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Examining the impact of students' ratings of architectural design studio on graduation project before and midst COVID-19

An exploratory study on Egyptian sophomore architecture students

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Abstract:

The interest in architectural design education is the haven for the development of the profession of the architect; the architectural-design-studio is the key-stone in architectural education, the design process in the labor market or in the design studio, is an intertwined process. Thus, the design studio needs more quantitative studies that study the performance of architecture students, in addition to the problem of the emergence of the COVID 19 epidemic requires contemporary studies to determine its impact on the architectural design studio. The study key objective is to investigate the association between sophomore-level students' scores (SLOS)/Design studio 2 (DS.2)/Design studio 3 (DS.3) and graduation-project overall-scores (GPOS), furthermore, the study aims to examine the relationship between the overall-scores of the graduation project students during and before COVID-19, to test the gender differences in the graduation project one of the key objectives of this study, the current study is a quantitative study conducted on 96 students of the architecture program in Canadian-international-collage (CIC), Egypt. The students' scores were tracked from Fall-2013 to Spring-2020, the study hypotheses consisted of 28 hypotheses. The study adopted a methodology consisting of three stages: 1. Dataset Processing, 2. Dataset Mining, 3. Data Analysis. SPSS v.20 utilized in the previous stages. Statistical tests related to quantitative data were used to examine the results (ANOVA, T-test, Pearson, and Spearman). The required assumptions for aforementioned test inspected. The results showed a direct proportion between SLOS and GPOS, and there were statistically significant differences between overall-scores during COVID-19 (C19GPOS) and before COVID-19 (NC19GPOS). The results of the statistical tests revealed the progress of COVID-19 students in scores compared to the rest of the students who studied in the conventional design studio, obviously, no significant differences between gender and the graduation project scores noticed. The results showed that students with good grades and pass grades in the sophomore-design-studio their grades in the graduation project rise to very good, while the grades of very good students remain the same, students of excellent grade, their grades remain the same value with a clear decrease.

Keywords:

Architectural design studio, graduation project, architectural students' score, sophomore level student

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Introduction:

Higher education needs many intensive studies, given its importance in preparing students for the marketplace, in the 2018/2019 year the number of students admitted to higher education in Egypt was 817225 students, additionally, 2624705 students enrolled in the university education in the same year, the number of students enrolled in private institutes in the field of engineering and construction is 83050 students[1]. The exceptional circumstances resulting from COVID-19 led to many difficulties in the architectural design studio, not all architecture colleges were fully equipped to deal with online teaching, curricula need to be updated and teaching methods require further development, to suit the post-COVID-19 era. No final solutions have yet been found in architectural design studios on the ideal mechanism for post-COVID-19 design studio[2]. The whole world was affected during COVID-19, the design studio turned into an electronic design studio, new technologies and means of communication have been used as communication mechanisms between students and design studio tutors[3]. Few studies have dealt with the impact of COVID-19 on architecture, given the novelty of the resulting exceptional case; some studies have discussed the opportunities that architecture offers to improve human health in conditions of epidemics[4]. Some educational proposals were made appropriate to the conditions of distance education during COVID-19, over and above, educational approaches were proposed to adapt to the state of non-direct communication with students in the design studio[5]. Thus, it is clear that the design studio has been investigated in several studies, but

the study of the relationship of the academic level of the sophomore-student and its effect on the academic level when graduating in the design studio has not been covered in previous studies, which represents a knowledge gap that the current study will try to start filling.

Architectural education goes deep into history, historically, Imhotep was the first architect ever, followed by other architects such as Bek and Senmut who were the architects of King-Akhenaten and Queen-Hatshepsut respectively, Newly, the design studio became the adopted form in the architectural schools, the key focus of architectural education is the design studio[6], and the design studio went through many historical stages, until it reached its current, contemporary form. Furthermore, the design studio evolved until it reached full-distance education as a result of the COVID-19. The insights of the initial architectural design studio (ADS) began in Italy in the 15th century[7], and then the regular ADS began in France in the 19th century[8]. When it comes to mentioning when the first architecture program began, it must be mentioned that this happened at the University of Oregon in the early 20th century[9], Ciravoğlu, A. (2014) indicated that the design studio in this early period was not the same as the design studio now, and the student presence, the number of design courses, and the relationship between tutors and architecture students were not the same as the current design studio[1] . In ADS, the success of architecture students is examined[1] , the effect of the student's creative, cognitive and visual abilities on their performance in the studio are investigated[1] . Overall, the ADS development has been used as a tool to improve the architectural design process. The importance of ADS due to the fact that the student receives and practices the design process through direct communication with design experts[1] . In the ADS, social interaction takes place between all parties, which forms the personality of student[1] . Some scholars tried to explain why students of architecture in the design studio could not finish tasks on time, and it was suggested to install a group of students during the architectural design studio[1] .

Incorporating creativity and rationality into a design studio is suggested as a method to develop a design studio[1] . The experiences of cooperation in the design studio showed a positive attitude of students[1] , over and above the cooperation in project between students that helps them in their architectural maturity, which in turn strengthens and develops their architectural characteristics, it supports the self-sufficiency and their ability to solve sophisticated architectural problematic[1] . The incorporation and use of E-portfolio in ADS is illustrated, furthermore, the various aspects of its application in ADS are explained[1] . Zairul, M. (2020) discusses the modern methods that increase students' enthusiasm and advance their architectural level in Design Studio[2] , an experiment proposed integrating construction-crafts in the design studio, this experiment was tested by applying it to a group of design studio students, and comparing it to another group that was not applied to them, the results of this experiment confirmed that the students who were experimented had their performance developed, additionally, the results explained the difficulties arising from the experiment[2] . Student work through the group system was examined in a previous study[2] .

The cultural and economic backgrounds of architecture students and its impact on the performance of students is the main topic of previous study, this backgrounds studied through a survey of the design studio instructors[2] .The cooperation between students as a strategy for working in the design studio was measured, the outputs resulting from it and the students' opinions that emerged from this experience examined[2] . Maximizing the benefits of the first phase of the graduation project (data collection) in the remaining stages was discussed[2] . Various organizational methods have been implemented in the graduation project, with the aim of reaching the best organizational method, to be employed in future architectural graduation projects. [2] . The various educational methods were also discussed from the point of view of graduation project supervisors[2] . Addressing the differences between what is taught in architectural education and the marketplace was conducted through a survey on graduate students via a questionnaire study[2] . Students in design studio 1, and the sophomore-level design studio require special attention. The prime challenge in these studios is that the architectural students' knowledge is limited. An experimental educational approach is suggested to address this challenge[2] . The various educational experiences in the sophomore-level of ADS were discussed[3] , there are many teaching and training challenges during the sophomore-level design studio[3] , besides, the different aspects of the engineering design studio were explained[3] . The design studio environment and its effect on architecture students' performance and satisfaction were examined[3] . sounds influence on the

development of the design process for students previously studied[3] , the final year of architecture students examined, in addition to, the courses in terms of their inclusion of modern trends in architecture reviewed[3] . The critique is illustrated in the design studio based on peer criticism, as a suggested method for instruction in the architectural design studio[3] .

Virtual-reality (VR) has been proposed as a method for fully teaching in all stages of design as a tool for developing the capabilities of architecture students[3] . The various VR, augmented-reality (AR) systems were shed in the design studio, the VR; AR technology has a distinct future in architectural design, and has not benefited from these technologies significantly until now[4] . A new technique in Augmented-communication has been described with an explanation of the criteria for its application in DS.2. The results indicated positive interaction of students with this technique and their grades affected positively after using this technique[4] . Another study examining VR showed students' positive evaluation of this experience, through a questionnaire about this experience in which it was found that the effect of this technology on it is positive and good[4] . In general, new experiences of VR are employed in the design process, and it turns out that they can be used to communicate the architectural concepts to clients, and some flaws appeared in these technologies, which are that they benefit only one customer at the same time[4] .

Blending the virtual-design-studio and the traditional design studio has been shown to have benefits; these benefits outweigh the benefits of both systems separately and lead to positive results with students[4] . The findings revealed that the use of a virtual design studio is appropriate to the architectural design process and meets its requirements[4] . Spatial-perception resulting from the use of VR and the description of how to utilize and adapt it in a design studio is the subject of previous research[4] . An experiment was conducted on architecture students in the first stage to develop the students' visual aspects[4] . The utilization of modern social-media in the ADS was discussed in a previous paper, in which the benefits of using these methods for ease of communication and follow-up of student projects were explained, and the results of this study discussed the effect of these methods on student success[5] . The results of a previous study indicated the need for online design studio tools for improvement, in order to facilitate the various design stages, to facilitate the process of project critique and students/supervisors communication[5] . Generally speaking, the design process in the labor market or in the design studio, is an intertwined process that includes vast information, and needs a countless decision-making, and these decisions lead to various design alternatives and wide solutions variety, this problem contributes to the complexity of the design process and huge diversity In the design alternatives, a prior study dealt with some modern methods that contribute to reducing these difficulties[5] . The effect of the various thinking approaches of architecture students on the performance in the design studio was examined previously, and the same previous study compared between two basic approaches, the first: some students adopt a design idea since the beginning of the project that controls their solutions at all project stages, and the second: the students who develop their idea based on directions instructors and the data extracted from the project, this study results indicated that the second type has better results than the first type[5] . Emphasis was placed on the integration of the design phases in the design studio projects; moreover, various strategies were clarified to ensure the occurrence of feedback between the phases of the design process[5] . Deamer, P. (2020) critiquing the design studio as it is now and explaining that it ignores some considerations as well, drawing attention to societal and urban problems that the design studio should be concerned with[5] . The design stages in the design studio require methods that suit the nature of each stage[5] . The students' scores were addressed in the design studio and studied, and it was taken as a criterion for determining the competence of architecture students in the design studio[5] . Most architecture instructors tend to think that the final grades are a main indicator for measuring the progress of students[6] , and from this stems the importance of the current study.

1.1 The importance and distinction of the study

The design studio represents the largest percentage of credit-hours in the student's educational history; correspondingly, it represents the largest number of contact-hours between the student and the teacher. All architectural courses develop the student's abilities, skills and knowledge to improve his/her performance in the design studio. ADS are the beating heart of architectural education, undoubtedly, if the studio successfully communicates its message to architecture students, this leads to the improvement of the architecture profession. ADS constitutes the architecture profession future. The significance of the current study is also evidenced by the apparent dearth of

studies dealing with students' grades through examination and analysis.

1.2 Objectives/questions/hypotheses of the study:

The study key objective is examining the relationship between, Sophomore-level, design2, design3 course-work scores (SLCS, D2CS, D3CS), Sophomore-level, design2, design3 final-term scores (SLFS, D2FS, D3FS), Sophomore-level, design2, design3 overall-scores (SLOS, D2OS, D3OS), and Graduation project course-work, final-jury, overall-scores (GPCS, GPFS, GPOS). The key objective is divided into four sub-objectives, based on it research questions and hypotheses were presented to reach these goals. The objectives, questions, and hypotheses will be studied consecutively as follows**:**

O1. Examine the association between students' ratings in sophomore (SLOS) level and scores of the graduation project.

Q1: *Is there a correlation between (SLCS) vs. GPCS?*

H1: There's a correlation between (SLCS) and (GPCS)

H1a: There's a correlation between (D2CS) and (GPCS)

H1b: There's a correlation between (D3CS) and (GPCS)

Q2: *Is there a correlation between SLFS vs. GPFS?*

H2: There's a correlation between (SLFS) and (GPFS)

H2a: There's a correlation between (D2FS) and (GPFS)

H2b: There's a correlation between (D3FS) and (GPFS)

Q3: *Is there a correlation between SLOS vs. GPOS?*

H3: There's a correlation between (SLOS) and (GPOS)

H3a: There's a correlation between (D2OS) and (GPOS)

H3b: There's a correlation between (D3OS) and (GPOS)

Q4,5,6,7,8,9: *Is there a correlating between SLCS, SLFS, SLOS vs. GPFS, GPCS, GPOS?*

H4: There's a correlation between (SLCS) and (GPFS)

H5: There's a correlation between (SLCS) and (GPOS)

H6: There's a correlation between (SLFS) and (GPCS)

H7: There's a correlation between (SLFS) and (GPOS)

H8: There's a correlation between (SLOS) and (GPCS)

H9: There's a correlation between (SLOS) and (GPFS)

2. Study the relationship between students' scores in the graduation project before and during COVID-19

Q10: *Is there a correlating between C19GPOS/NC19GPOS?*

H10: There's a correlation between (C19GPOS) and (NC19GPOS)

H10a: There's a correlation between (C19GPFS) and (NC19GPFS)

H10b: There's a correlation between (C19GPOS) and (NC19GPOS)

3. Inspecting differences between the SLOS/GPOS and gender.

Q11: *Are there statistically significant differences between the Gender/scores of students in the mean of SLOS and GPOS?*

H11: There are statistically significant differences between gender in the mean of SLOS and GPOS.

Q11a: Are there statistically significant differences between D2OS and GPOS?

H11a: The mean of male and female (GPOS) are equal according to (D2OS)

Q11b: Are there statistically significant differences between grades D3OS and GPOS?

H11b: There are statistically significant differences between the mean (GPOS) according to (D3OS)

Q12: *Are the mean of GPOS equal based on SLOS?*

H12**:** The mean of (GPOS) is equal according to the different of (SLOS)

Q12a: *Are the mean of GPOS equal based on D2OS?*

H12a**:** The mean of (GPOS) is equal according to the different of (D2OS)

Q12b: Are the mean of GPOS equal based on D3OS?

H12b**:** The mean of (GPOS) are equal according to the different of (D3OS)

Q13*: is there a presence of an effect of (Gender, SLOS) intersection on (GPOS)*

H13: The presence of an effect of (Gender, SLOS) intersection on (GPOS)

Q13a: is there a presence of an effect of (Gender, D2OS) intersection on (GPOS)

H13a: The presence of an effect of (Gender, D2OS) intersection on (GPOS)

Q13b: is there a presence of an effect of (Gender, D3OS) intersection on (GPOS)

H13b: The presence of an effect of (Gender,

D3OS) intersection on (GPOS)

4. Investigating mean differences between (C19GPOS, NC19GPOS).

Q14: *Is the mean of (C19GPOS, NC19GPOS) different?*

H14: There are statistically significant differences between C19GPOS and NC19GPOS?

1.3 Study limits, community, samples

The statistical community for this study is the students of the Architecture program in Egypt, the statistical sample is the students of the Architecture program at (CIC)-Zayed campus, (CIC) was chosen, due to the confidentiality of the students' results, besides, the inability to reach the results of the students in the rest of the institutes of architectural education in Egypt. The students' sample who have completed the graduation project, the temporal limits of the study start from Sep.2013, the students to be researched are those who joined the Architecture program from the previous date to 2020, these students studied sophomore-design-courses in the academic years 2015/2016, 2016/2017, 2017/2018. While the students of the statistical sample studied the graduation project in the years 2017/2018 and 2018/2019. The students' teaching method in this period depends upon the conventional design studio, with project-based, while some students studied during COVID-19 in 2019/2020 based the online design studio.

2. Methods

The study was conducted on 96 students during four years for the same course in the same spatial conditions (the internal environment and the same educational conditions, the teaching methodology adopted in the sophomore design studio was done through the same instructor (author), the learning-styles theory was adopted as an approved methodology for teaching and criticism in the design studio, learning was carried out in all sophomore-studios with the same educational bylaw, over and above, the same projects studied for students and the function program is identical, also, further, the same climatic conditions. The current study is an extension of a previous study[6] that dealt with experimenting with teaching style in a sophomore design studio. Design courses were taught for the sophomore-level in the fall, while the graduation project was studied during the summer. Thus, the current study tried to neutralize external and internal factors, which may affect the student's academic level, so that the study accurately measures the effect of SLOS on GPOS without interfering with other influencing factors.

Quantitative studies are widely used in education studies, this study is a quantitative research that includes in its different parts three types (descriptive -correlational- comparison)[6 6] , the descriptive part of the study is that it studies the gender of students, as an independent variable, accordingly, the description of students' cases and the different students' scores presented, as in result (3.1), while in another part, the study is a quantitative-correlational study as it inspects the Cause-effect between students' ratings and scores, as evidenced in result (3.2), it is also a quantitative-comparative study where it compares the mean students' ratings and scores, as shown in result (3.3).

2.1 Processing dataset:

Student architectural data requested from student system administrators, provided data in the form of registration cases for all students, missing-data were completed from actual student grades register in the architecture department. Initially, the data was classified and filtered through Ms. Excel. Different cases of students were collected. In the same row, so that each row represents each student's courses scores separately, DS.2 and DS.3, and graduation project scores inserted in a separate column, dropout students omitted, the Quantitative variables utilized to achieve the study objectives, students' data were processed based on the quantitative/qualitative variables of the study, which are dependent variables (GPOS), and independent variables (SLOS, D2OS, D3OS, and Gender). The students were classified as follows: 1.FRESH students who did not join the course Previously, REPEATER students who enrolled in the course for the second time or more, the student considered withdrawing from the course as a failing student, and also classified students according to: (TRSFR) students transferred from corresponding departments in other colleges of architecture, and NOT-TRSFR students who started their first year in architecture majoring in the same college. The students' grades were also classified according to: the students who studied the graduation project during COVID-19 (C19GPOS), or students who studied the graduation project prior to COVID-19 (NC19GPOS). [1]

2.2 Mining dataset

Mining-dataset contributes to finding new data emanating from separate sets of data; in addition to that it contributes to the development of students 'performance, improves the systems of interaction between the parties of the design studio, and accordingly makes future decisions to improve students' performance and academic achievement based on actual data[6 6] . This phase [4 5] conducted Through SPSS v.20, the primary-data processing was carried out: by calculating the

average scores of the student's SLOS by calculating the mean scores of the student in DS.2 and DS.3 courses, course-work ratings were also calculated as this is not available in the students' results system. The student rating system as follows, from 50 points to 59 points=pass students (PS), 60 points to 74 points=good students (GS), 75 points to 89 points=V. good students (VS), 90 points to 100 points=excellent students (ES), In order to be successful, the student must obtain at least accepted grade (D-grade).

2.3 Data analysis

The appropriate statistical test selections are a vital topic in the studies in which statistics are used[6] . The wrong selections of the statistical test lead to statistical errors[6] . The independent t-test[7] was selected to inspect and compare the differences between two independent groups, so that one of them is of independent categories and the other is a dependent quantitative[6] , while the two-way ANOVA-test[6] was adopted, when comparing the differences between 3 independent groups, the first having independent categories and the other two quantitative. The previous two tests are parametric-tests, the use of parametric/non-parametric tests in which there is a considerable debate[7] , briefly, to use the prior parametric-tests there must be a set of vital conditions[7] , if these conditions are not met, the results are not considered very accurate[7] , these conditions were tested for Using SPSS, one of the most important conditions is that the data is normal-data, then parametric-tests are used, and if study data non-normal non-parametric-tests[7] are used, another condition is the homogeneity condition which is checked by levene's test[7] .

To measure the association between the study variables, the Pearson-test[7] , Spearman-test[7] was used. To use Pearson-test, certain conditions must be met[7] , and these conditions must be met in all parametric tests[8] . If these conditions are met, the Pearson-test will be used. If not, the Spearman test will be used.

3. Results:

3.1 Student results statistics

The study was conducted on a 96 students, the students' grades were in DS.2 and DS.3, and the graduation project as in the figure (1) in which the axis (X) represents students' scores (course-work, final-term, overall-scores) for DS.2 and DS.3, while the (Y) axis students' scores (course-work, final-term, overall-scores) for the graduation project. Moreover, figure (1) also shows a numerical comparison between students' grades in sophomore architectural design courses and the graduation project.

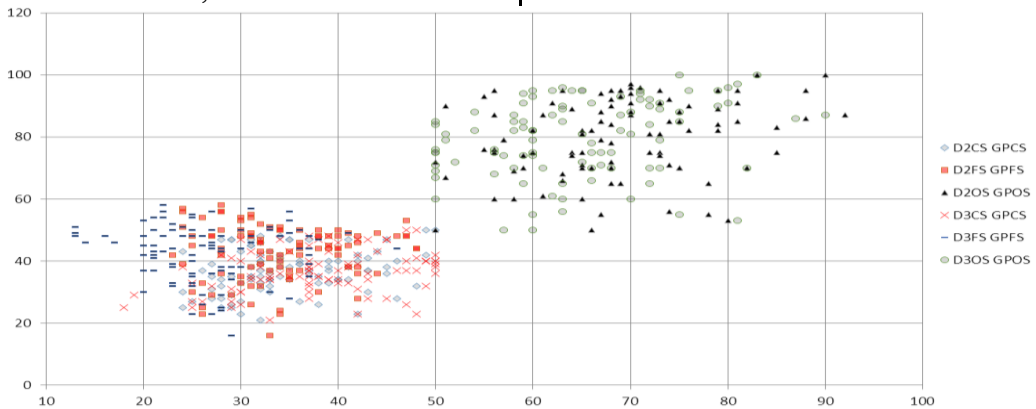

Figure (1) the study sample students' grades of DS.2, DS.3, and graduation project. Source, Author.

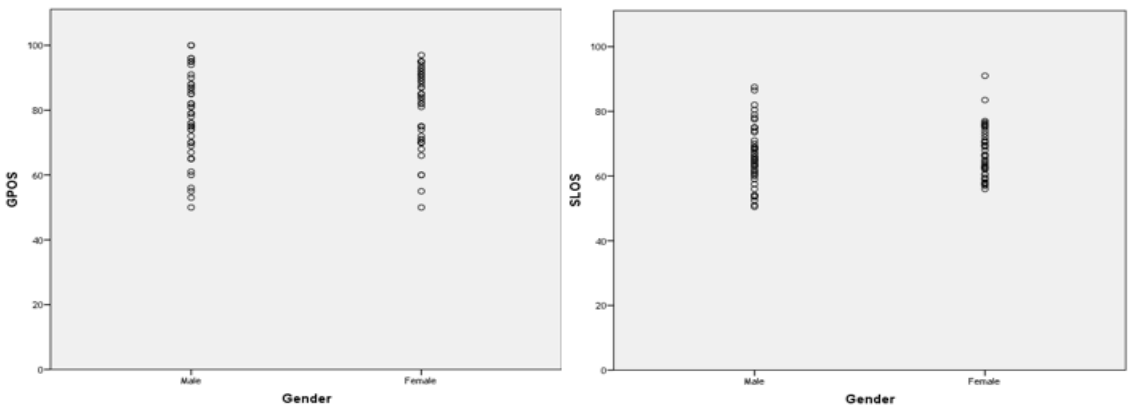

Figure (2) the study sample students grades of SLOS, and graduation project based on gender. Source, Author.

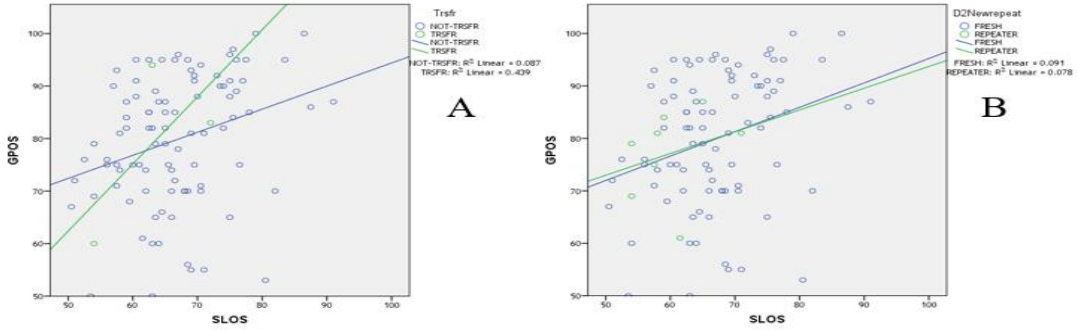

Figure (3) (TRSFR)/(NOT-TRSFR) and (FRESH)/(REPEATER) students results. Source, Author.

The sample of the study consisted of 49 males and 47 females, figure (2) shows the scores of students in the current study courses based on gender, preliminarily, the results shows raising scores in male/female in graduation project comparing to architecture design sophomore courses

The study sample consisted of 96.9% (n = 93) students (NOT-TRSFR), whereas, the percent of (TRSFR) was 3.1% (n = 3) students, and it is evident from figure (3-A) that there is a direct correlation between (TRSFR)/(NOT-TRSFR) students. The percentage of (FRESH) students was 91.7% (n = 88) students, while the percentage of students (REPEATER) was 8.3% (n = 8), and it became clear from the correlation coefficient (r) that there is a direct correlation between the grades of (REPEATER) and (FRESH) students, as shown by Figure (3-B). The sample size of (REPEATER)/(TRSFR) students is too small, hence, the initial results will be satisfied and these variables are not taken into consideration with the rest of the results.

3.2 Study variables correlation tests

3.2.1 SLCS vs. GPCS correlation

The conditions for applying the Pearson-test were taken into consideration before applying the various correlations, specifically, the normality checked, it was discovered that some values are not significant, therefore, the use of Pearson-test is not preferred, and the Spearman's rho-test will be utilized, the confidence-interval was verified and it was found that it was consistent with the correct statistical criteria in terms of indicating the existence of an association or not.

Quinnipiac University has divided correlation-coefficient (cc) into four categories, perfect association (0.7-1), very robust association (0.4-0.69), robust association (0.3-0.39), moderate relationship (0.2-0.29), and weak relationship (0.1-0.19) and below that relationship is neglected[8] .

Table (1) SLCS vs. GPCS correlation Spearman's-test results.

	SLCS, GPCS	D2CS, GPCS	D3CS, GPCS	SLFS, GPFS	D2FS, GPFS	D3FS, GPFS	SLOS, GPOS	D2OS, GPOS	D3OS, GPOS
(CC)	**.354****	**.244***	**.338****	-.085	-.045	-.090	**.313****	**.271****	**.314****
p	**.000**	**.017**	**.001**	**.408**	**.664**	**.385**	**.002**	**.008**	**.002**

It is evident from table (1) that sophomore-level course-work are directly proportional to the GPCS, except for D2CS it fits poorly. This indicates that the hypotheses **H1**, **H1a**, **H1b**, are correct hypotheses.

3.2.2 SLFS vs. GPFS correlation

Table (2) SLFS vs. GPFS correlation Spearman's-test results.

	SLFS vs. GPFS	D2FS vs. GPFS	D3FS vs. GPFS
(CC)	-.085	-.045	-.090
p	**.408**	**.664**	**.385**

The relationship between the final-term scores of in the design courses for the sophomore-level and the graduation project was not established, as p>0.05 in all cases, as in table (1) column (4,5,6) which indicates the incorrectness of the hypotheses **H2**, **H2a**, **H2b**.

3.2.3 SLOS vs. GPOS correlation

Table (3) SLOS vs. GPOS correlation Spearman's-test results.

	SLOS vs. GPOS	D2OS vs. GPOS	D3OS vs. GPOS
(CC)	**.313****	**.271****	**.314****
p	**.002**	**.008**	**.002**

The hypotheses **H3**, **H3a**, **H3b** are valid hypotheses because $p<0.05$ in all cases, therefore, the overall-scores of the graduation project are directly proportional with (SLOS, D2OS,D3OS), however the association weak with D2OS, D3OS, while there is an average direct proportionality between (SLOP) and (GOPS) as indicated in table (3).

3.2.4 SLCS, SLFS, SLOS vs. GPFS, GPCS, GPOS correlation

The interrelationships between the various students' evaluation methods (course-work, final-term exam, overall-scores) were examined, the association between (SLFS) and (GPOS) was not proven where $p=0.244$, and the correlation between (SLOS) and (GPFS) was not proven because $p=0.102$, so the hypothesis **H7**, **H9** is not correct, and it appears that the rest of the relationships are statistically significant because the *p*-values are (0.029, 0.000, 0.012) respectively, as shown in the table (4). Thus, the hypotheses **H4, H5, H6**, and **H8** are valid hypotheses. One relationship was calculated by Pearson-test and the value of $r=0.12$, which is a value that can be neglected. Whereas, the rest of the correlations were examined by Spearman-test, the results of this test showed a moderate positive relationship between GPOS, SLCS, and a weak relationship between SLCS, GPFS and SLFS, GPCS.

Table (4) The Pearson/Spearman tests results for SLCS, SLFS, SLOS vs. GPFS, GPCS, GPOS.

	SLCS vs. GPFS	SLCS vs. GPOS	SLFS vs. GPCS	SLFS vs. GPOS	SLOS vs. GPCS	SLOS vs. GPFS
(CC)/*r*	.224*	.355**	.256*	.120	.397**	.001
P	**.029**	**.000**	**.012**	.244	**.000**	.102

3.2.5 C19GPOS/NC19GPOS correlation

Q10: Is there a correlating between C19GPOS/NC19GPOS?

41 students were taught for a period of 5 weeks on-campus teaching method, and then the teaching method was transferred to online due to COVID19, while there are 55 students from the study sample studied in previous years, they were taught in a conventional architectural design studio. Figure (4) shows the scores' matrix for C19GPOS/NC19GPOS students in the sophomore-level design courses and the graduation project. Initially, it is evident from figure (4) that the mean overall-scores for the graduation project for C19GPOS/NC19GPOS students are raised than the students studying in traditional architectural design studios, as shown by in the trend line of each sub-group.

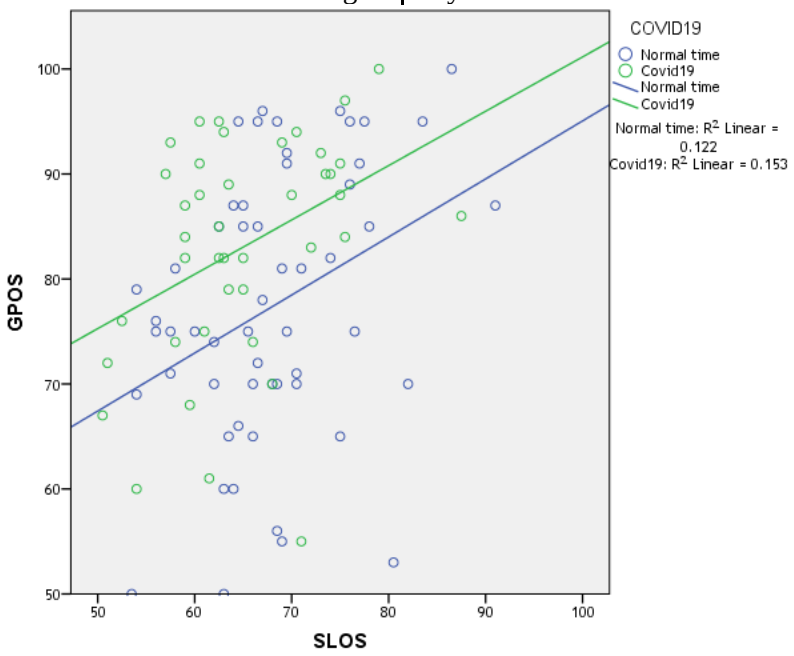

Figure (4) matrix for SLOS and GPOS vs. C19GPOS/NC19GPOS.

The relationship between C19GPOS/NC19GPOS studied, in terms of (course-work, final jury, overall-scores), and the *p*-value was (0.033,0.000,0.34), and there were statistically

significant differences between C19GPOS/NC19GPOS, and the relationship was a weak inverse between the grades of the two types of students in terms of the course-work, because Pearson-correlation= -0.218, with regard to the relationship between the two types of students in the jury degrees, the correlation was moderate as the correlation coefficient = 0.570. As for the GPOS, the relationship was weak positive, as in the table (5). Thus the hypotheses **H10**, **H10a**, and **H10b** are valid.

Table (5) correlation results for the relationships between (C19GPOS) and (NC19GPOS). Source, Author.

C19GPCS/NC19GPCS	C19GPFS/NC19GPFS	C19GPOS/NC19GPOS
-.218*	**.570****	**.217***
.033	**.000**	**.034**

3.3. Study variables comparison tests

3.3.1 The differences of GPOS, SLOS, D2OS, D3OS, and gender

Two-way (ANOVA) test was used, to tests the differences of the means between two independent variables. The conditions for this test are: (1) sample moderation (normal distribution), (2) the independence of the sample, (3) the homogeneity of the variance between groups, (4) equal sample size[8] , subsequently ensuring that the conditions are met the test is carried out. The results revealed that there are statistically significant differences between the gender/GPOS, hence, F=4.050, *p*=0.047, hence, **H11** is correct, it was evident from the results that the means of males tend to favor the female scores and vice versa, so there are no statistically significant differences between the scores of males and females, cause F=0.047, *p*=0.787, so **H11a** is correct. It is clear from the results that the means of males tend to favor the female scores and vice versa, so there are no statistically significant differences between the scores of males and females, F=0.474, *p*=0.493, so **H11b** is wrong, the results shown that there were no statistically significant differences between the overall-scores of all students based on (SLOS) courses, since, F=2.192, *p*=0.094, Which means that **H12** is correct. The results indicated that there were no statistically significant differences between the scores of all students based on the estimates of Design 2, because F=1.760, *p*=0.161, which means that **H12a** is correct. It emerged from the data extracted from SPSS that F=1.270, *p*=0.29, which indicates that there are no statistically significant differences between the different estimates of design 3 and the grades of the graduation project, thus, **H12b** is incorrect. There was no influence of gender and SLOS overlapping on the graduation project scores F=1.243, *p*=0.294, and hence the **H13** is an accepted hypothesis. There was no effect of overlapping Gender and D2OS on Graduation Project grades, since F=1.445, *p*= 0.235, so **H13a** is wrong. The intersection between Gender and d3OS does not affect (GPOS), because F=0.492, *p*=0.613, this's mean that **H13B** is incorrect, figure (5) Shows the overall results for students in the graduation project based on gender and sophomore design course ratings.

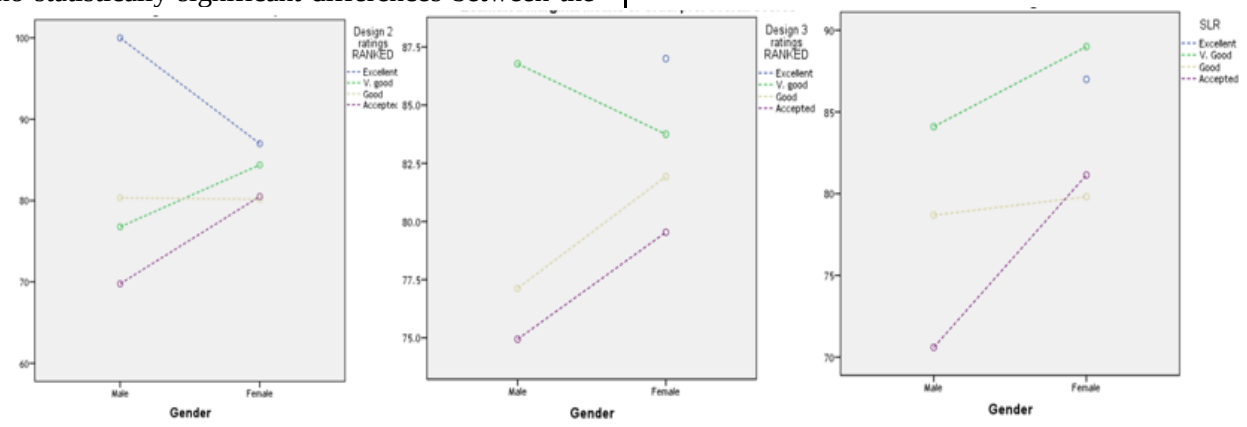

Figure (5) GPOS based on gender and sophomore design course ratings. Source, Author.

3.3.2 The differences in the mean of C19GPOS and NC19GPOS

To verify **H14** hypothesis an independent sample t-test was performed, afterward verifying the conditions required to be met, the results are as follows: mean of C19GPOS=83.05, Std. Div.=10.714, mean of NC19GPOS=77.38, Std. Div.=13.025, and values of Levene's-test as in table (6) and, F=2.602, *p*=0.110 and this means that the variance is equal, and this indicates that the two samples are taken from the same statistical community, from the table (6) t=2.271, *p*=0.025, thus it can be said that there is a significant different in terms of mean scores in side of

C19GPOS students, and thus hypothesis (**H14**) is a valid hypothesis.

Table (5) T-test results for (C19GPOS, NC19GPOS), Source, Author.

Levene's Test		T-test				
				Mean	95% Confidence Interval	
F	*p*	t	*p*	Difference	Lower	Upper
2.602	0.110	2.271	0.025	5.667	0.712	10.622

4. Discussion

The current study was applied to 96 students enrolled in the architectural program since Fall 2013, consequently, the teaching of architecture design 2 for the study sample is conducted in Fall (2015, 2016, and 2017), then architecture design 3 studied via Spring (2016, 2017, and 2018), the regular students joined the graduation project Spring (2018, 2019, and 2020), The current study aims to study students' scores, and to test the interrelationships between scores in the sophomore-level design studios and their relationships with the students' scores in the graduation project, in terms of course-work, the final-term and the overall-scores. The relationship between graduation students' scores during and before COVID-19 inspected, in addition to, examining the differences between the graduation project mean scores before and during COVID-19. The students' scores were investigated and followed up, and then the data was filtered to get the final study sample. Statistical tests related to quantitative data were used to examine the results (ANOVA, T-test, Pearson, and Spearman).

Initially, the relationship between SLOS and GPOS studied according to the status of the student (transferred or not transferred), and it became clear that the transferred students progressed significantly, as their grades increased in comparison between them and their non-transferring colleagues, as it was evident from the figure (3-A), where r=0.662, and r=0.294. The apparent development of TRNSFR scores is often a result of their familiarity with the teaching system followed in an (ADS) over time.

The proportionality between (FRESH) / (REPEATER) students was examined, and it became clear that the direct proportionality of the students in the degrees of the sophomore-level projects and the graduation project (FRESH)/(REPEATER) scores, and this direct proportionality of students is almost equal, but the direct proportionality is slightly higher for FRESH students, as r=0.301 for students (FRESH) , And r=0.279, as shown in figure (3-B). It was found in the current research that there is moderate direct correlation between the sophomore-level course-work in and the graduation project scores; nonetheless, the relationship between D2CS and GPCS is a weak relationship, conceivably due to the development of students' level with the escalation of the difficulty of design courses. No relationship has been established between the final-term scores in the sophomore-level design courses and the graduation project scores, and this is due to the courses' evaluation system, as the final evaluation of students at the sophomore-level is based on a 7-hour final-exam, while in the graduation project the evaluation system is based on the Jury system. In general, the results showed a direct correlation between the students' overall-scores of the sophomore-level and the scores of the graduation project, which indicates the importance of the sophomore-level and its clear effect on the grades of the graduation project.

It was found that there is an average direct proportionality between the course-work scores for the sophomore-level and the final evaluation of the graduation project (the overall score of the graduation project). This indicates the importance of the periodic evaluations stage during the design studio and its effect on the final stage of the evaluation of the graduation project. Furthermore, the Pearson-test showed a positive relationship close to a robust relationship, r=0.397, between the total scores of the sophomore-level design courses and the course-work grades for the graduation project. Perhaps this is attributed to that the students who can work hard continuously during the year in addition to can finish the final-term exam in an appropriate time, their grades tend to be high on graduation project periodic deliverables. The relationship between the overall-scores of the sophomore-level design courses hasn't association with the grades for the final-jury evaluation of the graduation project; this may be due to the fact that the evaluation of the graduation project is not only dependent on the quality of the project, but also on the student's presentation skills. The relationship between the scores of the students who completed the graduation project during COVID-19, and the graduating project scores in the period before COVID-19 were examined, accordingly, the statistical tests showed the presence of a weak inverse proportion between the grades of the course-work before and after COVID-19, this can be explained by the difficulty of studying architectural design courses online, in

addition to, the students' unaccustomed to critiquing projects using the online method, it was also found that there is a moderate direct proportionality between the degrees of the final-jury scours of the project in favor of COVID-19 students, this can be explained by the graduation projects jury committee putting in their consideration the exceptional circumstances during the period of COVID-19, which is enhancing in increasing the students' scores. Overall, it was found that there was a weak symmetry between students' scores during the COVID-19 period and earlier. The effect of COVID-19 on the grades of the graduation project was examined, and the results of the statistical tests showed the progress of the COVID19 students in scores over the rest of the students who studied in the traditional design studio, and that with 95% confidence, the actual differences between the grades of C19GPOS and NC19GPOS students range between (0.712,10.622), as it appears from the last two columns in table (5). The results revealed that the highest mean overall-scores for the graduation project obtained from males with an excellent grade in Design2, with an average of (100), and the lowest mean (69.78) came from male with pass grades in design2. The results indicated that there is no difference between the scores of females and males in the graduation project scores based on the Design2 ratings, as the mean scores of males and female (81.7, 83) respectively, while there is no difference between the mean scores of the graduation project scores based on Design2 scores, as the average scores of the various students' ratings (Excellent, Very Good, Good, and Pass) in Desing2 were: 93.5, 80.6, 80.2 and 75.1 respectively. Regarding the progression/ degression in the scores of the graduation project students, it was noted that the grades of pass students (PS) rose from (55%) to (75.1%) very good, also the level of good students (GS) increased from (67.5%) to (80.2%) very-good, while there was a slight increase in the grades of very-good students (VS) from (80%) to (80.6%), scores of (ES) diminished slightly from (95%) to (93.5%), as shown in figure (6-A).

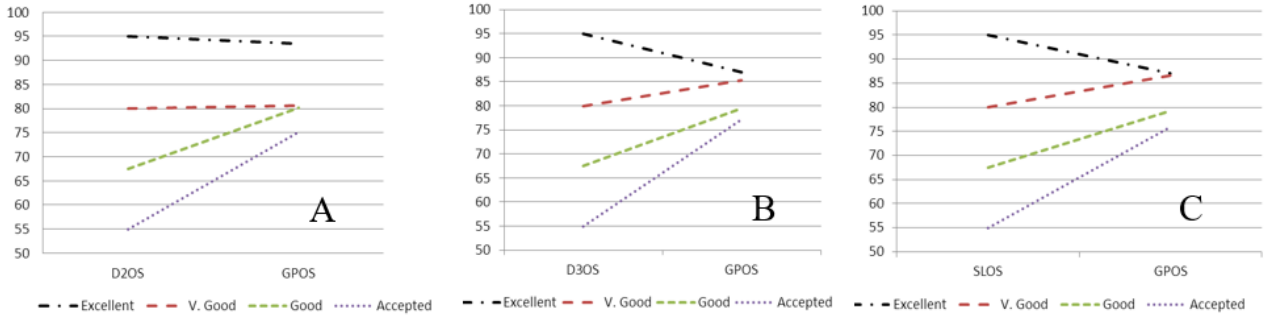

Figure (6) the progression of students' scores for different ratings in D2OS, D3OS and SLOS, Source, Author.

The differences based on gender in the graduation project resulting from the Design3 scores, it was not clear a difference between the average scores of females and males, as the mean scores for males are (79.6%) and females are (83%), then the difference between the average scores for the graduation project based on Design3 ratings has not been proven. (ES), (VS), (GS), and (PS) in design3 achieved mean scores as flows: (87%), (86.55%), (79.5%), and (75.87%). The grades of students who achieved a pass grade in design3 increased from (55%) to (75.87%) represented with very good, also the level of (GS) increased from (67.5%) to (80.2%) which is equal to very good, while there was a slight increase in the grades of very good students from (80%) to (86.55%), And the scores of (ES) decreased from (95%) to (87%), as shown in the figure (6-B). Generally, the aforementioned results showed that, there were no statistically significant differences between the gender and the scores of the graduation project; on one hand this contradicts the findings of Fulani, O., et al. (2016)[8] . On the other hand, this is consistent with the findings of Pienaar, J., el al., (2018)[8] , as for the difference graduated students' scores comparing the sophomore-level students' scores, the findings revealed that the different ratings of the students of sophomore design courses their grades as follows, (PS) their grades rose from (55%) to (75.87%), which means (very good), also the level of (GS) rose from (67.5%) to (79.25%), which is (very good). There was also an increase appeared in the grades of (VS) from (80%) to (86.55%), in addition to a decrease in (ES) scores from (95%) to (87%). The results show that when architecture students interact with projects of a simple functional (Design 2), or projects of an average functional (Design 3), students with good and acceptable grades increase their grades in the

graduation project to very good, while the level of very good students' grades remains as it is, Excellent students have their grades at the same value with a clear decrease, and this can be attributed to several factors, which are students' maturity as different design studios pass, additionally, via the design coursed continuous training causes students' progress in experience, over and above, the enthusiasm of low-level students to catch up with poor grades. It is also evident that it is difficult for excellent students to maintain the same academic level.

4. Future studies

It was evident from the above that there is a lack of literature related to student ratings in the field of architectural articles. Therefore, the current study recommends examining more regarding the trends of architecture students' scores.

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