teaching. This refers to a high degree of acceptance of online teaching for theoretical courses.

For online teaching satisfaction levels, only 3% of participants feel fully satisfied or completely dissatisfied with online teaching. Additionally, 35% of participants are very satisfied with online teaching compared to face-to-face teaching

Participants' responses to levels of satisfaction with online teaching indicate that teachers are very satisfied with teaching on the electronic medium, especially in teaching theoretical subjects.

Table 2. Experiences of level of effectiveness in online teaching

Sr. No	Level of effectiveness	Architecture Design (Stage 1)	Architecture Design (Stage 2)	Construction and Technology	Building Engineering and Services	Theorybased	Designbased
1	Not at all effective	15%	14%	11%	7%	2%	8%
2	Not so effective	46%	42%	31%	25%	10%	33%
3	Somewhat effective	31%	36%	43%	40%	40%	39%
4	Very Effective	4%	7%	13%	21%	37%	17%
5	Extremely Effective	4%	2%	2%	7%	11%	3%

After gathering structured information from various responses on the consequences of COVID-19 disruptions to the usual face-to-face teaching and learning processes in architecture programs, this paper provides information on the extent to which institutions adapt and the relative effectiveness of online learning and teaching processes. Based on previous information, the survey included questions for teachers' opinions on the future of online/integrated education for the future of architecture in Egypt.

7.1.4. Hybrid education in architectural education:

The pandemic has led to a marked shift towards online teaching, and survey participants have had about two or more years of experience in online teaching. Through their experiences, the survey seeks to gather early responses and perceptions from the teaching staff about the effectiveness of hybrid education in Egypt's architecture programs. Accordingly, the survey form included questions about:

The perceived importance of face-to-face teaching for different aspects of teaching and learning. The expected effectiveness of the transition to hybrid teaching of the various categories of courses detailed in the previous section. Views on how specific factors are perceived as drivers or impediments to the transition to hybrid education.

In their responses, less than 20% of participants consider that hybrid learning will be very effective/very effective for teaching professional courses, and even less (7%) for architecture design studio. For construction science and applied engineering courses, 31% of responses indicate that hybrid teaching will be very effective/very effective for these courses **Table 3**.

A comparison was made between the perceived effectiveness of online education **Table 2** and the expected effectiveness of hybrid education **Table 3** for various categories of courses recommended by the Architecture Council for Bachelor's Education of Architecture. This has been

done to review whether the perceived effectiveness of online teaching is also consistently reflected in responses to the future effectiveness of hybrid education.

Table 3. Opinion about effectiveness of hybrid teaching learning

Sr. No	Level of effectiveness	Architecture Design (Stage 1)	Architecture Design (Stage 2)	Construction and Technology	Building Engineering and Services	Theorybased	Designbased
1	Not at all effective	17%	8%	7%	4%	2%	7%
2	Not so effective	36%	35%	24%	18%	11%	29%
3	Somewhat effective	40%	45%	51%	47%	46%	46%
4	Very Effective	5%	10%	14%	26%	31%	15%
5	Extremely Effective	2%	2%	4%	5%	11%	3%

Responses indicate that after online teaching experience, participants seem more receptive to moving to hybrid teaching, although the results do not reflect being a very effective/very effective teaching and learning tool for bachelor's programs for architecture in Egypt. This is reflected in the low number of participants in **Table 3** who consider hybrid education to be somewhat ineffective/totally ineffective for all courses, and a marked increase in the number who consider hybrid education to be somewhat effective.

7.2. Student Survey Analysis

7.2.1 Participants:
- This study included third- and fourth-year students as they have experienced different educational systems and can compare them.
- 41 students participated in the study, 6 third-year students and 35 fourth-year students.
- Students were asked 4 multiple-choice and 6 open-ended questions to assess their views on the three educational systems.

7.2.2. Demographic Characteristics of Participants:
- 82% of the participants were females and 18% were males.
- 29% of the participants were fourth-year students and 71% were third-year students.
- 70% of the participants participated in project classes using a computer, 18% using a tablet, and 12% using a phone.

7.2.3. Student Preferences for the Educational System in Project Classes:

• **Most Useful Educational System: Fig. 3**
- 42% of students believe that blended learning is the most useful.
- 35% of students believe that online learning is the most useful.

- 23% of students believe that face-to-face learning is the most useful.

- **Student Preferences by Academic Year:**
  - 75% of third-year students and 80% of fourth-year students prefer blended learning.

- **Student Preferences for the Future:**
  - 59% of students prefer blended learning for the future.
  - 41% of students prefer online learning for the future.
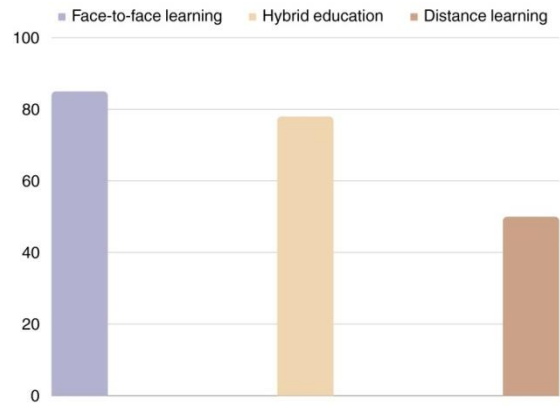 - No student prefers face-to-face learning.

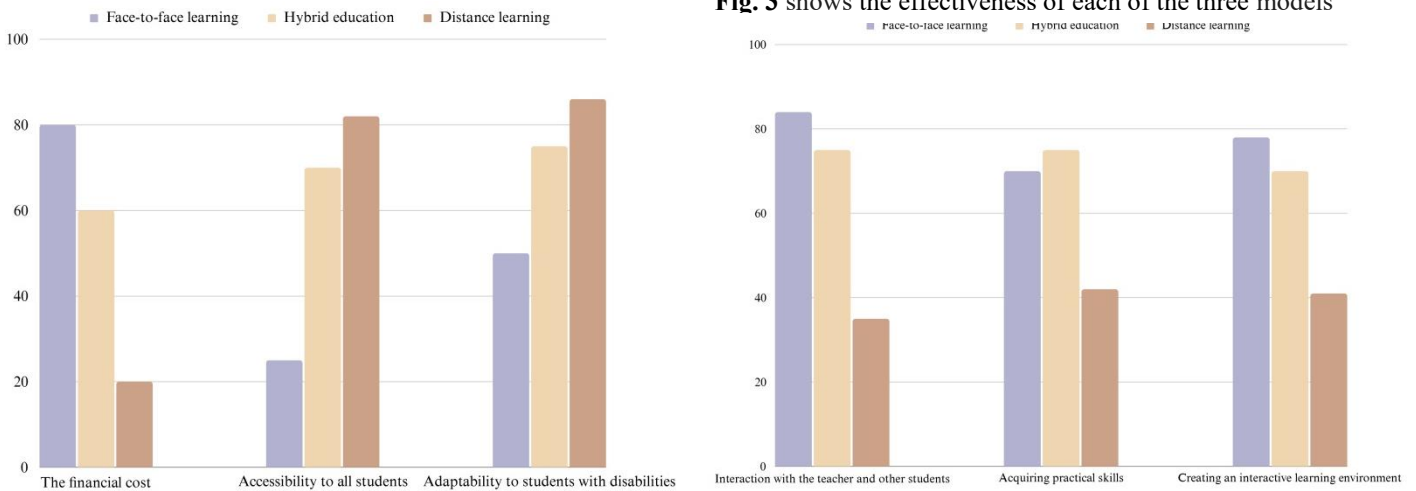**Fig. 3** shows the effectiveness of each of the three models

Fig. 4 shows the results of the student vote on strengths and weaknesses

Table 4. shows Advantages and Disadvantages of the three education models

Educational Model	Advantages	Disadvantages
Face-to-Face Learning	- Direct communication between students and teachers. - Interaction and collaboration between students. - Interactive learning environment.	- High cost. - Time spent commuting. - Logistic challenges (e.g., class size, availability of facilities).
Online Learning	- Low cost. - Flexibility in time and place. - Easy access to learning materials.	- Difficulty in direct communication. - Lack of interaction between students. - Lack of motivation in some students. - Difficulty in solving technical problems.
Hybrid Learning	- Combines the advantages of face-to-face and online learning. - Direct and virtual communication between students and teachers. - Flexible learning environment.	- Complexity in managing the educational process. - Need for technical skills among students and teachers.

7.3. Comparing Results with Previous Studies:

7.3.1 Similarities in Results:

- The results of this study are consistent with the results of many other studies conducted on architectural education after COVID-19.
- All studies indicate that the hybrid learning system is the preferred option for architecture students.

- The hybrid learning system shows academic and social benefits for students.

7.3.2. Examples of Studies:

Saudi Arabia: Alburgawi, S.A. Al-Gamdi, M.A. (2022) [20].
- The need to identify teaching strategies and methods to deal with emergencies.
- Integrating online learning with face-to-face learning while taking all precautions.
Turkey: Pekdaş, E., Kutsal, B. (2021). [15].
- Online learning is not enough.
- The need to conduct project classes face-to-face.
- The hybrid learning system is beneficial for both general education and projects.

8. Results and Recommendations:

Results:

1- The research results showed that the hybrid learning system is the preferred system for both students and instructors in the field of architectural design.
2- Despite positive opinions about the online learning system, they prefer the hybrid learning system, which indicates the importance of social interaction for them.
3- The results of this study support the hybrid learning system that combines face-to-face and online learning.
4- Neither online nor face-to-face education alone meets the needs and desires of students in the field of architectural design.
5- The hybrid learning system is considered a useful and positive educational system because it includes the dynamics that feed the social communication and interaction aspects of students in face-to-face education, which increases their motivation in the field of architectural design.

Recommendations:

1- Developing the digital infrastructure to ensure equal access to online education.
2- Providing support for students who face difficulties in using technology.
3- Designing integrated educational content that combines online and face-to-face education.
4- Training faculty members on using hybrid teaching methods.

9. Discussion

9.1. Effectiveness of Digital Education The Feedback Loop: Best Practices for Peer Learning

This transition from traditional to online, through a continuous process of trial and error, was a major learning curve for educators, who had to explore and adopt online teaching methods overnight. The survey reveals a widespread investment in content development methods and technologies as well as different platforms for online teaching for the purpose of delivering the courses. It also highlights the growing need for both faculty and students to master digital learning. Based on these observations, the study suggests an urgent need for systematic training of educators on technological and pedagogical tools for adoption in content development and teaching of architectural programs.

The range of self-reported responses regarding the perceived effectiveness of digital education for undergraduate architectural programs obtained from the survey requires triangulation of results with student feedback for more meaningful conclusions. The paper suggests an urgent need to develop a comprehensive feedback loop on various issues related to education during this

pandemic period. This can be done by obtaining input from all stakeholders such as IT officials, administration, etc. in a systematic manner.

The comprehensive information gathered through this feedback on academic experiences during the pandemic period is crucial for discussions on the continued adoption of online teaching for the architectural program. This will surely enhance peer learning and support networks and contribute positively to discussions on the trajectory of digital/hybrid teaching and learning in a broader context. In doing so, groups of educational institutions can be enabled to collaborate regionally and gather best practices of online teaching for adoption in hybrid learning.

9.2. Effectiveness of the Digital Medium as a Tool for Representation, Communication, and Design Process in Education

The survey revealed significant dissatisfaction with teaching, especially concerning the representational aspects of student outputs and the inefficiency of communication during design critiques or design-based courses when conducted online. This suggests a re-evaluation of previous instances where digital tools have been integrated with education, to explore a more holistic learning and teaching experience [21].There will be a need for major development of prevailing digital tools and software to enhance the online studio interface in academia, as faculty reviews currently rely on incomplete and inadequate digital representations.

In the context of architectural education in Egypt, the use of digital tools is still limited to form-making (Rhino), visualization (VRay), and building documentation (Revit), and generative design methodologies or AI models are rarely used [22].The study realizes that incorporating available digitalization tools in academia – which can immensely contribute to the fundamentals of learning and teaching architecture – is an area yet to be explored. There is a need for major development in integrated software that allows seamless integration of different processes of design considerations such as structure, form, light, energy, services, and building systems, etc., into one model on one platform. Linking these models with virtual and augmented reality in the long run will enhance visualization, representation, and communication, which may transform the architectural design representation process .

9.3. Rethinking Curriculum and Pedagogy

In response to the COVID-19 pandemic, the shift of architectural education to an online mode is a radical departure from the prevailing teaching paradigm of face-to-face instruction. The survey, based on the data collected from faculty, collates and analyzes institutional responses to the pandemic and attempts to rethink the prevailing curriculum and pedagogy in architectural programs. There is a large consensus among the participants on the continuation of online teaching, and some suggested a thorough exploration of its integration with the prevailing architectural education system in Egypt.

Given the increased digitization of data, visualization, and communication patterns in online teaching, this paper proposes a serious rethinking to formulate a new framework that encompasses blended/hybrid learning in architectural education. This framework should consider alternatives for visualizing, delivering, and assessing architectural programs. It will require rethinking the curriculum, pedagogy, and administrative aspects of architectural education in light of online teaching experiences. Subsequently, this framework should provide institutions with the autonomy to implement programs on mixed models that offer choices of physical/virtual spaces, synchronous/asynchronous content delivery, self-paced or scheduled courses, communication platforms, feedback mechanisms, and assessment methods, among other aspects.

10. Conclusions

As a result of the COVID-19 pandemic, the architectural education scenario in the world has presented a "new normal" situation where teaching has shifted largely to an online medium. Its utmost importance lies in overcoming the inertia barrier, which could have taken years to transition to online teaching. The widespread adoption of the online teaching method for architecture provides an opportunity for discussion about its future path.

The development of technology has allowed for the transfer of many areas of academic activity to the internet, without disruption, and often with benefits for the quality of education. However, given the specific nature of architectural education, the online mode of education has its limitations. Therefore, the study showed that the hybrid model is the best option as a model for architectural education. It effectively meets the requirements of the design studio methodology and at the same time addresses the limitations of both face-to-face and online education. This suggests that hybrid education holds promise for the future of architectural design education.

This is after highlighting the advantages of both face-to-face and online teaching, where the hybrid model combines the efficiency and accessibility of the online mode with the quality of reviews and teamwork of the face-to-face mode. However, it is worth noting that each curriculum requires an individual approach to the choice of teaching methods. It is important to consider the needs and expectations of both teachers and students when choosing a teaching mode. A carefully developed hybrid model can improve architectural education and have a positive impact on the development of universities.

Every crisis presents an opportunity, and this pandemic may be just the opportunity to move from an old, stagnant educational system to one that celebrates intuition, insight, imagination, skills, and creativity. The challenge is to look inwards and develop a progressive framework for architectural education in Egypt that has a wider reach, responds to technological advances, and thrives in its interaction with a comprehensive multidisciplinary educational system. This is an opportunity that must be seized, not by trying to retreat, but by reimagining the future.

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