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Assessment of E-Learning Methods in the Digital Design Studio for Architectural Design Course during Corona Crisis Case study the Architecture Department at PHI-Egypt

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Assessment of E-Learning Methods in the Digital Design Studio for Architectural Design Course during Corona Crisis
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Walaa Hussein Hussein Hanafi*

Abstract— **Corona pandemic forced education systems in the world to turn to distance learning via the Internet this study covered the period from March 2020 to the first semester of the academic year 2020/2021, which was performed by a hybrid system (face-to-face + online). Then studying its returns in the following year at the level of students and the method of teaching. Then integrating new mechanisms by questionnaire through an intended sample of three groups of students in the first, final, and pre-final courses for Architectural Design courses 2, 3, 6 and 7, as well as the graduation project course and statistical analysis of the results. The results showed the relative satisfaction of students with the hybrid education system in Design courses 6 and 7, and a great rejection of distance education, especially for students of architectural design 2 and 3. As for the graduation project, the dissatisfaction was greater, despite everyone's response to the new mechanism and enthusiasm for it, and a questionnaire was conducted for the same two groups after graduation to evaluate their experience and its impact on their scientific and professional level in the Labor market. Finally, the study summarized the advantages and difficulties that students faced and recommendations for applying distance education in architectural design courses.**

I. INTRODUCTION

THE Ministry of Higher Education in Egypt decided to prevent the presence of students on the university campus in March 2020, in order to ensure the safety of students to limit the spread of the Corona virus. As a result, the study was transformed into a digital distance learning method, and this is not new in many countries of the world, albeit in limited forms. However, the emergence of the pandemic prompted its application in educational institutions in Egypt, forcing them to try to provide the appropriate virtual environments, whether audio, visual, illustrations and animation. To transformation of education into a virtual interactive system, and thus distance education became an approach everywhere to meet the challenges of the epidemiological situation, and technology became necessary for the teaching process. Distance education added more flexibility in the educational process and the search for innovative tools and mechanisms that facilitate the education

process, especially as it is not linked to the restrictions of space or time. [1]

In the past, it was hard to imagine the idea of distance learning in architecture, but the compelling matter imposed by the conditions of the pandemic showed the possibility of teaching architecture in different modern ways. Like other educational institutions, the Pyramids Higher Institute of Engineering and Technology committed to applying the distance education system in all its departments. The architecture department and the design studio turned into a virtual studio for the first time in the institute's education system. The experiment was passed in the second semester of the university year 2019/2020 online, and continued in a hybrid form (online+ face to face) for the first semester of the academic year 2020/2021. That experience has many reasons, observations, and problems that have coexisted with some of them and attempts to solve others. Therefore, the unplanned experiment needs evaluation, especially for distance education has become a necessity in all stages of education and thus the development of mechanisms for teaching architecture by unprecedented means that which faculty members worked hardly to deliver information for students. Especially that the education of architecture includes the theoretical and practical part and depends heavily on direct communication between student and professor.

Consequently, there was a need for more studies and research related to teaching architecture online in Egypt. This research reviews an evaluation of the distance education experience in the Department of Architecture at the Pyramids Higher Institute of Engineering and Technology. As a sample in which this mechanism has been applied and the challenges and opportunities it faced during the pandemic and studying its returns to students, whether The category that is still in academic years in the department or undergraduate students during the pandemic and who have been graduated to conclude recommendations that will contribute to the development of architecture teaching.

Research Aim and objective

Evaluating the experience of learning architectural design online in a virtual studio, and identifying the challenges and opportunities that can be invested to develop visions about the development of architectural education in Egypt. And is it possible to switch from a traditional design studio to a virtual studio with the current capabilities in order to achieve efficiency in learning architecture?

In a History of Distance Education, although its beginnings are disputed, let us brief on some major occurrences and dates in the evolution of distance learning.

In the 1700s. Distance education was practiced through a method called correspondence education. The process was very simple; students received instruction via mail and responded with assignments or questions to the instructor. it was very slow.

In 1922, technological advances played a pivotal role in distance education. The introduction of the radio allowed universities to broadcast information and courses to students, and then universities employed television as a learning tool.

After the television, in 1989, the personal computer with internet capabilities was the next major invention to revolutionize distance education.

Distance learning had greatly developed by the 1990s by satellite virtual classrooms, mobile telephones, videoconferencing, and the Internet.

Architectural design has recently witnessed a great development as a result of the entry of digital transformation systems into the design process. Since the transformation of architectural drawings into files on CAD (computer-aided design), and the development of many computer applications in this regard, whether for drawing or presentation two or three-dimensional. Not only this, but simulation applications and BIM (Building Information Modeling) appeared in other applications, and therefore it had to be reflected in the teaching strategies of architectural design and the design studio be able to accommodate these mechanisms and modern requirements. E learning can be defined as a 'web-based learning system' The figure 1 summarizes the stages of digital transformation in education. [2,4]

1960s	First computer based training program
1970s	Mouse and graphical user interface
1980s	Personal computer era begins
1990s	First digital natives: email & e learning
2000s	Businesses adopt e learning courses for their employees
2010s	A new wave of e learning: social & mobile learning
2020s	**Blended mobile, social &on-demand learning**
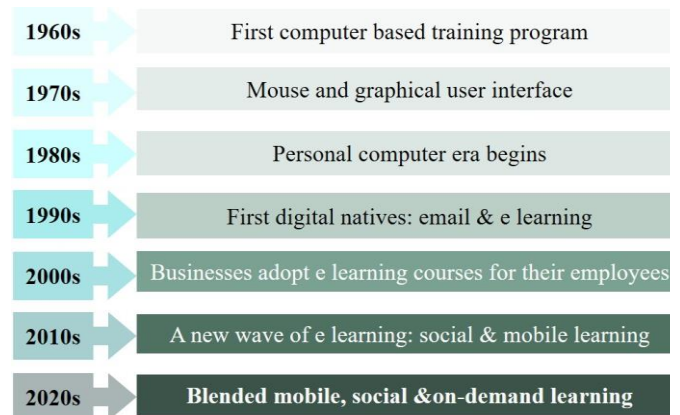
Fig. 1. Digital transformation in education. [5]

A. Traditional Design Studio Vs. Virtual Studio

The educational process of architecture is based on the design studio, which depends on a reciprocal process between the student and the professor that depends entirely on sensory and mental communication, whether individually or collectively. Flexibility is considered the basis in the educational process of architectural design, which is carried out through case studies, field visits, and group discussions, in which the student studies from previous case studies through presentations, discussions, and criticism. In addition, through design realistic project, in which the student prepares architectural projects under the supervision, and in a traditional design studio, this is done through direct face-to-face communication between the student and the professor. Fig.2 [6, 10].

Fig. 2. Design process in architecture studio.
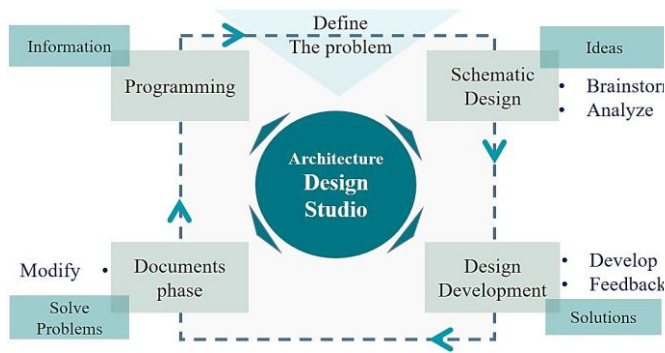
As for the virtual design studio, the educational strategy is carried out through the Internet with its different tools or media, and it achieves more flexibility, as it is not linked to a specific time or place through the creation of a virtual reality.

Digital education enables the architecture student to exploit all means of the Internet by collecting multiple cases of projects. It is more easily and he can collect different examples around the world through the dedicated web. In project design process, it may be implemented online through virtual spaces, workshops, meetings and design studios, giving lectures and the possibility of dialogue between the student and the professor, or making presentations and individual and group discussions, recording and uploading them through various media on the Internet, such as discussion panels on the Zoom application or Google Class, or sending designs by e-mail, WhatsApp or Messenger, or recording lectures, whether audio or A video according to the scientific material and uploaded to the students on an educational platform (LMS) known to both parties. Any of the previous curricula will be synchronously at the same time between the student and the professor or asynchronously, where the teacher raises the scientific content of the student and the student can follow it at any time available to him. Fig. 3 [11, 22]

Therefore, adopting in-studio teaching and learning strategies or devising other strategies to fit into the online studio design may present a challenge that has not yet been optimized.
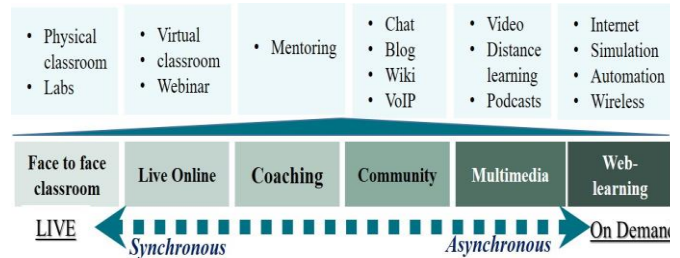

Fig. 3. Learning methods.

B. The Distance Education in the Architecture Department in PHI

Activating the electronic educational platform at the PHI had begun before the pandemic, but it was in a period of trial operation. This presence contributed to intensifying efforts to equip it as an official educational platform in line with the compelling circumstances of the ban and activating distance education in a way that suits the requirements of the stage in general for the institute and the requirements of the department of architecture, especially it has different ways to learning in it. Faculty members and students now have e-learning accounts in LMS to access the academic content. Table 1 listed types of courses and the number of students in two semesters intended for study.

TABLE 1
COURSES TYPE AND PROPORTIONS IN ARCHITECTURE DEPARTMENT IN PHI [20]

Students No. In Arch. department		Courses type	Contact hours no. (approx.)								Total %
			1st grade		2nd grade		3rd grade		4th grade		
			No.	%	No.	%	No.	%	No.	%	
		Theoretical courses									
In 2019/2020	210	History and theories of architecture - environmental control of buildings - technical installations - air conditioning and sanitary engineering,....)	24	44	20	40	14	25	10	33	32
		practical courses									
In 2020/2021	179	Building construction - computer applications - urban planning - environmental design - architectural design - visual skills.....	30	56	33	60	41	75	34	47	65
Graduation Project									12	20	4

Note: Total contact hours per semester ~ 55
8 hours of field training were omitted from the student's total contact hours (8-300 = 222

In the spring semester 19/2020 and after the decision was issued to activate distance education in the country, the study was at the beginning of the semester in the traditional way, face to face, and it turned completely suddenly, whether for the student or professor for distance education. According to sovereign decisions that would prevent students from being in universities and institutes as a precautionary measure in order to ensure for their safety. Consequently, many meetings were held between the Institute's administration, faculty members, and platform officials to discuss the mechanisms of managing

the stage and completing the educational process naturally and without defects or shortcomings as much as possible, and the courses were completed at a rate ranging from 80:75%. Theoretical courses were the least problematic compared to the architectural design courses and the graduation project, and the study was resumed through several media as shown in table 2.

In the next semester 2020/2021, the ministry of higher education decided that the study would be a hybrid system that combines face-to-face and distance education. The previous experience was benefited, especially after the summer vacation period was used to develop and search for better mechanisms and formulate courses in a way that is more compatible with distance education. Fig. 4.

TABLE 2
TEACHING MECHANISMS IN ARCHITECTURAL COURSES DURING CORONA CRISIS IN PHI.

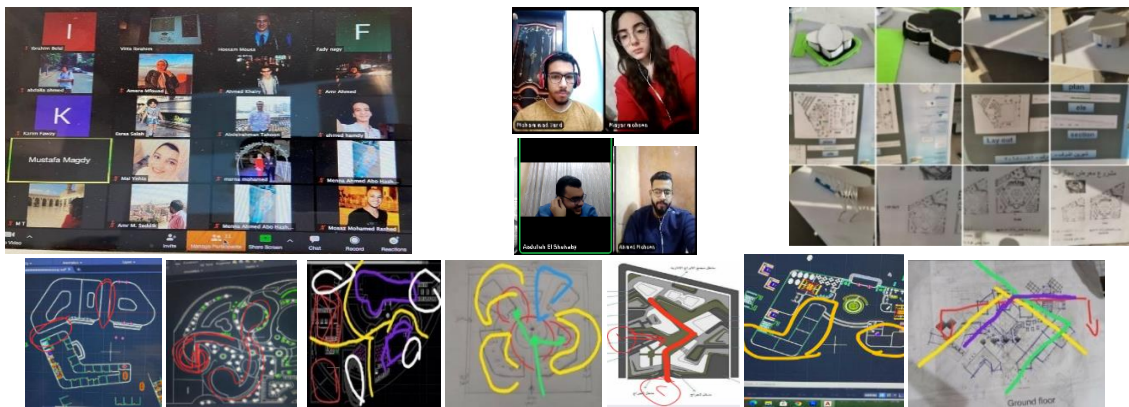|	Theoretical courses		Practical courses		Graduation Project	
	No	%	No	%	No	%
Power point	16	76	0	0	2	6
Google class/Microsoft teems	3	14	11	65	9	24
Messenger/ what's app	0	0	13	76	11	30
Yahoo/Gmail	2	10	12	70	9	24
Learning management system LMS	17	81	5	29	1	3
Zoom App.	1	5	12	70	4	11

Fig. 4. Realistic examples of applications used in the teaching of architectural design in PHI.

Neither the teachers nor the students had any previous experience or training in the video conferencing applications used. However, qualified personnel have been appointed by the Institute to respond to any technical issues and answer questions raised by faculty and students regarding the e-learning platform. The electronic platforms used in distance education are divided into two main categories: video applications, and was primarily used to hold Zoom for simultaneous meetings and Microsoft Teams and communication platforms such as e learning and Facebook Messenger. However, groups were less satisfied with the online design.

II.   METHODS AND EXPERIMENT [24-34]

Department of Architecture at the Pyramids Higher Institute of Engineering and Technology PHI – Egypt. The questionnaire tool was used for measurement through three stages by selecting Architectural Design Courses 2 and 6 (online), Architectural Design 3 and 7 (hybrid) and the graduation project (online / hybrid).

The reason for choosing these courses is the architectural design process is the most difficult that it is carried out through mechanisms for direct communication between the student and the professor. The research used a mix of qualitative and quantitative methods for assessment of e-learning methods in the digital design studio for architectural design course during corona crisis.

The study sample: chosen from a group of students as following:
- Students who studied Architectural Design Course 6 in the second semester 19/20 (completely online). The same group with the graduation project in the first semester 20/21 (hybrid).
- Architectural Design 7 and their follow-up after graduation in the year 21/22.
- Another group is the graduation project in 2020 online. As well as their follow-up after graduation, also first-year student group in architectural design courses 2 and 3 chosen in order to know the feasibility of distance education in starting the design process for students of the first stage.

- *The Questionnaires*

- Questionnaire were the measuring tool and is distributed over three semesters, and the students were divided into four groups, group (A), group (B), (C) and (D) for each of the architectural design courses 2, 3, 6 and 7, the graduation project and the graduates as shown in the following table3

TABLE 3
THE STUDY SAMPLES.

Survey period		Group	Sample	Responses	%
Second semester 2020 (Distance learning)	(A)	Architectural design 2	21	18	86
	(B)	Architectural design 6	72	56	78
	(C)	Graduation Project	47	36	79
First semester 2021 (hybrid)	(A)	Architectural design 3	21	18	86
	(B)	Architectural design 7	72	61	85
	(D)	Graduation Project	68	60	83
First semester 2022	(D)	Graduates 2020	47	28	60
	(B)	Graduates 2021	68	45	62

- It was designed by the researcher as a faculty member in most of the courses selected for research on the one hand and the quality coordinator for the architecture program on the other hand, in addition to being a teacher of scientific research methods in the Department of Architecture at the Institute.

- Questionnaires were presented to a group of professors and experts and their observations were completed. Where the questionnaire was divided into three parts:

1) The first dealt with questions related to the various mechanisms, tools and methods of teaching design and supervision of graduation during the Corona pandemic. In addition, the necessary skills of teachers and students that were applied in the two periods (online - hybrid) and related to new teaching methods and the percentage of achievement of academic courses.

2) The second part, it deals with the percentage of satisfaction with the educational process, the level of student interaction, the capacity and efficiency of the educational electronic platform, the skills necessary to conduct an online studio or to evaluate and discuss design projects, the capabilities of using distance learning, and the efficiency of providing feedback.

3) The third part, it relates to the challenges and obstacles in this experience, the advantages and disadvantages of teaching architectural design online, the level of output and the quality of the final product for students.

In addition to an additional, part of students after graduation that deals with their vision of the experience and its impact on their scientific and professional level after graduation with the aim of focusing on exploring the operational and technical aspects of distance learning.

In the end, the results of the questionnaires were analyzed, then through this evaluation process, it is possible to access the modifications and possible ways to improve teaching mechanisms in the form of distance learning in architectural design courses in particular and architecture teaching in general as distance education is an urgent necessity in this era.

III. RESULTS

The data obtained from the questionnaires were tabulated and a simple statistical analysis was conducted on the information to obtain rates through which ratios of answers to the questions can be calculated, and then a comparison between these percentages for each discussion group. The following tables show an inventory of students' answers, where Table 4 lists the problems and Table 5 relates to the acquired advantages

TABLE 4
PROBLEMS IN E LEARNING DURING CORONA CRISIS

Problems	Des.2 Gr(A) No.19		Des.3 Gr(A) No.19		Des.6 Gr(B) No.72		Des.7 Gr(B) No.72		G. P1 Gr(C) No:36		G. P2 Gr(D) No:60	
	No.	%	No	%	No	%	No	%	No	%	No	%
Technical difficulties (infrastructure - Internet speed – computers)	9	47	10	53	52	72	43	60	21	58	41	68
Not suitable for practical courses	18	94	17	89	65	90	46	64	30	83	51	85
Students' skills are insufficient for learning and communication to convey their ideas online	9	47	7	37	51	71	37	51	20	56	47	78
Difficult interaction between students and professor and enriching ideas for discussion about the project	8	42	6	32	35	49	30	42	29	81	58	97
improper communication with students, and the ease of giving up attending lectures	7	37	4	21	61	85	53	74	32	89	42	70
A prof. cannot answer all questions or follow through on assignments and commitments with the same accuracy and speed	7	37	3	16	55	76	31	43	29	81	31	52
Some profs. do not know how to do the required goals online	5	26	3	16	35	49	30	42	28	78	32	53
The difficulty of accurately evaluating (tests - tasks - projects)	9	47	2	11	40	56	27	38	30	83	42	70

(TABLE 4: continued)

Problems No	Des.2 Gr(A) No.19		Des.3 Gr(A) No.19		Des.6 Gr(B) No.72		Des.7 Gr(B) No.72		G. P1 Gr(C) No:36		G. P2 Gr(D) No:60	
	No.	%	No	%	No	%	No	%	No	%	No	%
Students worry about this system	12	63	7	37	64	89	45	63	32	89	26	37
The rate of work on the course is greater and the follow-up to design projects throughout the day	16	84	10	53	66	92	43	60	33	92	25	42
The negative impact on the student in the event that the teacher is unable to use the appropriate method effectively	12	63	7	37	61	85	53	74	34	94	42	70
many attempts and relative failure to use new technologies	9	47	4	21	53	74	41	57	30	83	26	43
Lack of privacy for the learning environment and the unbalanced psychological state associated with it	16	84	14	74	63	88	44	65	31	86	52	87
The negative impact on the eyes, back and neck vertebrae due to the increased use of the computer or phone	17	89	13	69	61	85	53	73	28	78	44	73
Irrational use of technology and the spread of so-called project theft	15	79	10	53	53	74	32	44	28	78	47	78
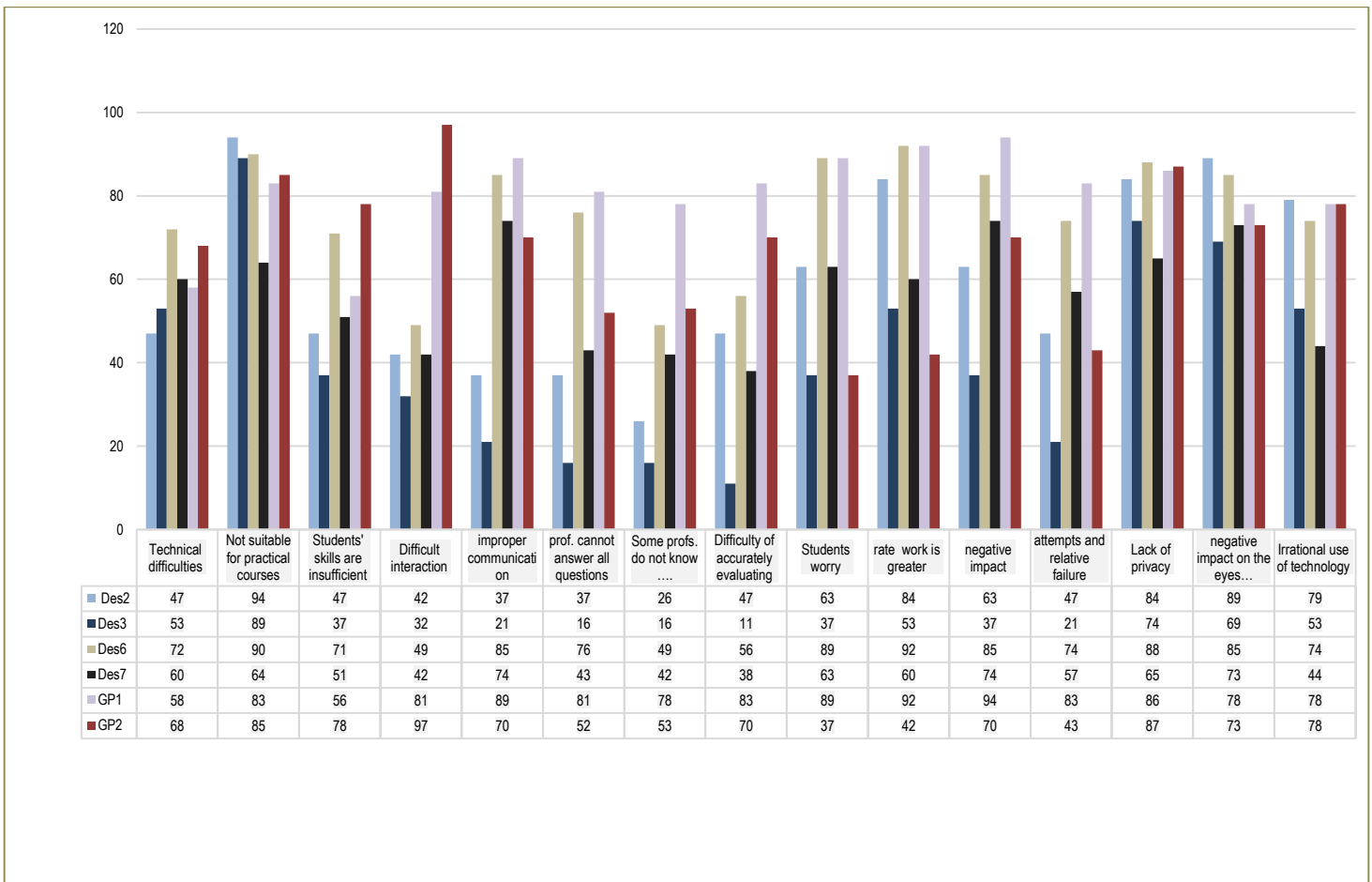
Fig5. Percentages of students' opinions about the difficulties of distance education in architectural design.

In Figure 5, most of the problems faced by students on the graduation project, especially in the first stage of the pandemic and the ban, may be due to the sudden crisis. Where the percentage exceeded 60% Design students 2 and 6 also had the same concerns Design 3 and 7 students were less in presenting their problems, the percentages ranged between~ 10%: 60%.

TABLE 5
LEARNING ADVANTAGES GAINED IN E LEARNING DURING CORONA CRISIS

The advantages gained	Des.2 Gr(A) No.19		Des.3 Gr(A) No.19		Des.6 Gr(B) No.72		Des.7 Gr(B) No.72		G.P Gr(C) No:36		G.P Gr(D) No:60	
	No.	%	No	%	No	%	No	%	No	%	No	%
Save and invest the learner's time	5	26	8	42	66	92	51	71	20	56	52	87
Easy access to knowledge sources	17	89	15	79	58	81	42	58	21	58	45	75
Multiple teaching aids (video, audio, video conference, chat, discussion group, and email)	13	68	16	84	57	79	54	75	32	89	41	68
Direct communication can be made at the same time directly between the teacher and the learner, or asynchronously	12	63	13	68	35	49	53	74	32	89	32	53
Shows students' varying abilities and helps students acquire new skills	9	47	10	53	42	58	51	71	25	69	24	40
Convenience and flexibility in scheduling study times, helps prevent students from being absent	17	89	10	53	54	75	39	54	26	72	34	57
Develop skills to use modern information and communication technology	13	68	9	47	56	78	52	72	29	81	26	43
Suitable for expatriate students	17	89	14	74	66	91	57	79	32	89	41	68
Positive and interesting interaction	13	68	10	53	42	58	35	49	18	50	23	38
subject materials are always available to the student, which reduces the psychological burden	17	89	12	63	50	69	55	76	21	58	32	53
It is the ideal solution in the event of epidemics and crises	15	79	17	89	34	47	47	65	21	58	42	70
Raising the efficiency of the student, developing his personality and creating self-reliance	17	89	13	68	36	50	26	36	27	75	35	58
Benefiting from technological and informational developments and modern means of communication in making a qualitative leap in the field of education	16	84	14	74	60	83	63	88	29	81	53	88
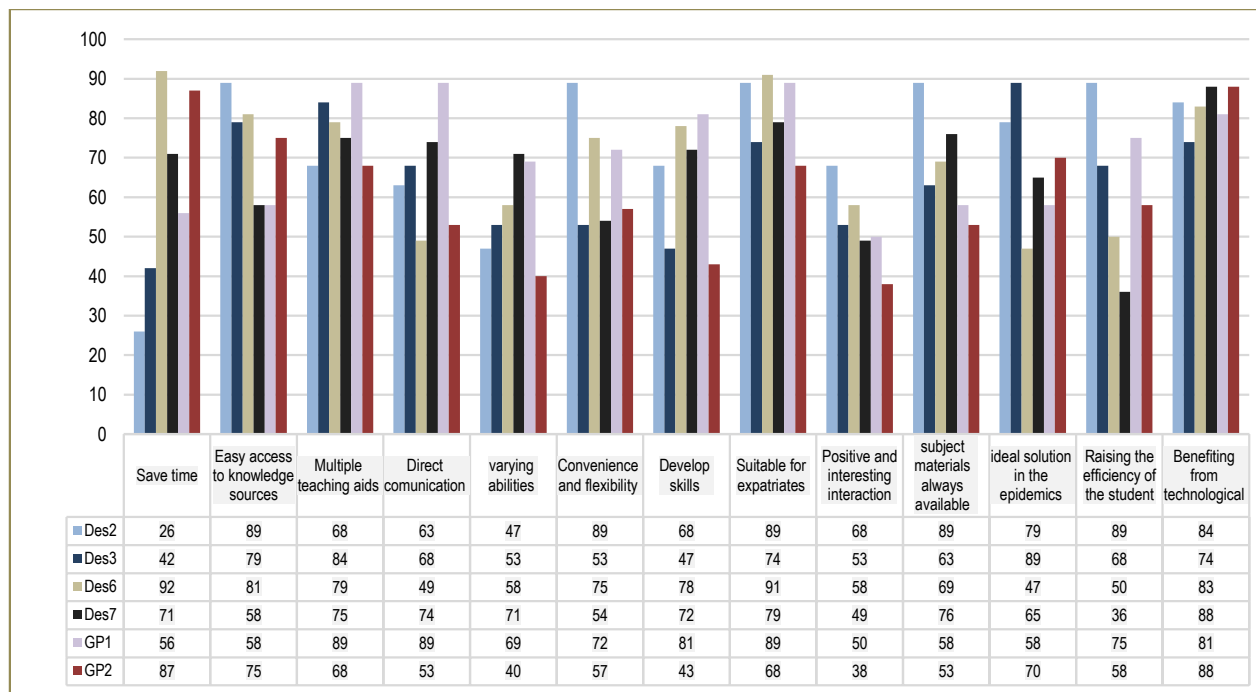
Fig. 6. Percentages of students' opinions about Advantages gained in distance education in architectural design

Design 3 and 7 students and the first semester of the graduation project, their opinions exceeded 50% of the acceptance and satisfaction. They have advantages because the study of these courses was hybrid. The students unanimously agreed that the application of distance education increased their skills, was more flexible, and saved them time, especially for students who did not reside in the same governorate. However, design 2 students had a different opinion about saving time, and the percentage did not exceed 25% only, as they spent a long time trying to understand the professor's corrections and

comments, the lack of direct communication constituted a problem for them in the ease of achieving. This may be due to the lack of knowledge and theories that were studied in the first class in the department.

The results obtained from the student questionnaires can be divided and summarized as follows:

A. The results of the questionnaire can be expressed in the part of the infrastructure for distance education with regard to online and hybrid in the Fig7.

- The figure shows that the use of the Internet infrastructure in the hybrid system was more efficient.
- The communication with students was more effective, as the loading on the networks was alternate due to the presence of teaching loads that were partially resumed face to face.
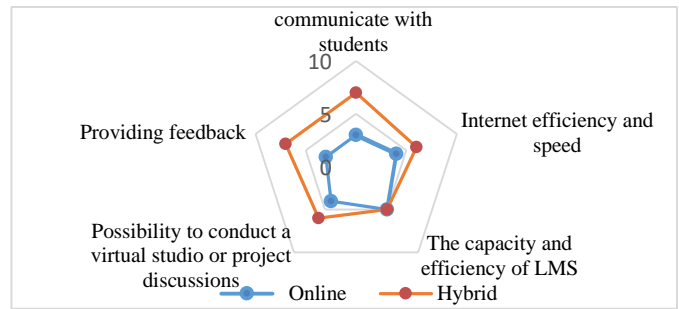

Fig. 7. Internet infrastructure (online- hybrid)

B. The Results of Student Questionnaires Regarding the Degree of Satisfaction and Acceptance of Students for Online and Hybrid Education Can Be Limited to Architectural Design Courses 2, 3, 6 And 7, As Well as The Graduation Project as Shown Fig.8.

	Design2 (online)	Design3(hybrid)	Design6 (online)	Design7(hybrid)	Graduation Project(online)	Graduation Project(hybrid)
fully satisfied	1	1	0	2	1	1
satisfied	2	3	2	4	2	3
neutral	0	1	1	1	0	1
not satisfied	3	3	3	2	3	2
Totally not satisfied	4	2	4	1	4	3
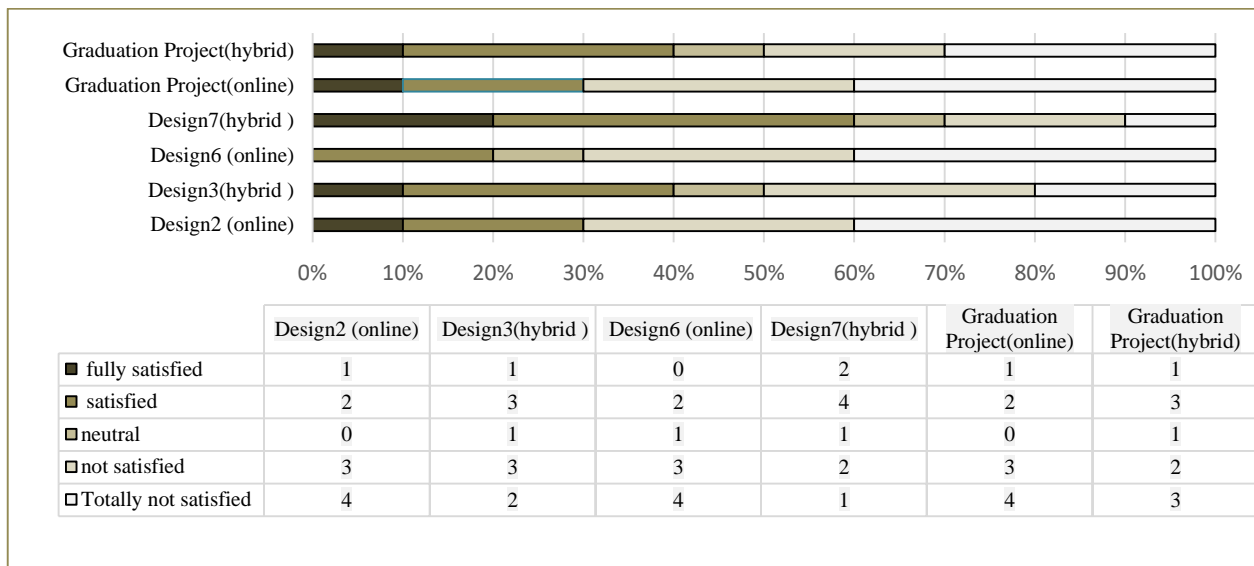
Fig. 8. Means value of student acceptance about e learning in architectural design.

	The graduates' vision for the distance education experience	The graduates' vision for the hybrid education experience	Distance education Impact on the scientific and professional graduates level	Hybrid education Impact on the scientific and professional graduates level
Completely satisfied	0.5	2	1	2
Satisfied	1.5	4	1	3
Neutral	2	2	1	2
Not satisfied	4	1	3	2
Not completely satisfied	2	1	4	1

Fig.9 The return of distance education / hybrid on the graduate.

- Conclude that the dissatisfaction in general for teaching architectural design completely online.
- The dissatisfaction was higher for each of the students of the graduation project, as well as students of the first stages of design, because they need direct communication to understand the design process, especially the lack of previous experience of how to design architectural projects.
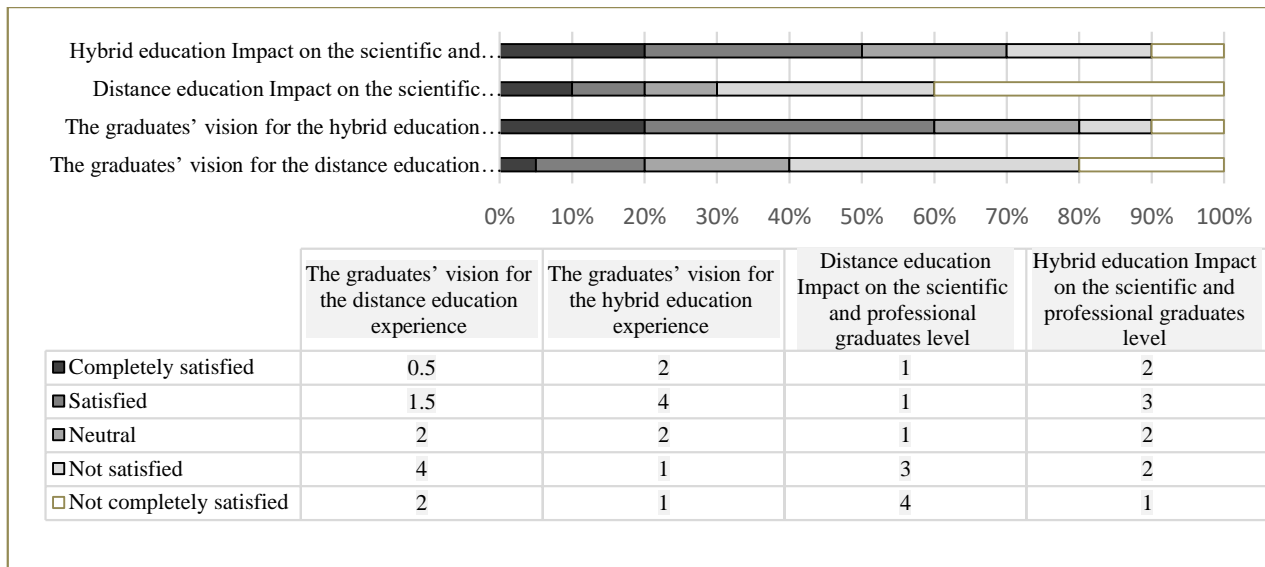- Most students prefer hybrid education in architectural design courses to combine direct and indirect communication between the student and the professor.

C. With regard to expressing the graduates' opinion and the degree of their satisfaction with the distance architectural education, and your impact on their scientific and practical level after graduation, as shown in Fig.9

- The figure shows that the hybrid education system was more satisfied with the graduates.
- Dissatisfaction with online education with architectural design courses for graduates seems to have seen an unsatisfactory effect on their work.

D. In terms of innovative teaching mechanisms and methods for learning architectural design from a distance, its efficiency, and the skills of the student and teacher towards this new learning mechanism, the ratios were as shown in the Fig.10.

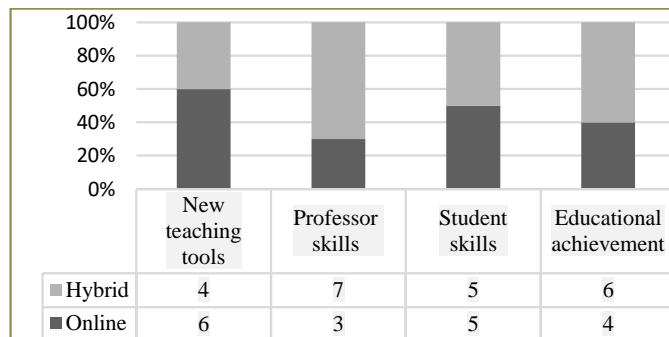|	New teaching tools	Professor skills	Student skills	Educational achievement
Hybrid	4	7	5	6
Online	6	3	5	4

Fig. 10. Mechanisms and methods of teaching.

- It is clear that the use of new tools in online education was greater than that of hybrid education.
- The skills of most professors were insufficient to fully online education in architectural design.
- Students' skills are almost equal 50%, whether online or hybrid education is installed with architectural design.
- -The percentage of educational attainment in architectural design courses in the hybrid system was greater than online.

IV. DISCUSSION

The experience of teaching architectural design courses in the departments of architecture in the faculties of engineering is a matter worthy of study and analysis due to the difference in teaching mechanisms in these courses, which depend, since the inception of architectural education, on the direct interaction between the student and the teacher, and the student's awareness of sensory concepts that he can only through the interaction of all his senses, such as the sense of color, light, proportions of spaces, etc.

- The Corona pandemic prompted all architecture teachers to apply distance learning and without prior preparation ‹and everyone went through the experience ‹whether they agreed with the application mechanism or refused ‹as there is no alternative and the necessity of continuing the educational process and in the absence of students attending the traditional design studio. [35-38].
- This study focused only on one educational facility PHI. Students of universities and other engineering institutes may have different experiences.
- This study is an evaluation of the experience at the Pyramids Higher Institute as an example of a traditional learning environment for architecture. The students' opinion was surveyed and divided into two main parts, the first related to difficulties and problems, and the other to the advantages that the student sought in the application of architectural education via the Internet.
- From the analysis of the previous questionnaires and graphs, it was noticed that most of the items related to the courses that were taken entirely through distance education are worse than those taught in a hybrid system. Although there is a consensus on some points in both methods of teaching, where ≥ 50% of the students admitted the existence of technical problems, whether in the infrastructure or the speed of the Internet, and the students agreed on the inadequacy of applying distance education for practical courses, especially architectural design.
- With regard to the difficulty of communication and interaction between the student and the professor, it was for the first year students, unlike the students of the final years, as they were more interactive with the professors via the Internet than their colleagues were in the graduating year.
- As for the inability of some professors to implement the system or to communicate the objectives of the course to the students online, it exceeded 50% of the students' opinion and was less than that of the hybrid system course
- The student rejection rate exceeded 50% for the appropriateness of using the Internet in assessment methods in architectural design courses
- The students' anxiety in applying the distance learning system was very high ~85% of the students agreed on that, while when the experiment was repeated and combined with face-to-face in a hybrid system, the students' anxiety decreased significantly.
- The students unanimously agreed that: the time allotted to work with online design courses has become significantly more throughout the day. As a result of the many attempts and difficulties in sending and uploading files and waiting for the professor's response and their attempts to comment on the work and notes, which constituted a great mental burden on them, especially in the case of the inability to communicate due to technical problems or inappropriateness' times for both sides
- The problem of lack of privacy in the learning environment was reciprocal between students and teachers, and ≥85% of the students agreed on that.

- The emergence of new and unexpected problems for the application of distance learning, such as those related to psychological and nervous tension and spending long hours in front of computer devices, which negatively affected the social life of students and also physically, such as eyesight and neck pain. The problem of theft of projects and hacking of electronic accounts, etc., also emerged as a result of the excessive use of technology
- Some opinions were related to the difficulty of not owning a computer/laptop, in addition to the lack of prior preparation for acquiring computer skills, in addition to the difficulty of providing a suitable space at home for learning.
- On the other hand, the students saw that the use of the Internet in teaching saves time instead of the time taken for commuting and transportation, especially for expatriate students. While first-year students were on the contrary, they faced difficulty in teaching architectural design from a distance due to the lack of any strong architectural background and the fact that they were still in an early stage

of establishing architectural design, its trends and ideas, which took them many times to understand and communicate. However, all classroom, students, with a percentage of $\geq 75\%$, felt the ease of obtaining information, research, and the availability of the scientific content of the courses on a permanent basis, whether they obtained them synchronously or asynchronously, and as a result of the availability of many teaching methods that were welcomed by the students
- 60% of the students found more flexibility in online learning, with the requirement to improve technology and to avoid previous problems. New skills for students developed in the use of multiple technologies with an interesting experience. They also agreed that distance education via the Internet is an ideal solution now in the event of the spread of epidemics or crises.
- The following figure 11 summarizes the strength points, weakness, opportunities and threats in SOWT analysis of online learning in architecture education.
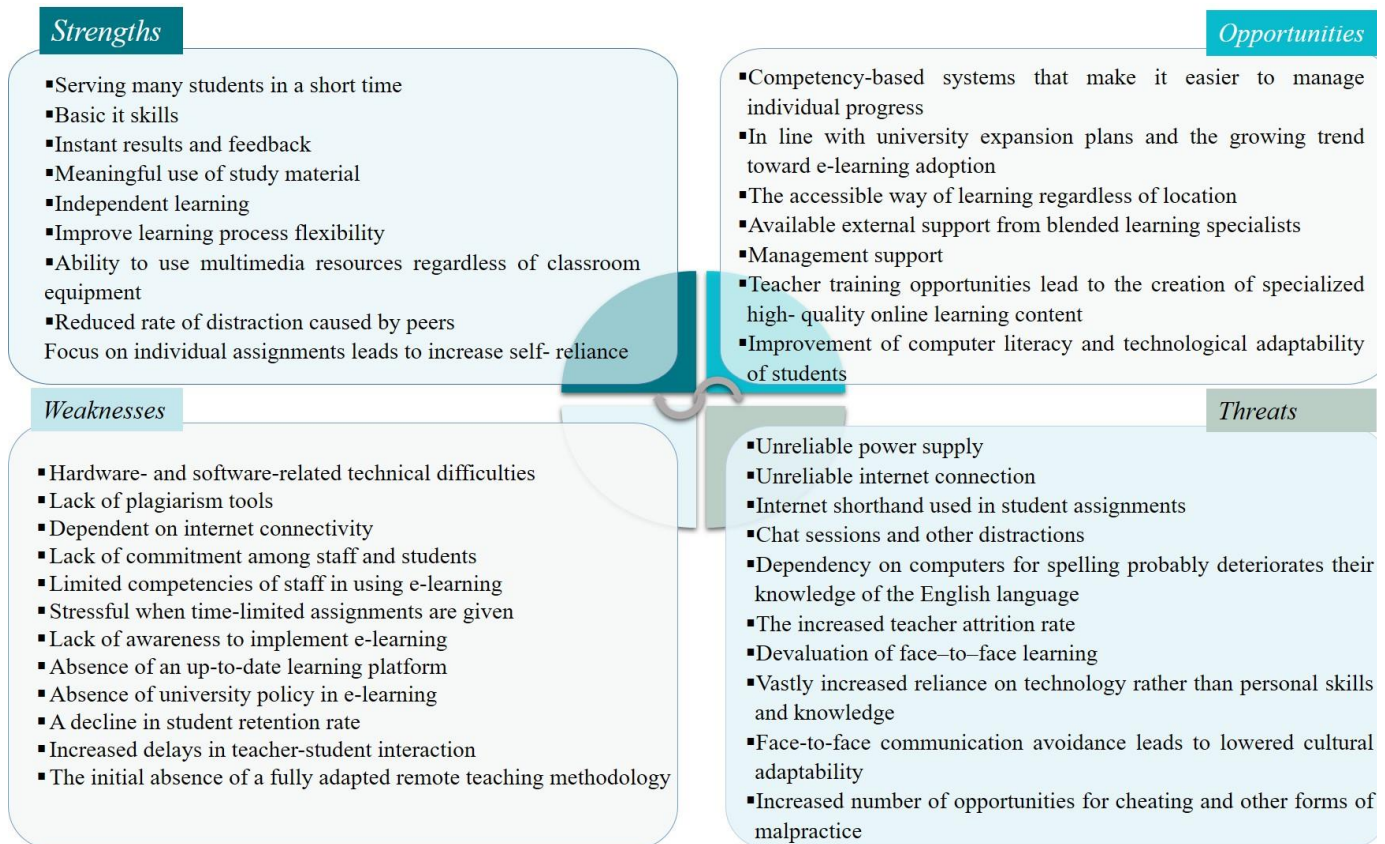
Strengths
- Serving many students in a short time
- Basic it skills
- Instant results and feedback
- Meaningful use of study material
- Independent learning
- Improve learning process flexibility
- Ability to use multimedia resources regardless of classroom equipment
- Reduced rate of distraction caused by peers
- Focus on individual assignments leads to increase self- reliance

Opportunities
- Competency-based systems that make it easier to manage individual progress
- In line with university expansion plans and the growing trend toward e-learning adoption
- The accessible way of learning regardless of location
- Available external support from blended learning specialists
- Management support
- Teacher training opportunities lead to the creation of specialized high- quality online learning content
- Improvement of computer literacy and technological adaptability of students

Weaknesses
- Hardware- and software-related technical difficulties
- Lack of plagiarism tools
- Dependent on internet connectivity
- Lack of commitment among staff and students
- Limited competencies of staff in using e-learning
- Stressful when time-limited assignments are given
- Lack of awareness to implement e-learning
- Absence of an up-to-date learning platform
- Absence of university policy in e-learning
- A decline in student retention rate
- Increased delays in teacher-student interaction
- The initial absence of a fully adapted remote teaching methodology

Threats
- Unreliable power supply
- Unreliable internet connection
- Internet shorthand used in student assignments
- Chat sessions and other distractions
- Dependency on computers for spelling probably deteriorates their knowledge of the English language
- The increased teacher attrition rate
- Devaluation of face–to–face learning
- Vastly increased reliance on technology rather than personal skills and knowledge
- Face-to-face communication avoidance leads to lowered cultural adaptability
- Increased number of opportunities for cheating and other forms of malpractice

Fig. 11. SOWT analysis of online learning in architecture education.

V. CONCLUSION

Architects have superior capabilities to imagine the future, and therefore this must be exploited to meet the challenge of the virtual architectural design studio by supporting investment in the future of the infrastructure of Internet networks in line with the living environments of the architectural student. This

requires vision, competence and direction to activate future predictions.

This research provides insights about distance learning as the future trend in the teaching of architecture. Digital information has become a basic infrastructure, and with the

expansion of Internet networks, it has become an indispensable part of society, whether in terms of entertainment, practical practices, industrial and commercial activities. Therefore, the applications of the Internet in education are urgent due to the nature of the age. Especially as it achieves more flexibility and provides great educational opportunities for students across different countries of the world without the burden of travel or restrictions, and sharing the capabilities of universities and making them available to everyone effectively and expanding the scope of student acceptance. It will also enhance networks of cooperation between various architectural institutions, and the possibility of linking them directly to the labor market.

- Teaching architecture entirely online is a complex matter, because the courses are based on direct communication between the student and the professor. However, the hybrid system can be gradually relied upon, starting with 30% online, and supporting it with face-to-face communication with 70%, and increasing this percentage successively, as experience proved the difficulty of moving entirely to distance education, especially in architectural design courses.
- Searching for simulation technology systems in order to convey the realistic experience of the student, in which he depends on the sense of color and texture, etc. Until this is done, face-to-face education cannot be dispensed with for architectural education
- This research contributes to the development of a map toward the transformation of education and e-learning and its inclusion in architectural education with specific systems and systematic strategies, whether in the design studios understudy or other architectural institutes and universities locally and internationally
- The need for more research and studies dealing with the various teaching and learning activities to devise new educational strategies using digital transformation, through which educational mechanisms can be developed that, would remove the obstacles that students faced during the Corona Virus period.
- More studies and research with larger samples and different educational environments for architecture, such as universities, whether governmental, private or international, enriches with many important results. A future architectural design studio must be sustainable and resilient, at the same time, able to accommodate the new requirements of the post-coronavirus era.

ABBREVIATIONS

CAD　　Computer-aided design.
BIM　　Building Information Modeling.
LMS　　Learning management system.
PHI　　Pyramids higher Institute for Engineering and Technology.

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Title Arabic:

**تقييم طرق التعلم الإلكتروني في استوديو التصميم المعماري الرقمي
أثناء أزمة كورونا**

دراسة حالة قسم العمارة — معهد الاهرامات العالي للهندسة والتكنولوجيا-مصر

Arabic Abstract:

اجبرت جائحة كورونا نظم التعليم في العالم على التحول إلى التعلم عن بعد عبر الإنترنت، وغطت هذه الدراسة الفترة من مارس ٢٠٢٠ إلى الفصل الدراسي الأول من العام الدراسي ٢٠٢١/٢٠٢٠، والتي تم تنفيذها بنظام هجين. (وجها لوجه + عبر الإنترنت). ثم دراسة عوائدها في العام التالي على مستوى الطلاب وطريقة التدريس ودمج الآليات الجديدة عن طريق الاستبيان من خلال عينة مقصودة من ثلاث مجموعات من الطلاب في المساقات الأولى والنهائية وقبل النهائية لدورات التصميم المعماري ٢، ٣و ٦ و ٧ وكذلك مقرر مشروع التخرج والتحليل الإحصائي للنتائج. . أظهرت النتائج الرضا النسبي لدى الطلاب عن نظام التعليم الهجين في مقرري التصميم ٦ و٧، ورفض كبير للتعليم عن بعد، خاصة لطلبة التصميم المعماري ٢ و٣. أما بالنسبة لمشروع التخرج، فقد كان الاستياء أكبر بالرغم من استجابة الجميع للآلية الجديدة والحماس لها، وتم عمل استبيان لنفس المجموعتين بعد التخرج لتقييم تجربتهم وأثرها على مستواهم العلمي والمهني في سوق العمل. وأخيراً، لخصت الدراسة المزايا والصعوبات التي واجهها الطلاب وتوصيات لتطبيق التعليم عن بعد في مقررات التصميم المعماري.