

Exam Grades in Architecture Classes: A Comparative Assessment of Before and During COVID-19 Pandemic Modes of Teaching and Learning

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Over the last couple of months, universities worldwide have unprecedentedly switched to online teaching due to the recent outbreak of the COVID-19 pandemic. This has changed the teaching and learning methods of both faculties and students. Therefore, this study assesses the learning effectiveness of the two instructional modes using students' performance records. Data on full-time undergraduate students of architecture was obtained and analysed using descriptive and inferential statistics. The Chi-square analysis test indicates no statistically significant positive relationship between the traditional and web-based modes of instruction with respect to learning effectiveness ($\chi^2 = 0.003$, $\alpha = 0.05$, $p > \alpha$). The study concludes by recommending certain practices that will improve students' participation and performance in the web-based classes during emergency periods, for example, the current period of the COVID-19 pandemic.

Keywords: *COVID-19, Students' Performance, Traditional Classroom, Web-based Classroom*



INTRODUCTION

Starting from the beginning of 2020, universities across the globe have faced sudden, unprecedented change in their modes of teaching and learning at all levels following the World Health Organization (WHO) declaration on COVID-19. In March 2020, WHO declared the COVID-19 outbreak a pandemic (WHO, 2020). The pandemic has caused sudden, unprecedented educational interruption to 825 million students, putting 340 million jobs at stake and subjecting about 100 million people to abject poverty (UNESCO, 2020). This caused the Saudi Arabian government to issue circular switching to web-based teaching and learning. Thus, the COVID-19 pandemic forced Imam Abdulrahman Bin Faisal University to launch live web-based classes for a total of 92 undergraduate courses and 59 postgraduate courses in order to guarantee the usual teaching and learning procedures.

However, this will have specific impacts on the students' performance. Researchers have investigated the impact of the modes of teaching and learning on students' performance. For example, in a recent study conducted by Fadol et al. (2018), students' performance was compared through three different teaching and learning modes, namely online, traditional, and flipped methods. It was found that the students performed better using the online and flipped teaching and learning methods than the traditional mode. Ni (2013) empirically investigated the impact of traditional and web-based modes of teaching and learning on students' performance and found no significant relationship between teaching modes on the students' performance.

Similarly, Hannay and Newvine (2006) found that students scored higher grades in web-based classes because of its flexibility in balancing their daily activities. Another study conducted by Khorsandi et al. (2012) revealed higher grades in the web-based teaching and learning environment. Poirier and Feldman (2004) have also found the web-based teaching and learning environment more effective with respect to the students' performance. Their findings revealed higher grades in web-based learning than the traditional learning mode despite allocating the same amount of examination time. However, some studies have reported higher exam grades in traditional classrooms than web-based classes (Figlio et al., 2010; Parsons-Pollard et al., 2008; Brown and Leidholm, 2002). Stack (2015) has conducted a review article presenting different studies that compare the learning effectiveness of traditional and web-based classrooms.

Web-based technology is evidently transforming the academic environment. Advocates of web-based learning have seen it as more effective in removing barriers in learning, increasing flexibility, convenience, adapted learning process, and feedback compared to the traditional mode of teaching and learning (Ni, 2013). However, there are several incidences of overall malpractice regarding exams and other evaluation techniques in web-based classrooms than in traditional classes (Moten et al., 2013). An essential element of the traditional learning environment is the communicative and social interactions among students and their teachers,



as well as students and students. It motivates the students to ask questions and to share their opinions concerning a point of view. On the contrary, a web-based learning environment requires the adjustment of teachers and students to achieve effective interactions (Ni, 2013). However, Allen and Seaman (2013) believe that the higher the involvement of academic institutions in web-based teaching and learning, the higher the possibility of converting to a blended mode of instruction.

Given the sudden, unprecedented change from traditional to web-based instruction, which has disrupted the mode of teaching and learning, especially in practical classes like architectural design studios, it is therefore essential to assess the before and during COVID-19 learning effectiveness by comparing the two modes of instruction based on students' performance records.

MATERIAL AND METHODS

Study Area

Imam Abdulrahman Bin Faisal University (IAU), formerly known as the University of Dammam (UoD), is a conventional public university with faculties and undergraduate students' population of about 3,484 and 29,152, respectively. The university was founded in 1975. It is situated along the eastern shore of Saudi Arabia, roughly 15 km from the Arabian Gulf in Dammam city (Figure 1). It is among the earliest universities in the Eastern Province of the country as well as one of the top universities in the field of medicine, architecture, and planning in the country. The eastern and western campuses are bound by the municipalities of Khobar and Dhahran, King Abdulaziz Seaport, and the Arabian Gulf. The primary reason for selecting IAU as a study area is data availability. The study's scope is narrowed down to the undergraduate students of architecture at the College of Architecture and Planning.

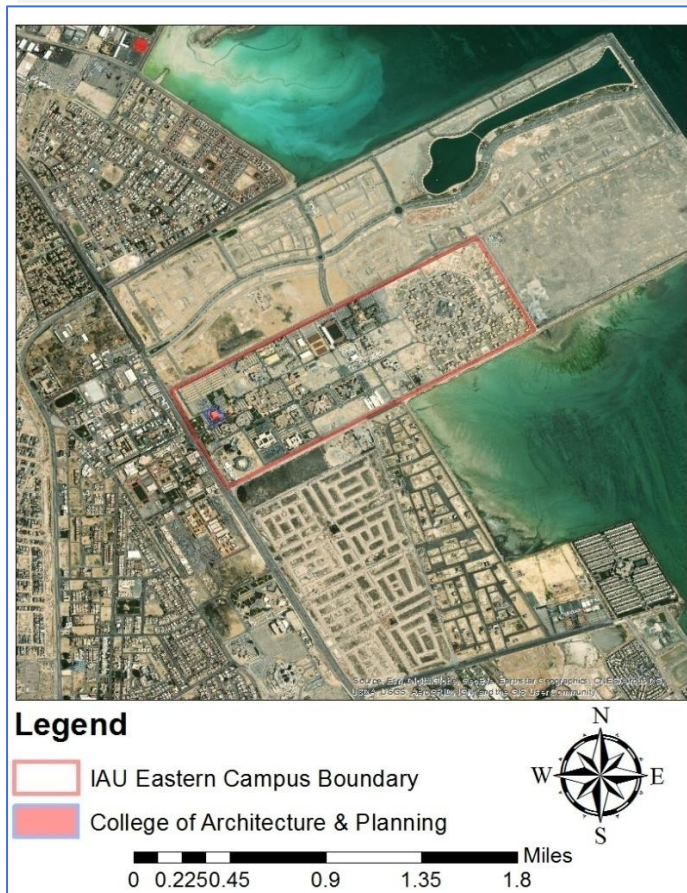


Figure 1: Map showing the study area's boundary (Source: Authors, 2020)

Data description and statistical analysis

The goal of this study is to assess the learning effectiveness of the web-based and traditional classes by comparing the undergraduate students' performance in the department of architecture taught by different instructors in the College of Architecture and Planning, Imam Abdulrahman Bin Faisal University, Saudi Arabia, for two semesters (2019-2020 academic session). Due to the COVID-19 pandemic, the university switched to delivering web-based courses in place of the usual traditional classes. In delivering similar learning skills for both teaching modes, similar course content and structure were designed for both modes. Table 1 presents the content delivery comparisons used for the two modes of instruction. Students in traditional and web-based classes have access to use the blackboard system. In the web-based classes, the blackboard is used in conveying course materials, announcements, and lectures via the Zoom platform or blackboard collaborate. While in the traditional classes, readings other than the use of textbooks and multimedia materials are readily available via the internet.

Moreover, the students must use the blackboard system to access, submit, and retrieve assignments and feedback. Other in-class activities, for example, lectures, group

assignments, and discussions, are conducted in person. Therefore, the major difference between the two modes of instruction is the teacher-student and student-student interactions.

The present study explores two main hypotheses as follows:

H0: There is no statistically significant relationship between the two modes of instruction with respect to learning effectiveness.

H1: Web-based classes differ significantly from traditional classes with respect to learning effectiveness.

Table 1: Comparison of course content method of delivery

Method of teaching	Traditional	Web-based
Reading apart from books	Web-based	Web-based
Resources from multimedia	Web-based	Web-based
Lectures	Tutor and PowerPoint	Descriptive PowerPoint
Discussions	In class communication	Discussion board
Group assignments	In-class groups	Online group arrangement
Submission of assignments	In class	Web-based
Quizzes	In class	Web-based
Feedbacks	In class	Web-based

This study assesses the learning effectiveness as the dependent variable with the independent variable- the students' grades. Table 2 presents the courses delivered for each undergraduate level using both modes of teaching and learning.

Table 2: List of first and second semester courses delivered using the two modes of instruction.

Undergraduate levels	Traditional: Semester 1 Courses	Web-based: Semester 2 Courses
Second year	<ul style="list-style-type: none"> ▪ ARCH 201: Design III ▪ ARCH 212: Construction System & Material ▪ ARCH 221: Surveying ▪ ARCH 231: Environmental Design I ▪ ARCH 241: Cad Applications ▪ ARCH 251: Design Methods 	<ul style="list-style-type: none"> ▪ ARCH 202: Design IV ▪ ARCH 211: Concept of Structure ▪ ARCH 222: Environmental Control System (Thermal) ▪ ARCH 232: Environmental Design II ▪ ARCH 242: Advance Cad &GIS Applications ▪ ARCH 252: Site Planning
Third year	<ul style="list-style-type: none"> ▪ ARCH 301: Design V ▪ ARCH 321: Construction System 7 Assemblage ▪ ARCH 331: History & Theory I ▪ ARCH 341: Structures I ▪ ARCH 351: Computer Modelling 	<ul style="list-style-type: none"> ▪ ARCH 302: Design VI ▪ Arch 322: Environmental Control System (Lighting) ▪ ARCH 332: History & Theory II ▪ ARCH 342: Structures II ▪ ARCH 352: Humanities I
Fourth year	<ul style="list-style-type: none"> ▪ ARCH 401: Design VII ▪ ARCH 411: Housing & Settlement ▪ ARCH 421: History & Theory III 	<ul style="list-style-type: none"> ▪ ARCH 402: Design VIII ▪ ARCH 412: Issues in Urban Design ▪ ARCH 422: Humanities II
Fifth year	<ul style="list-style-type: none"> ▪ ARCH 501: Design IX ▪ ARCH 511: Research & Programming ▪ ARCH 521: Contemporary Issues 	<ul style="list-style-type: none"> ▪ ARCH 502: Design X ▪ ARCH 512: Professional Practice ▪ ARCH 572: Architecture & Urban Future

Therefore, the present study utilizes students' performance reports obtained from the two modes of instruction (web-based and traditional) of the second, third, fourth, and fifth year undergraduate students of architecture. The students' performance reports were treated with high confidentiality. The authors freely obtained the available datasets from the Students Information System available on the PeopleSoft system. The collected data underwent a quantitative analysis conducted using descriptive statistics (percentage) and inferential statistics (Chi-square: χ^2 test) facilitated by Microsoft Excel software. Chi-square analysis test is appropriate for ascertaining whether there is a statistically significant difference with respect to an independent variable such as the mode of instructions and dependent variable such as students' grades. Equation 1 presents the Chi-square formula:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

(Equation 1)

RESULTS

This section presents and discusses the variation between students' performance reports conducted through web-based and traditional teaching modes. Table 3 shows the grades distribution of the four undergraduate levels (second, third, fourth, and fifth year) of architecture under investigation. Similarly, Table 4 presents the observed and expected values of the students' grades. A Chi-square test show that the p-value is more than the significance level ($\chi^2 = 0.003$, $\alpha = 0.05$, $p = 1$, $p > \alpha$). Therefore, we cannot reject the null hypothesis: There is no statistically significant relationship between the two modes of instruction with respect to learning effectiveness as measured by the student grades. There is also a higher failure rate in the second-year web-based classes compared to traditional classes in the same year (Table 3). Similarly, 11.1% of the second year students failed in the web-based classes, while only 2.4% failed in traditional classes (see Table 5). This result concurred with findings from earlier studies that there are higher failure rates in web-based classes than in traditional teaching and learning (Ni, 2013; McLaren, 2004; Carr, 2000).



Table 3: Traditional and web-based classrooms grades comparisons

Grade Distribution	Traditional					Web-based				
	Second Year	Third Year	Fourth Year	Fifth Year	Total	Second Year	Third Year	Fourth Year	Fifth Year	Total
A+	31	2	5	2	40	33	2	3	11	49
A	56	11	7	16	90	42	18	7	20	87
B+	82	16	10	18	126	73	41	25	25	164
B	88	24	32	25	169	84	29	23	16	152
C+	76	41	23	24	164	75	23	30	10	138
C	81	24	15	9	129	73	9	7	4	93
D+	73	13	4	1	91	54	5	3	3	65
D	40	4	3	2	49	46	5	2	1	54
F	9	4	0	0	13	26	1	0	0	27
W	4	6	0	0	10	34	7	1	2	44

Table 4: The students' grades Chi-square test

Grade	Traditional	Web-based	Total
A+	49	40	89
	43.401	45.5994	
A	87	90	177
	86.314	90.6865	
B+	164	126	290
	141.42	148.582	
B	152	169	321
	156.53	164.465	
C+	138	164	302
	147.27	154.731	
C	93	129	222
	108.26	113.742	
D+	65	91	156
	76.073	79.9271	
D	54	49	103
	50.228	52.7724	
F	27	13	40
	19.506	20.4941	
Total	829	871	1700
Chi-square = 0.003; d.f = 8; p value = 1			

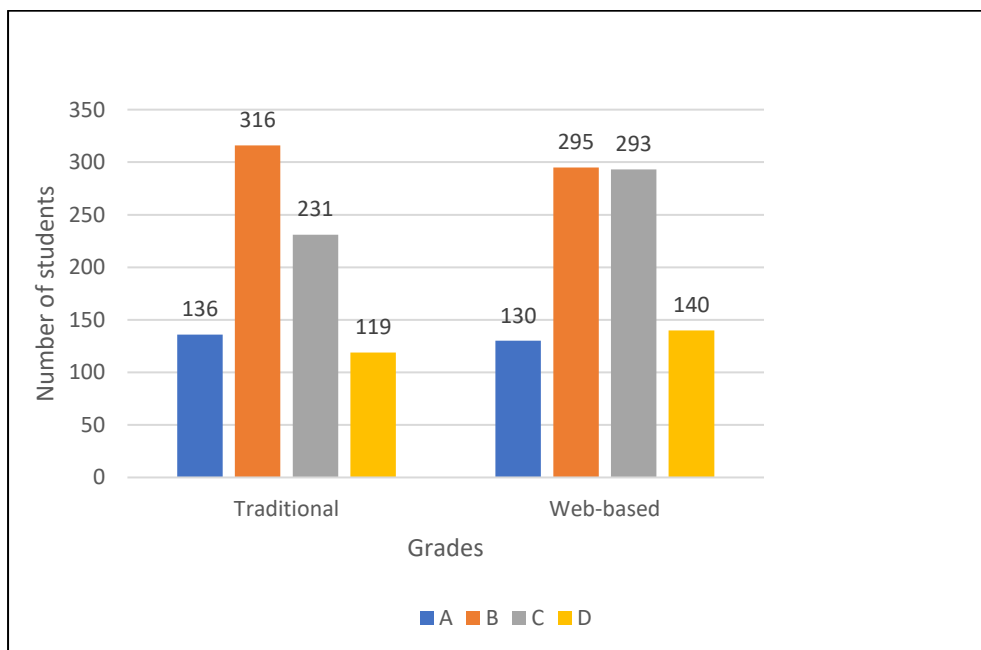


Figure 2: Grades achieved by students in both modes of teaching

Table 5 presents the comparison of failure rates for all the four undergraduate studies under investigation taught by different instructors in the College of Architecture and Planning. In calculating the failure rates, the students that withdrew from their courses with valid reasons were included. Regardless of who teaches a course, the findings reveal consistent lower grades starting from grades C+ to D in the web-based classes compared to the traditional classes with higher grades starting from grade A+ to B (Figure 2). Surprisingly, higher grade students tend to perform better in traditional classes and vice versa (Figure 2), which is likely due to a lack of psychological comfort with the virtual learning space.

Table 5: Comparison of fails and withdraws between the traditional and web-based classrooms

Undergraduate levels		Traditional	Web-based
Second year	Students' number	540	540
	Number of withdraws/fails	13	60
	Percentage of withdraws/fails	2.4%	11.1%
Third year	Students' number	145	140
	Number of withdraws/fails	10	8
	Percentage of withdraws/fails	6.9%	5.7%
Fourth year	Students' number	99	101
	Number of withdraws/fails	0	1
	Percentage of withdraws/fails	0%	1%
Fifth year	Students' number	97	92
	Number of withdraws/fails	0	2
	Percentage of withdraws/fails	0%	2.2%

DISCUSSION

The COVID-19 pandemic has disrupted the usual way things are being done worldwide in a profound way. The pandemic has impacted educational institutions across the globe and raised fundamental concerns about the status and quality of education at all levels. Given the lack of web-based classes in Imam Abdulrahman Bin Faisal University, the current study explores the learning effectiveness by assessing the two modes of instruction using students'

performance records. The study found no statistically significant relationship between the two modes of instruction with respect to learning effectiveness with a Chi-square test result of 0.003(p-value 1). A mode of instruction is not statistically significant with respect to learning effectiveness at $p > 0.05$. Concerning lower grades, the findings in this study somewhat concur with that of the previous studies (Means et al., 2010; Gratton-LaVoie, 2009; Harmon, 2006), that students' grades are higher in the web-based classes as compared to traditional classes.

Conversely, concerning higher grades, the results tallied well with other prior studies that have reported higher grades in the traditional classes (Figlio et al., 2010; Parsons-Pollard et al., 2008; Brown and Leidholm, 2002). Comparatively, Ni (2013) found no significant relationship between the two modes of instruction by reporting an independent relationship between the students' grades and teaching and learning modes. However, the author has recommended future research to explore different elements of learning effectiveness that can be influenced by the two modes of instruction.

Concerning the failure rate, the present study reported a high rate of failures in the web-based classes for the second year students, possibly due to a lack of digital and manual design skills as they are new in the system. The likely reasons for the high failure rates in the web-based classes for the second year students might be due to several factors. For example, Boa (2020) has pointed out some critical factors that can profoundly impact the students' performance in web-based classes. For example, due to the recent outbreak of the COVID-19 pandemic, factors such as lack of appropriate and decent learning atmosphere, lack of interactions, and lack of appropriate learning resources can cause severe distractions to the students learning effectiveness. In the web-based classes, students miss some fundamental elements that increase students' understanding, for example, facial and body expressions. All these became restricted because it is difficult to use these elements while delivering on-screen web-based classes.

Therefore, to assess learning effectiveness, multiple elements should be considered as the current study found no statistically significant relationship between the two modes of instruction with respect to the student grades. This is obvious, seeing the variation between the students' grades (upper and lower grades) of the two modes of instruction, which could be due to the students' persistence rates and their level of interactions in the two modes of instruction. The low persistence rates in the web-based class may be subjective. For example, Ni (2013) highlighted that, specific courses that require practical in-class tutorials may not fit with the web-based classes such as architectural design, medical, physic, and chemistry courses. Hence, the web-based program designers should consider such courses in designing the web-based environment. It is crucial to carry out more research works to investigate the several elements of learning effectiveness that can be inappropriate for web-based teaching and learning mode.



The study's findings also reveal the importance of pre-enrolment and post-enrolment counselling to identify and eliminate students who cannot continue with the web-based classes. This could be achieved by designing a module that can allow students to self-evaluate their chances of completing a course by explaining how long and intensive a course will be. Coupled with ongoing counselling, it will help in retaining the enrolled students in the web-based courses. Moreover, the counselling team should allow students' feedback on courses, share students' successful stories, share time management skills, as well as create teacher-student and student-student interactions to reduce the feelings of loneliness in the web-based classes. For instance, Frankola (2001) recommends that inspiration, rational expectations, well-incorporated live meetings, and use of modern technologies contribute to persistence in both modes of instruction. Therefore, the counselling team should give more emphasis to challenging courses to enable students to succeed in those courses, such as the architectural design courses.

Furthermore, the traditional classes could also be improved by introducing virtual spaces in each classroom section to increase students' participation. This is because 21st-century students are internet-oriented and virtual space is taking most of their time. Therefore, the traditional classes should integrate this avenue to accommodate students who face difficulties in class participation by designing supplementary web-based discussion modules through the blackboard discussion platform. This will offer such students opportunities to fully participate in the traditional classrooms and subsequently increase participation quality. According to Smith and Hardaker (2000), an online learning environment should promote thorough and articulated discussions.

This study's findings clearly show how less effective the web-based classrooms are compared to traditional classes for higher grades students and students who lack specific skills, like in the second year students. Further research should explore the fundamental differences concerning learning effectiveness between the traditional and web-based modes of instruction.

CONCLUSION

This study underscores the importance of assessing learning effectiveness by comparing the efficiency of traditional and web-based teaching and learning environments. It utilizes students' performance records for both modes of instruction and discusses likely factors that may affect the teaching and learning effectiveness in web-based classrooms. The findings reveal that students' performance is independent of the teaching mode; however, specific architectural design courses are not entirely suitable for the virtual environment. Furthermore, the fundamental lesson of this study's findings is not to provide large-scale web-based educational programs through Imam Abdulrahman Bin Faisal University's case study, instead to establish and improve certain practices. Hence, students' teaching and learning environments, curriculum design, and course development should be improved for



effective learning. For example, the amount, length, and difficulty of course content should tally with the students' willingness and learning habits.

Moreover, students' character regarding the lack of attention in web-based classes should be addressed by adjusting the instructors' teaching speed to guarantee effective communication between instructors and students. Similarly, the instructors need to provide sufficient support to students, such as timely feedback. High-quality participation is another vital factor to be put into consideration. It is essential to adopt specific procedures to enhance the students' in-class participation rate. Finally, a contingency plan should be readily available to contain likely issues that may arise, such as web traffic, among others. With the sudden, unprecedented change from tradition to the web-based mode of instructions due to the COVID-19 outbreak, more research should be carried out to investigate the likely drawbacks that will hinder learning effectiveness in the web-based teaching and learning environment.



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