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Architecture Education in (COVID-19) Pandemic Analytic Study for (Online Learning for Building Construction Courses)

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Abstract:

In March 2020, the World Health Organization (WHO) officially announced the COVID-19 outbreak as a global Pandemic, during this time, the Egyptian government announced closing the schools and higher educational institutes, hence, the commitment to online learning in schools and faculties become mandatory to prevent the spread of the virus.

From this point, the lecturers of Building Technology Courses in Modern Academy for Engineering and Technology were tasked to find ways to teach the course without physical contact with the students nor access to campus facilities traditionally used to run the program and its associated courses. In fact, it became a challenge because, Building Construction Courses considered one of the core courses in architectural education after the design courses, which means, any defect in teaching these courses will affect directly in the educational process. Furthermore, bachelor architecture programs for design and building construction courses for undergraduate student in Preparatory and Sophomore years are usually associated with the direct interaction between the lecturer and each student. This paper argues the evaluation of an operational model prepared for the design and building construction courses to overcome this challenge, then, examining this model through a questionnaire prepared to evaluate the efficiency and deficiencies of online-learning for two Consecutive courses for building construction and materials (1and2) by using an online learning platform as an alternative method for education, as well as, discussing the final result for the two courses to evaluate the operation model effectiveness, and improve the e-learning process for the coming semesters.

Keywords:

Architecture Education, Analytic Study, Online Learning, Building Construction Courses

ملخص:

في مارس 2020، أعلنت منظمة الصحة العالمية رسمياً تفشي مرض كوفيد-19 باعتباره وباءً عالمياً، وبناءً على ذلك، أعلنت الحكومة المصرية قرار إغلاق المدارس والجامعات ومعاهد التعليم العالي، مع الإبقاء على استمرار العملية التعليمية، وبالتالي أصبح الالتزام بالتعلم عن بعد في المدارس والكليات إلزامياً لمنع انتشار الفيروس القاتل. من هذا المنطلق، ومن واقع منصب كمدرب ومحاضر جامعي في قسم الهندسة المعمارية ومكلف بتدريس مادة الإنشاء المعماري ومواد البناء 1 و2، فقد تطلب هذا التغيير المفاجئ على العملية التعليمية إيجاد طرق فعالة لتدريس المواد المكلف بها من خلال التعليم عن بعد. فأصبحت العملية التعليمية تحدياً كبيراً لتحقيق أقصى استفادة للطلاب وتوصيل المعلومة كاملة، وذلك لان الهدف الرئيسي للتعليم المعماري هو الجمع بين المبادئ والفنون الجميلة لتحقيق الأساسيات

والمهارات والإبداع (الوظيفة والشكل). لذلك، فإن لا مجال لحدوث أي قصور في العملية التعليمية، لما له من تأثير سلبي مباشر على عملية إعداد الطالب ليصبح معماريا لديه جميع المهارات اللازمة للقيام بوظيفته واستكمال مراحل تعليمه المترتبة على هذه المرحلة، تناقش هذه الورقة تقييم نموذج تشغيلي تم إعداده لدورات تشييد المباني، ثم فحص هذا النموذج لدورتين متتاليتين لمنهج تشييد المباني (1 و 2) باستخدام منصة التعلم عبر الإنترنت كوسيلة بديلة للتعليم التقليدي، وكذلك تقييم الصفات الإيجابية والسلبية من خلال الدراسة التحليلية باستخدام مؤشرات التعلم الناتج. بالإضافة إلى وضع توصيات مستقبلية من خلال مجموعة من الإجراءات التي يجب اتخاذها في حالة استمرار الية التعليم عن بعد أو التعليم الهجين في مجال الهندسة المعمارية لتحقيق محاكاة تكون الأقرب للتفاعل المباشر بين المحاضر والطلاب لنقل المهارات الاحترافية والإبداعية وربط الشق النظري بالشق التطبيقي لضمان خريج يحمل مقومات المهندس المعماري الناجح.

الكلمات المفتاحية:

التعليم المعماري، دراسة تحليلية، التعلم عن بعد، مقرر تشييد المباني

1. Introduction

Egypt is one of the leading countries in the Middle East in terms of university education, whether governmental or private, the number of universities in Egypt (24) official governmental universities and, (26) private universities and institutes, all of them are administrated by the supreme council of universities, the council of private universities, and the ministry of higher education (MHE, 2018). The modern academy for engineering and technology is one of the leading private institutes; it founded in Nov. 2000 following the approval ministry of higher education. Students graduated in four specializations namely: computer engineering, electronics engineering, manufacturing engineering, and architecture building technology. In the opening academic year 2000/2001, only 80 students enrolled. In the following year 2001/2002, this number jumped to 1080 students. Ever since, the academy accepts more than 1200 fresh students each year. This reflects the high reputation deservedly earned by the newly born academy and the great trust in its capabilities. The architecture department acquires about 300 students every year from the total number of students applying to the institute (MAM).

The main objective of architectural education is the combination of principles and fine art to achieve basics, skills, and creativity (function and form). Therefore, any defect that may occur in teaching the principles will lead to the transformation of the architecture profession from being an applied human science to become an abstract work of art (Lina Ahmad, 2020). In Addition, The architectural discipline has become widely dependent on digital computer technology, especially in the process of design and workshop drawing preparation; hence, it becomes mandatory to adopt the architecture education process with this transformation. On the other hand, bachelor architecture programs for design and building construction courses for the undergraduate student in Preparatory and Sophomore years are usually associated with the direct interaction between the lecturer and each student, face-to-face communications, using reams of tracing paper laid, and constructing models, therefore, all the presented assignments by the students done manually, so that, computer technology as a learning platform for teaching design and building construction courses has rarely been attempted in these stages. In contrast, and as a response to the COVID-19 pandemic at the end of March

2020, the transfer to online learning becomes mandatory, suddenly, all the educator in architecture schools faced a great challenge and, There is a question that must be answered, how can these courses be taught throughout online platforms?, in addition, many design educators regard the online or blended learning environment as inadequate (Fleischmann, 2016) (Mohammed, 2017) (Saghafi, 2012).

When the new mandate announced in our academy, and whereas Building Construction Courses are considered one of the fundamental pillars courses in architectural education after the design courses, that means, any defect in teaching these courses especially in Preparatory and sophomore years will affect directly the educational process. This study evaluates an operational model applied for design and building construction courses and examining this model in two Consecutive courses for building construction and materials (1and 2) for Sophomore year by using an online learning platform as an alternative pedagogy method for education, as well as, assessing the positive and negative attributes through an analytic case study using outcome learning indicators, taking into consideration the impact of the COVID-19 pandemic in the educational process.

2. Research Objectives And Methodology

As a result of the decision taken by the ministry of higher education in march 2020 to suspend the education process in order to achieve social isolation and minimize total interaction, all the universities started to switch to digital platforms across the distance learning. This research presents the student's point of view in online- learning and discusses the points of strength and weakness for the operation model, which prepared to explain these courses to improve the e-learning process for the coming semesters.

2.1 Research Objectives

This study was carried out to assess the positive and negative features of using online-learning for two Consecutive courses for building construction and materials (1and 2) for Sophomore year in Modern Academy for Engineering and Technology, architecture department through a surveying study, it consists of a sample of (61) students participated a questionnaire prepared with (google form) to evaluate the efficiency and deficiencies of online-learning on the course curriculum and to scale the student's perception, response, and performance.

2.2 Research Methodology

The research focuses on three parts, (A)- the first part is a literature review by: identifying the difference between the traditional and online architecture studio concepts, the relationship between architectural education and research, and Modern Academy Experience in Online Learning using the inductive method.

(B)-The second part is collecting the data: a quantitative study based on a surveying technique (online questionnaire) to collect the data using a google form, it is distributed to (62) students after they completed the two courses, The first axis of the form consists of (4) questions and (24) sub-dimensions to measure knowledge and understanding, intellectual skills, professional skills, and general skills of the course curriculum to conclude the learning outcome ratios which reflect the student's perception, response, and performance to the course. The second axis of the form consists of (3) questions and (23) sub-dimensions to evaluate the efficiency

and weakness of online E-learning in the education process and exploring the technical problems which the students may face in dealing with the operation model and in solving the assignments. expressions in the scale are rated as 5-point Likert as illustrated in **Table (1)** and **Table (2)**.

Table (1): Results of the Questionnaire for the first Axis

| Knowledge and Understanding (lectures) | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | A | | B | | C | | D | | F | |
| | N | % | N | % | N | % | N | % | N | % |
| Isolation. | 30 | 49 | 27 | 44.3 | 4 | 6.6 | 0 | 0 | 0 | 0 |
| Construction joints. | 24 | 39 | 14 | 23 | 22 | 36 | 1 | 1.6 | 0 | 0 |
| Internal treatments for (floors, walls, ceiling). | 23 | 38 | 27 | 44.3 | 11 | 18 | 0 | 0 | 0 | 0 |
| Stairs (concrete, wooden, steel). | 32 | 52 | 25 | 41 | 4 | 6.6 | 0 | 0 | 0 | 0 |
| Wooden connections. | 42 | 69 | 11 | 18 | 8 | 13 | 0 | 0 | 0 | 0 |
| Opening (windows, doors). | 35 | 57 | 18 | 29.5 | 8 | 13 | 0 | 0 | 0 | 0 |
| Short span structure systems. | 21 | 34 | 24 | 39.3 | 14 | 23 | 2 | 3.3 | 0 | 0 |
| Introduction to working drawing. | 38 | 62 | 17 | 27.9 | 5 | 8.2 | 1 | 1.6 | 0 | 0 |
| Intellectual Skills | | | | | | | | | | |
| Analyze building elements. | 21 | 34 | 25 | 41 | 15 | 25 | 0 | 0 | 0 | 0 |
| Solve building structural problems. | 12 | 20 | 27 | 44.3 | 18 | 30 | 2 | 3.3 | 2 | 3.3 |
| Apply innovative materials. | 13 | 21 | 28 | 45.9 | 17 | 28 | 2 | 3.3 | 1 | 1.6 |
| Apply the knowledge of working drawings. | 24 | 39 | 28 | 45.9 | 9 | 15 | 0 | 0 | 0 | 0 |
| Express description of the chosen material. | 18 | 30 | 26 | 42.6 | 10 | 16 | 6 | 9.8 | 1 | 1.6 |
| Design the joints between finishing materials. | 12 | 20 | 29 | 47.5 | 17 | 28 | 2 | 3.3 | 1 | 1.6 |
| Professional Skills | | | | | | | | | | |
| Interpret technical drawings using manual drawing techniques. | 20 | 33 | 28 | 45.9 | 11 | 18 | 2 | 3.3 | 0 | 0 |
| Select materials that are suitable for specific purposes. | 18 | 30 | 28 | 45.9 | 14 | 23 | 1 | 1.6 | 0 | 0 |
| Identify installation problems on site. | 10 | 16 | 25 | 41 | 19 | 31 | 7 | 11 | 0 | 0 |
| Produce professional execution drawings for a small project. | 33 | 54 | 24 | 39.3 | 4 | 6.6 | 0 | 0 | 0 | 0 |
| General Skills | | | | | | | | | | |
| Work in an unconventional environment. | 24 | 39 | 23 | 37.7 | 11 | 18 | 3 | 4.9 | 0 | 0 |
| Understanding of professional conduct and ethical responsibility. | 37 | 61 | 16 | 26.2 | 8 | 13 | 0 | 0 | 0 | 0 |
| Discuss and present ideas in a professional manner. | 33 | 54 | 22 | 36.1 | 6 | 9.8 | 0 | 0 | 0 | 0 |
| Use modern materials required for sound professional practice. | 26 | 43 | 27 | 44.3 | 6 | 9.8 | 2 | 3.3 | 0 | 0 |
| Seek plans and meet them with a deadline (time management). | 26 | 43 | 25 | 41 | 8 | 13 | 1 | 1.6 | 1 | 1.6 |
| Listen and critically respond to the views of others. | 29 | 48 | 21 | 34.4 | 7 | 11 | 2 | 3.3 | 2 | 3.3 |

Where (A) = Extremely Agree- (B) = Agree- (C) = Average- (D) = Disagree- (F) = Extremely Disagree
(N)= No. of Answers.

Source: by Author.

Table (2): Results of the Questionnaire for the second Axis

| Do you find Online learning provides these substances? | | | | | | | | | | |
|--|----|------|----|------|----|------|----|------|----|------|
| | A | | B | | C | | D | | F | |
| | N | % | N | % | N | % | N | % | N | % |
| Effective like traditional education. | 19 | 13.1 | 11 | 18 | 22 | 36.1 | 8 | 13.1 | 1 | 1.6 |
| Increases your self-confidence. | 26 | 42.6 | 10 | 16.4 | 21 | 34.4 | 2 | 3.3 | 2 | 3.3 |
| Provide enough feedback to you from the lecturer. | 22 | 36.1 | 17 | 27.9 | 14 | 23 | 7 | 11.5 | 1 | 1.6 |
| Support communication with the lecturer. | 25 | 41 | 24 | 39.3 | 7 | 11.5 | 4 | 6.6 | 1 | 1.6 |
| Encourages you to research. | 33 | 54.1 | 19 | 31.1 | 9 | 14.8 | 0 | 0 | 0 | 0 |
| Express your interpretations more freely. | 27 | 44.3 | 17 | 27.9 | 11 | 18 | 4 | 6.6 | 2 | 3.3 |
| Promotes a sense of responsibility. | 25 | 41 | 24 | 39.3 | 5 | 8.2 | 6 | 9.8 | 1 | 1.6 |
| Affects negatively in working as teamwork. | 15 | 24.6 | 11 | 18 | 15 | 24.6 | 15 | 24.6 | 5 | 8.2 |
| You can spare enough time for yourself. | 34 | 55.7 | 13 | 21.3 | 9 | 14.8 | 3 | 4.9 | 2 | 3.3 |
| You get bored studying. | 6 | 9.8 | 6 | 9.8 | 10 | 16.4 | 23 | 37.7 | 16 | 26.2 |
| You recommend to continues in E-learning in the next years | 24 | 39.3 | 19 | 31.1 | 7 | 11.5 | 8 | 13.1 | 3 | 4.9 |
| Waste of time learning | 3 | 4.9 | 3 | 4.9 | 9 | 14.8 | 20 | 32.8 | 26 | 42.6 |
| Modifying to your experience | 17 | 27.9 | 25 | 41 | 17 | 27.9 | 1 | 1.6 | 1 | 1.6 |
| During your study online, Do you face one of these problems below? | | | | | | | | | | |
| Absence or shortage of internet. | 18 | 29.5 | 16 | 26.2 | 23 | 37.7 | 1 | 1.6 | 3 | 4.9 |
| The slowness of help provided by (LMS) staff. | 7 | 11.5 | 11 | 18 | 18 | 29.5 | 15 | 24.6 | 10 | 16.4 |
| Inflexibility in dealing with (MOODLE). | 8 | 13.1 | 7 | 11.5 | 25 | 41 | 15 | 24.6 | 6 | 9.8 |
| Difficult Access to online learning tools. | 6 | 9.8 | 9 | 14.8 | 20 | 32.8 | 19 | 31.1 | 7 | 11.5 |
| Lack of personal training in online learning technology. | 7 | 11.5 | 11 | 18 | 26 | 42.6 | 11 | 18 | 6 | 9.8 |
| During your study online, Do you face one of these problems in solving the assignments? | | | | | | | | | | |
| Non-interactivity with lecturer to correct the assignments. | 1 | 1.6 | 4 | 6.6 | 24 | 39.3 | 18 | 29.5 | 14 | 23 |
| Lack of skills required to solve the assignments. | 3 | 4.9 | 7 | 11.5 | 34 | 55.7 | 12 | 19.7 | 5 | 8.2 |
| Misunderstanding of some assignment requirements. | 2 | 3.3 | 5 | 8.2 | 20 | 32.8 | 23 | 37.7 | 11 | 18 |
| Uncertainty of how to solve one of the assignment aspects. | 2 | 3.3 | 11 | 18 | 24 | 39.3 | 21 | 34.4 | 5 | 8.2 |
| Following a wrong route during the drawing the assignment. | 0 | 0 | 10 | 16.4 | 18 | 29.5 | 25 | 41 | 8 | 13.1 |

Where (A) = Extremely Agree- (B) = Agree- (C) = Average- (D) = Disagree- (F) = Extremely Disagree
(N)= No. of Answers.

Source: by Author.

(C)-The third part is statistical analysis and discussion for the online questionnaire using a five-point rating scale (Likert), which is (Extremely Agree-Agree-Average-Disagree-Extremely Disagree), then Calculated the Mean Value for Each Indicator by Using the Statistical Analysis Program (SPSS), and then Calculated the Relative Importance Index (RII). Also, discussing the final result for the two courses to evaluate the operation model effectiveness.

3. Architecture Studio between Traditional and Online

The discipline of architecture education known to associate itself with the design studio approach. The terminology design studio refers to both the implemented teaching and the physical environment. Modern design educational principles encourage combining arts with up-to-date practices (Nerdinger, 1985) through a range of learning methodology that brings together lecture courses (theory) and workshops (practice).

3.1 Traditional Studio for architecture

The studio learning methods in the design and building construction education considers the prevailing mechanism for learning over generations, these studios became an example of architecture signature pedagogy; a concept defined as “types of teaching that organize the fundamental ways in which future practitioners are educated for their new professions” (Shulman, 2005). From this point of view, the Royal Institute of British Architects (RIBA) states in 2011 validation criteria for undergraduate courses in architecture that they should consist of at least 50% design studio projects (RIBA, 2014).

3.2 online-learning Studio for architecture

In fact, online learning not considered a new mechanism for learning, whereas, the first educational platform applied in the 1960s at the University of Illinois by using radio technology (Bitzer, 1986). With the rise of the internet and personal computers recently, this approach began to spread and become an approved mechanism for education in many universities, and the US approved the online- learning architectural education certificate in March 2020 by issuing a comprehensive guide that determines the criteria for the accreditation of these certificates (GTOS, 2020). After (COVID-19) Pandemic, online learning becomes the only alternative method to overcome and crossing the physical boundaries imposed by this epidemic. Architecture education is a communication process through an exchange of mainly visual messages. From this point of view, Laswell’s mass communication model (who? say what? In which channel? To whom? With what effect?) is considered a convenient tool to apply this concept in architecture e-learning (Severin, W.J. & Thankard, J.W.Jr., 1992).

Building construction courses require not only understanding the complex relationships between functional, technical, performance, and physical aspects of the different buildings types and function but also the aesthetic aspect, so, these courses depend on interaction and experience between the lecturer and students, therefore, the e-learning model must concentrate in technology tools not only in technology itself to achieve the aims of these courses.

4. Research in Architecture Discipline

The relation between research and teaching is complex in nature in the higher education environment particularly in the architecture discipline because it is not depend only on the theoretical study but also on practice (Jenkins, 2004), where the research must lead to measurable, reliable, rational, and reproducible results. Research preparation by students in architecture schools is mandatory to develop the intellectual capacity for them to link the theoretical aspects with the practical ones especially in building construction courses.

4.1 relationship between architectural education and research

The relation between architectural education and research consider the magic key to achieve integration between learning and practice (Roberts, 2007) , in fact, architecture is multi-discipline science, as a result of the relation between architecture and social, physical, economic, and environmental sciences therefore, usually, there is no specific methodology can be applied. Even though most of the architecture researches are oriented towards applying knowledge related to other disciplines rather than creating knowledge, for instance, the application of nanotechnology in construction material to improve its properties (Griffiths, 2004).

There are four essential fields in architectural research as (Jenkins, 2004): building construction and materials, social science, art, and humanities science. Indeed, the first field always attracts the height degree of funding. Building construction researches associated with the scientific properties of materials, so it involves quantitative measurement and monitoring of some phenomena (Griffiths, 2004).

4.2 Building Construction and Material Courses as a research

Most of the lecturer of building construction and material courses is also practitioners of architecture in the market, that may lead to generate an innovation works especially in execution and finishing phases in the projects, which could be considered as important research points available to discuss and analysis between the lecturer and students, hence, these courses must include researches as assignments besides the working drawings for many reasons:

- Improving the student's intellectual capabilities
- Motivating the student to be creative
- Connecting the student to the labor market
- Introduce students to modern technologies and materials in this field

From this point of view, research in these courses consider the key to expand the boundaries of knowledge for the students beyond the basic solution of the traditional problems. Furthermore, it could bridge the gap between architectural education and the architecture profession. Practice-based research and research-led teaching are the ideal methodology and technique for these curriculums because, “students learn about research findings. The curriculum may be based around staff research interests, and the principal mode of teaching is the transfer of information from teacher to student” (Healey M(2005 ,) Healey M(2006 , .

5. Modern Academy Experience in Online Learning

The academy accepts more than 1200 fresh students each year; the architecture department acquires about 300 students every year from the total number of students applying to the institute. After (WHO) announced the covid-19 as a global pandemic, the ministry of higher education decided to transfer to the online learning platform. When the academy received this mandate officially, the Head of the Architecture Department dealt with it as a crisis especially with the huge number of students in the architecture department. On this basis, Four questions were discussed in the architecture department council as follow: (1) how can we use our available resources to transfer to an online- learning environment?, (2) what is the new priorities to achieve the educational process?, (3) how can design and building construction courses be taught throughout online platforms?, and (4) how can we develop the curriculums to face this challenge?. The department council assigned each curriculum professor to present a proposal explaining the answers to these questions.

5.1 Building Construction's Lecturers Proposal

Building construction's lecturers faced many challenges during preparing the proposal, especially, that architectural education linked with studio-based teaching which considers the common method for education, that provide direct interaction between the lecturer and students ([Schenkman, 1955](#)), the following strategies have been implemented by lecturers to answer architecture department council questions and to overcome this challenge.

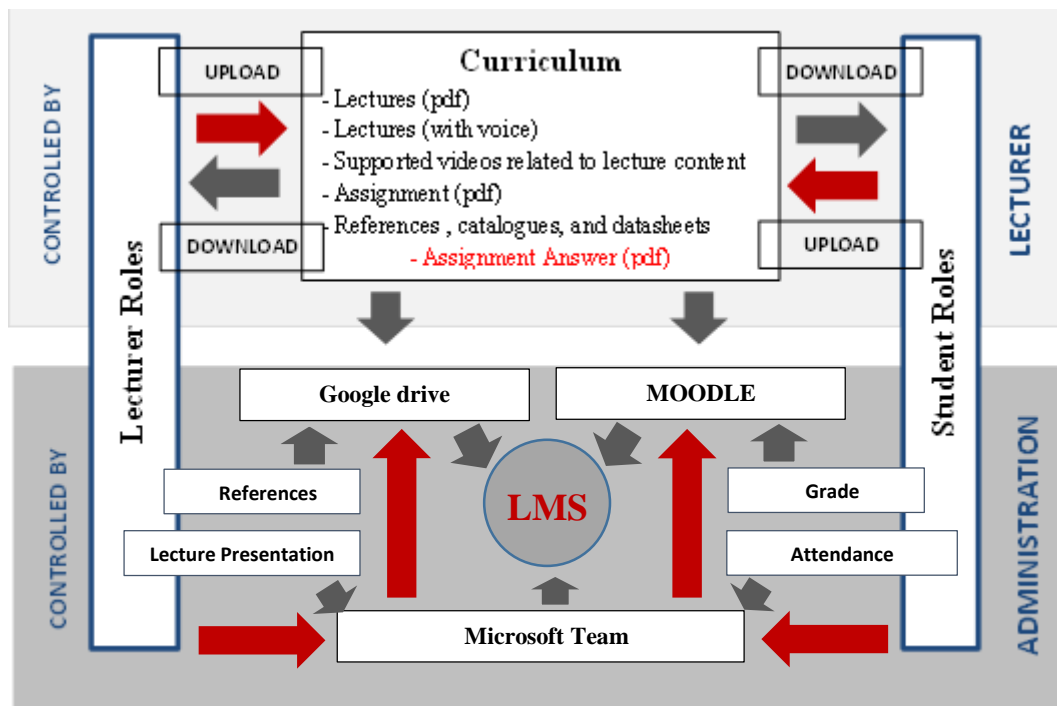
1- Developing the educational process through course syllabus, course learning outcome, and learning management system as illustrated in **Table (3)**,

2- Propose an operational model depend on "Laswell's mass communication model concept" to be able to: (a) deal with day-to-day students problems ([WCED, accessed on August 2020](#)), (b) improve students understanding and productivity, provide flexibility in the communication between lecturer and students, (c) encourage student for innovation, (d) provide experiential problem-based teaching environment ([Mayer, 2005](#)) ([Sidawi, 2012](#)), (e) and achieve integrated relation between lecturer, students, LMS, and institute administration, as illustrated in **Figure (1)**.

Table (3). Developing the Educational Process

| Subject | Action |
|---|---|
| <ul style="list-style-type: none"> • Course syllabus | <ul style="list-style-type: none"> • Grade distribution: 50% year work and 50% final research, • Using Practice-based research and research-led teaching methodology, • Assignments must be uploaded in (MOODLE), • Providing technical videos related to lecture subject uploaded in (MOODLE), • Providing references, datasheets, and catalogs as (GOOGLE DRIVE LINKS), • Discuss the lecture and assignments in (MICROSOFT TEAM PROGRAM). |
| <ul style="list-style-type: none"> • Course learning outcome | <ul style="list-style-type: none"> • Knowledge and understanding: Demonstrate the principles of building technologies in using different materials, process assembly, and classify the different components of construction materials. • Intellectual skills: analyzing and solving building structural problems, applying innovative materials, express description of the chosen material, and solving construction and finishing joints. • Professional skills: Interpret technical drawings using manual drawing techniques, Identify installation problems on-site, and Produce professional execution drawings for a small project. • General skills: Work in an unconventional environment, Discuss and present ideas in a professional manner, Seek plans and meet them with a deadline (time management), and Listen and critically respond to the views of others |
| <ul style="list-style-type: none"> • Learning and management system(LMS) | <ul style="list-style-type: none"> • Providing academic email for staff and students, • Using (MOODLE) as a platform, and uploading course schedule, lectures, assignments, and references by the lecturer, • Consider (MICROSOFT TEAM PROGRAM) the official channel to discuss lectures, and link it with (MOODLE). |

Source: by Author



Source: by Author

Figure (1). The Operational Model for Developing the Educational Process

The Operation Model is activated through 4 stakeholders the lecturer, students, LMS, and administration. The Role of each one can be describe as:

- **Student role:** student must activate the academic email, download the course schedule, download the lecture package (lecture pdf, lecture with voice, the supported videos, and the assignment) weekly, hear the lecture, and prepare the notes one day before the lecture in Microsoft team, attend the lecture in Microsoft team to discuss the lecture notes with the lecturer, and upload the assignment in Moodle in the determined time.
- **Lecturer role:** provide the lecture packages and upload it in Moodle, discuss the student's notes in Microsoft team, correct the assignments, and prepare feedback to the students for the common mistakes in the assignment.
- **LMS role:** provide a manual for the students and lecturer in how they can deal with the operation model, provide immediate technical support for both lecturer and students, and monitor (LMS) system to avoid any failure.
- **Administration role:** provide financial support to LMS to update the tools (computer, routers, networks, software), monitor the educational process, follow the regulations of the ministry of higher education, and manipulate any gap that may be occurred in the operation model.

The overall objective of the implemented strategies is to enhance and expand the education process in the building construction courses within a virtual studio instead of the traditional one through the development of the course's curriculum and the suggested operation model.

Strategies goals include:

- Using the available resources including computer labs, and academic staff,
- Provide social support for students and consider that as a priority issue,

- Provide technical solutions by (LMS) for the student during using the e-learning platform,
- Develop technical videos within 3d models or you-tube links related to lectures,
- Achieve Integration in administrative, curricular, and communicative infrastructure for the department (Patel, 2019).
- Develop virtual class to engage lecture and discussion between students and lecturer to achieve continuous evaluation and feedback therefore, promote deep learning (Renée M. Filius1, 17 March 2019).

5.2 Online Questionnaire Analysis

The data collected through an online questionnaire to the students who attended the architectural Construction and Building Materials Courses 1 and 2. Which taught using the E-Learning method. The Research Obtained a Sample of answers from (61) Students in order to examine the efficiency and deficiencies of online-learning in the course curriculum and to scale the student's perception, response, and performance.

The collected data were analyzed and conclude the Mean Value for Each Indicator using the Statistical Analysis Program (SPSS), then calculated the Relative Importance Index (RII) using (Likert) classification (k) as (Ankur Joshi, 2015): "5" extremely agree, "4" agree, "3" average, "2" disagree, and "1" extremely disagree, and examine the results by the equation below:

$$RII (\%) = \frac{n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)} * 100 \text{ (R., 1932).}$$

Where n_1 , n_2 , n_3 , n_4 , and n_5 are the numbers of the students who scored "1" extremely disagree, "2" disagree, "3" average, "4" agree, and "5" extremely agree. Then the study set the Importance level as follow (Hatkar K., Hedao N., 2016):

- RII = 0 : 0.20 = Importance level (Low = L)
- RII = 0.21 : 0.40 = Importance level (Medium low = M-L)
- RII = 0.41 : 0.60 = Importance level (Medium = M)
- RII = 0.61 : 0.80 = Importance level (Medium high = M-H)
- RII = 0.81 : 1.00 = Importance level (High = H)

The results of the Questionnaire was summarized as shown in **Table (4)** for the first Axis (the learning outcome ratios), and **Table (5)** for the second Axis (evaluate the efficiency and weakness of online learning through students opinion).

Table (4): Results for the First Axis

| Knowledge and Understanding (Lectures) | | | |
|---|-------------|--------------|-------------------------|
| | Mean | (RII) | Importance level |
| Isolation. | 4.43 | 0.89 | H |
| Construction and Finishing joints. | 4.00 | 0.80 | M_H |
| Internal treatments for (floors, walls, ceiling). | 4.20 | 0.84 | H |
| Stairs (concrete, wooden, steel). | 4.46 | 0.89 | H |
| Wooden connections. | 4.56 | 0.91 | H |
| Opening (windows, doors). | 4.44 | 0.89 | H |
| Short span structure systems. | 4.05 | 0.78 | M_H |
| Introduction to working drawing. | 4.51 | 0.90 | H |
| Intellectual Skills | | | |
| Analyze building elements. | 4.10 | 0.82 | H |
| Solve building structural problems. | 3.74 | 0.75 | M_H |
| Apply innovative materials. | 3.82 | 0.76 | M_H |
| Apply the knowledge of working drawings. | 4.25 | 0.85 | H |
| Express description of the chosen material. | 3.89 | 0.78 | M_H |
| Design and solve the joints between finishing materials. | 3.80 | 0.76 | M_H |
| Professional Skills | | | |
| Interpret technical drawings using manual drawing techniques. | 4.08 | 0.82 | H |
| Select materials that are suitable for specific purposes. | 4.03 | 0.81 | H |
| Identify installation problems on site. | 3.62 | 0.72 | M_H |
| Produce professional execution drawings for a small project. | 4.48 | 0.90 | H |
| General Skills | | | |
| Work in an unconventional environment. | 4.11 | 0.82 | H |
| Understanding of professional conduct and ethical responsibility. | 4.48 | 0.90 | H |
| Discuss and present ideas in a professional manner. | 4.44 | 0.89 | H |
| Use modern materials required for sound professional practice. | 4.26 | 0.85 | H |
| Seek plans and meet them with a deadline (time management). | 4.21 | 0.84 | H |
| Listen and critically respond to the views of others. | 4.20 | 0.84 | H |

(L) = Low, (M-L) = Medium low, (M) = Medium, (M-H) = Medium High, (H) = High

Source: by Author

Table (5): Results for the Second Axis

| Do you find Online learning provides these substances? | | | |
|--|-------------|--------------|-------------------------|
| | Mean | (RII) | Importance level |
| Effective like traditional education. | 3.64 | 0.73 | M_H |
| Increases your self-confidence. | 3.92 | 0.78 | M_H |
| Provide enough feedback to you from the lecturer. | 3.85 | 0.77 | M_H |
| Support communication with the lecturer. | 4.11 | 0.82 | H |
| Encourages you to research. | 4.39 | 0.88 | H |
| Express your interpretations more freely. | 4.03 | 0.81 | H |
| Promotes a sense of responsibility. | 4.08 | 0.82 | H |
| Affects negatively in working as teamwork. | 3.26 | 0.65 | M_H |
| You can spare enough time for yourself. | 4.21 | 0.84 | H |
| You get bored studying. | 2.39 | 0.48 | M |
| You recommend to continues in online learning in the next years | 3.87 | 0.77 | M_H |
| Waste of time learning | 1.97 | 0.39 | M_L |
| Modifying to your experience | 3.92 | 0.78 | M_H |
| During your study online, Do you face one of these problems below? | | | |
| Absence or shortage of internet. | 3.74 | 0.75 | M_H |
| The slowness of help provided by (LMS) staff. | 2.84 | 0.57 | M |
| Inflexibility in dealing with (MOODLE). | 2.93 | 0.59 | M |
| Difficult Access to online learning tools. | 2.80 | 0.56 | M |
| Lack of personal training in online learning technology. | 3.03 | 0.61 | M_H |
| During your study online, Do you face one of these problems in solving (drawing) the assignments? | | | |
| Non-interactivity with the lecturer to correct the assignments. | 2.34 | 0.47 | M |
| Lack of skills required to solve the assignments. | 2.85 | 0.57 | M |
| Misunderstanding of some assignment requirements. | 2.41 | 0.48 | M |
| Uncertainty of how to solve one of the assignment aspects | 2.77 | 0.55 | M |
| Following a wrong route during the drawing the assignment | 2.49 | 0.50 | M |

(L) = Low, (M-L) = Medium low, (M) = Medium, (M-H) = Medium High, (H) = High

Source: by Author

Table (4) analysis for the First Axis (the learning outcome ratios) shows that:

- The overall average of Learning Outcome (ILO) achieved for Knowledge and Understanding (87%) and the Importance level for all the lectures are (H) except Construction and Finishing joints, and Short span structure systems lectures were (M-H), which reflect the

high understanding of the students for the course content, the clearness of the course curriculum represented in (lectures, supported videos links, catalogs, and references), and the good communication and interaction between the lecturer and students during the time of lecture in Microsoft Team,

- The overall average of learning outcome (ILO) achieved for Intellectual Skills (78.5%) and Importance level for all the skills indicators are (M-H) except analyze building elements and apply the knowledge of working drawings was (H), the reason for the decline of the (ILO) for Intellectual Skills, that the development of these skills especially for the students in Sophomore year need to improve the ability of them by self-research, using Practice-based research methodology, direct interaction with the lecturer “face-to-face” to transfer the experience, the lack of feedback, and provide experiential problem-based teaching environment, which is considered weak points in the virtual studio,
- The overall average of learning outcome (ILO) achieved for Professional Skills (81.5%) and Importance level for all the skills indicators are (H) except identifying installation problems on-site was (M-H), which demonstrate that the uploaded catalogs, datasheets, and references were directly related to lectures content, therefore, support the students to understand and apply the principles, functions, and proprieties of the materials deeply,
- The overall average of learning outcome (ILO) achieved for General Skills (85.6%) and Importance level for all the skills indicators are (H) that means the great success of the operation model in achieving the commitment between lecturer and students particularly in work at the unconventional environment, understanding of the professional conduct, and time management.

Table (5) analysis for the Second Axis (evaluate the efficiency and weakness of online-learning through students opinion) shows that :

- Regarding the Evaluation of the E-Learning process, the results ranged between (H) for four indicators and (M-H) for six indicators, that reflect not only the acceptance of the students for the on-line learning direction but also the appropriation to continues in online learning in the next years, the effectiveness and efficiency of the operation model, and the integration between lecturer, students, LMS, and institute administration. In addition, the indicator (You get bored studying) received (M) value because of the long class time, and the weakens of the social communication between the students.
- The answers obtained from the students about the Technical Problem during E-Learning ranged between (M-H) for two indicators, and (M) for three indicators, that illustrate, despite the high understanding of the content of the lecture by the students, and students confidence in the E-learning approach as mentioned above, but the weakness in internet network reflected directly on the educational process, for instance, students faced some problems in access to Moodle and Microsoft team especially whom leave in villages of Upper Egypt.
- Referring to the assessment for the Students response to the Assignments, all the indicators were (M), and that occurred for many reasons as follow:
 - The ability of the students to deal with e-learning tools still need development,

- Moodle lack the visual and drawing tools considered mandatory for architecture education (Juvancic, M., Mullins, M., & Zupancic, T., 2012).
- The students could not communicate or directly interact with the lecturer in order to get feedback.

5.3 Final results Analysis for two Consecutive Courses

This part of the study discusses the final results for two consecutive courses (ARC311-Spring) and (ARC312 - Summer) for building construction and materials (1 and 2) for a sample consist of (61) students attended the two courses and using an online learning platform as an alternative method for education as illustrated in **Figure (2)**.

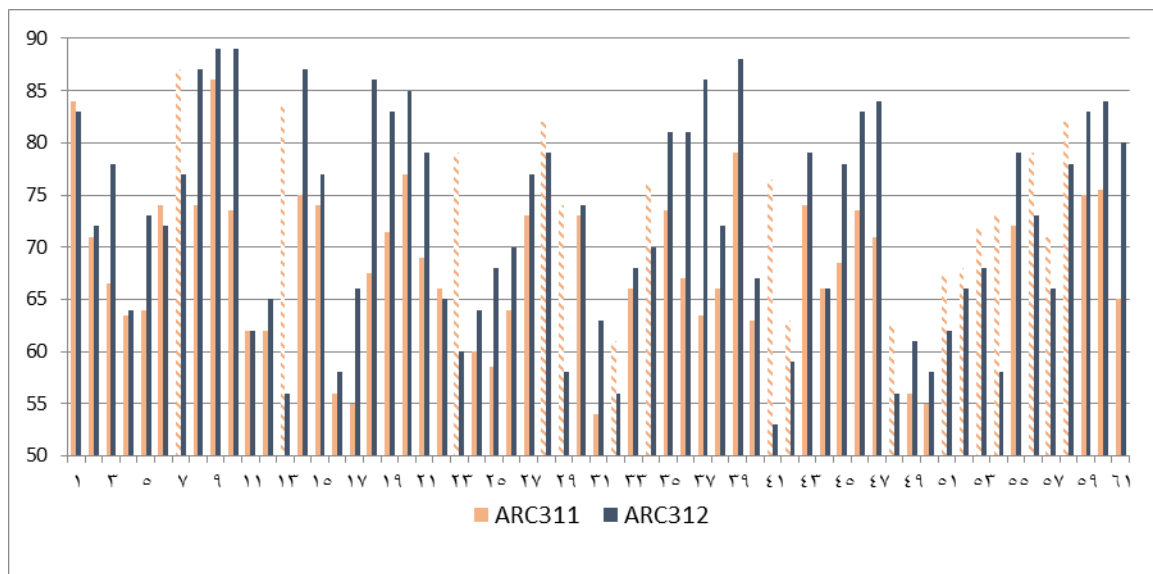


Figure (2). The Final Results for Two Consecutive Courses (ARC311) & (ARC312)

Figure (2) analysis for the final results for two consecutive courses (ARC311- Spring) and (ARC312 - Summer) for Building Construction and Materials (1 and 2) shows that:

- The comparison between the two courses illustrates that the grade of (44) student was improved significantly in (ARC312) with overall percentage (72.2%), and the grade for (17) student was decreased with overall percentage (27.8%), the drop in the results for these students occurred for many reasons, for instance, (5) students faced health problems, and (4) students faced technical problems in them laptops.

6. Results

The results can be classified into three issues, The First issue related to the theoretical issue, it can be concluded that: Research preparation by students in architecture schools is mandatory to develop the intellectual skills for them to link the theoretical aspects with the practical one especially in building construction courses, in addition, Practice-based research and research-led teaching are the ideal methodology and technique for these curriculums. Laswell's Mass Communication Model is considered a convenient tool to be applied in architecture e-learning, in this context, Building construction courses require to depend on interaction and

experience between the lecturer and students, therefore, the e-learning model must concentrate on technology tools not only in technology itself to achieve the aims of these courses.

The Second issue concerned with Online Questionnaire Analysis, it can be conclude that: (ILO) achieved for Knowledge and Understanding (87%) which reflect the high understanding of the students for the course principles. (ILO) achieved for Intellectual Skills (78.5%), the main reason for the decline of the (ILO) for it, that the development of these skills especially for the students in Sophomore year need direct interaction with the lecturer “face-to-face” to transfer the experience. (ILO) achieved for Professional Skills (81.5%), which demonstrates that the uploaded course materials were directly related to lectures content, therefore, support the students to understand and apply the principles, functions, and proprieties of the materials deeply. (ILO) achieved for General Skills (85.6%), which confirms the great success of the operation model in achieving the commitment between lecturer and students particularly in work in the unconventional environment, understanding of the professional conduct, and time management.

On the other hand, the evaluation of the E-Learning process form students point of views, it was determined that the majority of them express that:

- the acceptance of the students for the on-line learning direction and the appropriation to continues in online learning in the next years,
- The students get bored studying, because of the long classes time, and the weakens of the social communication between the students,
- the weakness in the internet network reflected directly on the educational process, for instance, students faced some problems in access to Moodle and Microsoft team especially who leave in villages of Upper Egypt,
- The ability of the students to deal with e-learning tools still need development,
- The students could not communicate easily or direct interactions with the lecturer in order to get feedback.

The third issue related to results Analysis for two Consecutive Courses, which reflect that: the students succeed in the deal with operation Moodle, the deep understanding of the principles of the course, the great efforts achieved by the administration and (LMS) to support both students and lecturers in the educational process through the operation model.

7. Conclusion

The study reflects the satisfaction of the students in online e-learning, and their experience with the operational model is quite good, in addition, the e-learning offers opportunities for students and the lecturer to know each other better, furthermore, the research clarifies that there are negative aspects in e-learning specially in design and building construction courses, the most important negative aspect was the lack of direct interaction and commination between the students and lecturer which considered a critical issue in the architecture education process, where the direct interaction or the “face-to-face” discussion between the students and the lecturer improve the intellectual skills for the students by transfer the lecturer’s practical experience for them, therefore, developing the student's ability for innovation and creativity. also, teaching research methods course in the first year must be

mandatory to enhance research skills for the students, thus, reducing the gap between the theoretical study and the practical one particularly in building construction and design courses.

Furthermore, if we consider that the e-learning system the lifebuoy to overcome this pandemic nowadays, it may be accepted, but in the future, more procedures must be taken to continue in this method of education, for instance, improve the internet services, decrease the lecture time in Microsoft team, provide smart technology to the lecturer Congruent with the architecture education needs, more training is needed for both students and lecturers not only to use the technology but also to deal with its tools in a smart way, continues development for courses including course syllabus is required, manipulate the lack in feedback process between lecturer and students by using smart communication programs like WhatsApp, continues evaluation for the courses by the quality unit is required every semester to develop the educational process by e-learning system. Finally, from the researcher's point of view, direct interaction and communication between students and the lecturer are too important in design and building construction courses, otherwise, the graduated architects in the near future will lose the ability for innovation and creativity, which consider the main aspect of the architect. This problem could be solving by using a hybrid education system after the end of the epidemic.

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