Impact of Covid-19 on the Effectiveness of Teaching Operative Dentistry in Iraq

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Abstract
Several dental colleges and instructors are planning how they guide and engage with students as a result of the COVID-19 pandemic problem. Covid 19 played a significant role in changing teaching strategies from classroom learning (CL) to online distant learning (DL) and eventually to blended learning (BL). The aim of this survey study was to analyze the rich experience of a currently undergraduate dental student at Iraqi dental university in the field of operative dentistry. 200 undergraduate students who had experienced CL, DL and BL preclinical education before clinical procedures at the collage of dentistry at Usul AL-Deen University were involved in this survey study in 2021. All the students received the questioner and were encourage participating in the answering. Although not all of them answered all the questions but most of them did and answered the online survey questions that was borne on the effectiveness and the problem of each strategy from their own experience and perception. The survey is comprised with 6 parameters concerning; coast, exams, social consideration, general preference, curriculum, need for improvement. Furthermore, each parameter consists of five question and each question with 3 choices and one of them to be selected either CL, DL, or BL. The data for the number and %of each choice that obtained , analyzed and discussed The following conclusions were withdrawn Classroom learning; still the most preferable choice for learning though need improvement Distant learning carries some advantages in spite of its shortage and limitation Blended learning that applied in 2021 that depend mainly on DL with some CL gain no support and satisfaction by the students Implication and feature: The came up with the following predictions and recommendation; The best teaching strategies for the feature is the blended learning that combine CL+DL in a customized % according to the need of the curriculum Tis issue will continue to be area of development and a focus of the researchers even after the subsided of the pandemic The skills of the teaching staff and their knowledge will enhanced and further enriched
Key words: COVID-19, Dental Education, Operative Dentistry

1. Introduction

COVID-19 is a unique disease that has recently spread to a number of nations throughout the world [1]. The COVID-19 epidemic has thrown the globe's health and economic systems into disarray [2]. Different countries have implemented various measures, disrupting many daily routines and harming labor, free movement, trade, and, in especially, learning [3]. Dental professionals should consider clinical planning by dentists via protective and infection control aspects [4]. However, little is known about the impact on dental education and research. The analysis of COVID-19's educational impact was initially based on the minimal literature available

However, the majority of the research was done on official websites of various dental schools as well as dentistry education organizations around the world.

Face-to-face traditional classroom interactions with bachelor dental students have been nearly disrupted worldwide as a result of COVID-19 outbreak. Educators are striving to adapt to various quarantine or social separation. Faculties all over the world have continued working from home and conduct remote courses and exams [5], minimal suggestions were given on how to pursue dental education and how to use social isolation to protect students, instructors, staff, including patients [7]. Furthermore, due to a lack of awareness and inadequate infection control in many dental colleges, particularly in low-income nations, dental scholars are much more sensitive to diseases, particularly COVID-19[8]. Email, Google online technology, Chat, YouTube, Whats App, and Telegram are all widely utilized platforms for theoretical information, and they are now adjusting to this new situation [9-12]. LinkedIn and Pinterest are examples of other platforms that can be leveraged. Many institutions have deployed new types of classroom discussions and lectures using videoconferencing platforms such as Zoom, Jitsi, Microsoft Exchange, and WebEx [13-14]. Other universities propose using personal platforms like Moodle

Although these new adjustments concentrating on educational issues, there is no proof of these media channels' actual impact on student creation and knowledge consolidation. Successful encounters have been reported in studies, regrettably in limited dental disciplines [15]. Furthermore, when it comes to training in both pre-clinical and clinical settings, the possibilities are limited.

The initial influence of COVID19 on field of dentistry learning was noted relatively early because of epidemic's tremendous impact [16], immediately after stating the necessity for "social distance" and eliminating any face-to-face interaction, such as instructing and learning programs. The terrible COVID-19 pandemic has hit colleges all across the

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world. Shutdowns in pre-clinics and clinics, restricted not to access to clinical actually learning options for people, and no treatment accessible for patients in institutions clinic are just a few of difficulties that dentistry students confront [17].

Several dental colleges have stopped practicing dentistry except in emergency situations, while others use social distancing in research lab preclinical simulation exercises. Because of the time, labor, and technology required for training, mannequin simulation is sometimes problematic for institutions that do not have the option of teaching online. Because technologies of virtual reality cannot be employed right now [18]. Because dentistry is essentially a clinical profession, using virtual learning methodologies remains a problem for colleges all around the globe. Academics, on the other hand, incorporate virtual simulation approaches and online training programs [19].

Following this, both dental colleges and professional teaching institutions discontinued daily face-to-face instruction, hands-on laboratory expertise, and supervised clinical learning. As a result, alternate modalities of presentation and evaluation, such as written online articles, multimodal seminars, problem-solving activities, webinars, and computer-oriented tests

As a result, any methodology that relies on direct connection with pupils is no longer valid

Dentistry schools all over the world have transitioned to a virtual environment [20].

The American Dental Association (ADA) has advised dentists only to provide dental care to patients who are experiencing a dental emergency. This has culminated in a totally virtual dental programme [21].

The virtualized curricular design is based on the anticipated duration of COVID-19. While dentists and schools intend to re-open as soon as their various states offer instructions, it is crucial to understand that the virtual curriculum may need to be expanded in several way to provide the financial circumstances created by epidemic [22]. Students can now listen to lectures and review them wherever they want, thanks to today's smart devices and apps, promoting educational autonomy. [23]

Virtual simulation using dental training manikins is exceedingly difficult for preclinical e-learning activity. Although various clinical dental treatment simulators have been created and shown to be effective [24], they are hard to come by in educational colleges, are not transportable, don't cover entire aspects of dentistry, and are prohibitively costly. Other virtual models, on either hand, could be employed more widely. For example, for oral pathology teaching, good experiences using virtual slides employing whole-slide images have been recorded, with better results than the conventional way [25]. As per the digitization system, many commercially applicable technologies scan glass slide, creating a high-resolution digitized slide (whole-slide imagination), that allows the examination and evaluation of slide in specialized programs.

Case-based discussions are a useful learning method that is used in a variety of dentistry specialties and courses. Simulating clinical scenarios to enhance student' decision-making and diagnosing skills is what virtual patient (VP)-based learning is all about [26]. Case-based conversations may also be possible on the learning platforms. Live talks, as well as the exchange of clinical, imaging, and/or histological pictures, are permitted in addition to chat discussions. The safeguarding of patients' data, particularly photographs and demographic information, is critical in such activities. End-to-end encrypted networks are essential. Furthermore, several nations' data privacy laws prohibit the transmission of patient data to overseas servers [27]. Social media platforms such as Facebook, Instagram, Twitter, YouTube, LinkedIn, and Pinterest can also be used to facilitate case-based conversations [28].

The COVID-19 epidemic caused the International Organization of Dental Research (IADR) to postpone their March 2020 meeting in Washington, DC, USA, one of biggest world dental research gatherings [16].

The termination of major laboratory-based dentistry research studies and graduate research programs was inevitable because of mandatory governments and institutional restrictions prohibiting non-essential research operations. As a result, several dental researchers have transformed their concentration to off-campus and digital research methods such as paper reviews and online polls [16]. It has, however, initiated a slew of research studies centered on COVID-19 and related dental disorders. [4,19]

Possible positive impact of COVID-19

There has been a significant increase in international and domestic exchanges between universities, as well as the growth of cooperation. [4] Dentistry colleges work in a variety of settings, including educational and academic institutions, minor clinics, and businesses with significant service and support expenditures. The significance of such faculties cannot be underestimated, as they provide oral health care support [17]

The aim of this survey study was to analyze the rich experience of a currently undergraduate dental student at Iraqi dental university in the field of operative dentistry before and during the pandemic that resulted in changing teaching strategies from classroom learning (CL) to online distant learning (DL) and eventually to blended learning (BL)

2. Materials and Methods

Participants in the study were third and fourth year undergraduate dental students at Faculty of Osouleldeen University in Iraq

The online survey was completed at end of the semesters. They were actively inspired to complete the survey, although participation was entirely optional

The participant backgrounds

The study participants' names and other confidential information were kept private

Prior to the COVID-19 epidemic, the University's dental academic study program (pre-clinical) used student-centered classroom active learning methodologies. The

class room learning (CL) was mostly employed in courses for first and second year dental students in earlier semesters before 2020 Theoretical and laboratories and the exams were carried at the university , distant learning (DL) was mostly employed in courses for second and third-year dental students during the first year of the pandemic in 2020 that based on attending online classrooms and lectures and examined with electronic exams irrespective to the theoretic or practical part of the curriculum .Because COVID-19 pandemic protocol mandated a mandatory work and study from home policy, methodologies have been converted to full distance learning since March 2020. Various online platforms were used for group discussions, this dramatic fast and major turn over encountered a lot of disadvantages and limitation, furthermore, the pandemic began its second year in 2021 and the DL not suitable for long term education for all specialties. Therefore, shifting to blended learning BL when these group of dental student start taking the third- and fourth-year courses. BL centered on implementing CL on some practical part of the curriculum such as the important field of operative dentistry, the other part was completed using DL. The currently undergraduate student in 2021 asked to participate in this survey study

Data collection

Online based questioner that is based on the effectiveness and the problems of each education strategies from their own experience and perception. The survey is comprised with 6 parameters with 5 multiple choice questions for each one and the answer either CL, DL or BL. (table 1)

The other variables were fixed such as the following.

-Participant background, they had the same CL, DL, and BL experience

The university was the same (Osuleldeen university) as well as the collage (the collage of dentistry) and the country is Iraq

The curriculum that was implicated and testing the impact of the three learning strategies was fixed to conservative dentistry that include 3 branches: operative dentistry, crown & bridges and endodontics. The curriculum implicated throughout all 5 years of dental student ranging from basic, preclinical and clinical theoretical and practical parts After one month of several encouragements for the participation in this study and educate the dental students about the importance of this study, the number of the participant was increased to suitable level then the online survey is closed and received no more answer to begin the analysis

Table 1: The survey study parameters and questions

Parameter	Question	Answer choices
1 Coast and economic factors	1-Which one is much economic to you 2-Which one needs more printed references 3-Which one needs more electronic devices and internet charge 4-Which one more coast for various resin like dueling and exportation 5-Which one spare more time for part time job	DL, BL, CL
2–The exams	1-Which one has easiest exams 2-Which one is best for the theoretical part 3-Which one is best for the practical part 4-Which one was fare and represented your grade effectively in the theoretical part 5-Which one was fare and represented your grades effectively in the practical part	DL, BL, CL
3 Social consideration	1-Which one is best for effective interaction between the students 2-Which one is best for the effective interaction with the professors 3-Which one is best in saving time for study and spare time 4-Which one is less stressful 5-Which one is preferred by your family	DL, BL, CL
4-In general preference	1-Which one is the more effective 2-Which one makes the curriculum easier 3-Which one was best for your understanding 4-According to your opinion which one is the best 5-Which one was best in reducing the problems you might face	DL, BL, CL
5-Curriculum variable	1-Which one was best in teaching operative dentistry 2-Which one was best in teaching endodontic 3-Which one is best in teaching crown and bridge 4-Which one you prefer for teaching the basic science 5-Which one you choose for teaching all the theoretical parts	DL, BL, CL
6-The need for improvements	1-Which is the most one in need for improvements 2-Which one is much in need for further supportive additional courses before and after it to be sufficient 3-Which one you prefer the most if accompanied with teaching improvements such as virtual patient programs 4-Which one need to improve the curriculum with it 5-Which one needs more training courses for the teaching staff	DL, BL, CL

The statistical analysis

The results were obtained electronically as percentage of the number of students that selected each choice for each question in each parameter to the total number of the student that participated in each question. These percentages were obtained electronically from the online survey program

The percentage data obtained was analyzed and discussed using the descriptive statistic for the tables and figures for the online survey questioners

3. Results

The results of this survey study are shown in table 2 and figure 1

Table 2: The results of the survey study

Parameter	Question	DL	BL	CL
1	1	67(72%)	17(18.3%)	16(17.2%)
	2	31(33.7%)	21(22.8%)	54(58.7%)
	3	81(87.1%)	15(16.1%)	5(5.3%)
	4	4(4.35%)	16(17.4%)	77(83.7%)
	5	64(69.6%)	23(25%)	11(12%)
2	1	50(53.8%)	13(14%)	40(43%)
	2	30(32.3%)	16(17.2%)	49(52.7%)
	3	11(11.8%)	18(19.4%)	68(73.1%)
	4	11(11.8%)	13(14%)	75(80.6%)
	5	6(6.95%)	13(14%)	80(86%)
3	1	15(16%)	13(13.8%)	71(75.5%)
	2	17(18.1%)	12(12.8%)	71(75.5%)
	3	56(59.6%)	22(23.4%)	24(25.5%)
	4	46(48%)	19(20.2%)	37(39.4%)
	5	28(29.8%)	23(24.5%)	48(51.1%)
4	1	11(11.7%)	17(18.1%)	72(76.6%)
	2	32(34%)	21(22.3%)	50(53.2%)
	3	16(17%)	18(19.1%)	71(75.5%)
	4	16(17%)	30(31.9%)	58(61.7%)
	5	34(36.2%)	17(18.1%)	47(52.1%)
5	1	2(2.12%)	23(24.5%)	75(79.8%)
	2	1(1.06%)	16(17%)	79(84%)
	3	2(2.13%)	21(22.3%)	74(78%)
	4	37(39.4%)	20(21.3%)	39(41.5%)
	5	31(33%)	26(27.7%)	38(40.4%)
6	1	30934.5%)	28(32.2%)	39(44.8%)
	2	56(59.6%)	35(37.2%)	21(22.3%)
	3	27(28.7%)	30(31.9%)	43(47.7%)
	4	48(51.1%)	25(26.6%)	36(38.3%)
	5	55(58.5%)	28(29.9%)	32(34%)

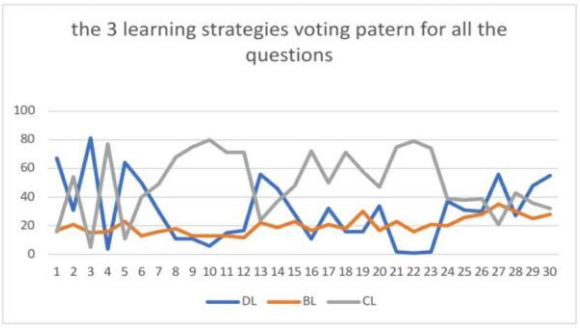

Figure 1: The result of the of the survey study

1-The result of the first parameter, the coast and the economic factors, the highest scoring percentages were as follow.
Question 1 67% for DL
Question 2 58.7% for CL
Question 3 87.1% for DL
Question 4 83.7% for CL
Question 5 69.6% for DL
2-The result of the second parameter, the exams, the highest scoring percentages were as follow.
Question 1 53.8% for DL
Question 2 52.7% for CL
Question 3 73.1% for CL
Question 4 80.6% for CL
Question 5 86% for CL
3-The result of the third parameter the social consideration, the highest scoring percentages were as follow.
Question 1 75.5% for CL
Question 2 75.5% for CL
Question 3 59.6% for DL
Question 4 48.9% for DL
Question 5 51.1% for DL
4-The result of the fourth parameter, in general preferences, the highest scoring percentages were as follow.
Question 1 76.6% for CL
Question 2 53.2% for CL
Question 3 75.5% for CL
Question 4 61.7% for CL
Question 5 52.1% for CL
5-The result of the fifth parameter, curriculum variable, the highest scoring percentages were as

follow.
Question 1 79.8% for CL
Question 2 84% for CL
Question 3 78.7% for CL
Question 4 41.5% for CL
Question 5 40.4% for CL
6-The result of the sixth parameter, the needs for improvements, the highest scoring percentages were as follow.
Question 1 44.8% for CL
Question 2 56.6% for DL
Question 3 45.7% for CL
Question 4 51.1% for DL
Question 5 58.5% for DL

4. Discussions

The COVID-19 pandemic has resulted in unprecedented university closures, affecting millions of students around the world. The abrupt conversion of teaching and learning activities to virtual modalities was carried out in order to keep academic courses running while minimizing crowding and risk of infection spreading. The current study analyzed the classroom learning in the undergraduate dental study program to student perspective of student-centered active learning offered by full distance learning since March 2020. Full remote learning, in which group discussions were held synchronously via online communication frameworks, is a novel learning strategy that has never been used before in our school. In the 2012 blended learning applied by continue learning theoretical subject using DL while CL applied to a limited extend to some practical parts of the curriculum
keeping in mind students' uneven access to high-quality internet, particularly among low-income students. However, when it comes to pre-clinical and clinical scenarios, dentistry students have few viable options [6] Furthermore, dentistry will need to work more closely with medicine [8]. In light of this new reality, we should reassess our curriculum and how we give classes and lectures [7].
Three teaching strategies were applied before and during the pandemic, and according to the result of this study (table 2 and figure 1) they can be discussed as followed.

1-Class room learning CL

This teaching strategy was implicated before the pandemic, the results showed the highest percentage of voting toward this type of learning, young people including dental students generally keen of the modern technology and in spite of that the result showed a bias toward CL these findings attributed to its superiority from their experiment and perception almost in all the 6 parameters

2-Distant learning DL

This strategy started to be implicated during 2020 and the whole learning shift into online distant learning. The same undergraduate student studies for one year in this strategy, and the result of this study showed a preferable to certain degree to that kind of DL for some parameters but far beyond their referral to CL
Several of the reasons that may have contributed to this outcome is the curriculum in use at the time of this research. Clinical dental science programs, which include both theory and operational knowledge and abilities, were taught to senior dental graduates. Fundamentally, such courses necessitate laboratory competency sessions in order to enhance understanding of the topics covered. Due to the university's shutdown, all practical and dental laboratory work were postponed, resulting in a shortage of motoric learning experiences, fewer opportunities for direct consultation with professors, and fewer practical exercises that were normally used to reinforce theoretical class.

3-Blended learning BL

Because of continuity of the pandemic and the disadvantages of DL, from the second year of the pandemic in 2021 blended learning begins to be implicated that combine both of the above strategies. In this study most of the result showed unsupported to that kind of learning in spite of their preferred to CL as well as DL but when applied together the resulted strategy BL was failed to gain their preferred .These findings attributed to the fact that the blended learning that was applied during 2021 was consist of approximately 70% DL and only 30% CL, if it was applied in a way that CL more than DL then the result could be much more different
Dental education cannot be conducted in the same manner as medical education, it is well understood. The cause for this disparity is that dental students need enough physical settings and psychomotor ability from the start of their academic careers, which could not be substituted by a distance learning strategic plan like that used during the pandemic. Aside from students' required preparedness for distance learning methodologies, other aspects including such personality characteristics may affect student preference for distance learning approaches. Personality influences how people perceive, make decisions, and react in different situations. Students' approval of e-learning is frequently linked to their ability to self-regulate. The ability to create goals, good time management, problem-solving aptitude, and knowledge of when to seek guidance from instructors are all instances of self-regulatory behavior. Other elements that support the blended/online learning choice include self-efficacy restriction, e-learning incentive, and high task value, in addition to self-regulatory behavior. Despite the lower number of students who preferred distance learning in this study, students believed that online learning could help them stay motivated to prepare course material prior to group conversation.

5. Conclusions

From this survey study the following conclusions were withdrawn

In general classroom learning is the most preferable,

it makes the curriculum easier and much understandable and best in reducing problems encountered with learning
For economic reasons, classroom learning CL was the most preferable. Although DL spare more time for part time job but still needs more electronic devices and internet
In respect to the exams, CL is the most preferable for both practical and theoretical part, Though DL exam is very easy, but CL is much fare in representing the students
According to social consideration, both CL&DL are preferable, CL is best in interaction between students and teachers and much trusted and preferable by the students' families. DL is less stressful and provide much more spare time
Curriculum variable revealed that the students prefer the CL for each part of the conservative dentistry (endodontic operative, crown& bridges) whether theoretical, practical, preclinical, or basic part of the curriculum
Both DL and CL in need for improvement, but DL needs much more improvements and additional supportive training courses for both the student and the teachers
BL that applied in 2021 that depends mainly on DL, with very limited and little extent of CL gain no support in its form

6. Implication and Feature Perspective

1-The feature of learning strategies:

Efficiency has greatest odds proportion in relation to desire for distant learning, according to a logistic regression analysis. Furthermore, students realized that online learning provided them with additional time to study and review information. Such findings are consistent with prior research, which has depicted that remote learning offer for more versatility in study process, while also saving time and money by eliminating need for commuting to and from campus. Distance learning that is well-designed allows students to have more time to explore more topics and obtain endless information. In recent decades, such an advantage has suited the learning experience of medical and dental students, who have had to ingest larger loads of new and up-to-date topics.
The feature will be for the well designed and proportionate BL that give the necessary and % of DL in addition to the %of CL that is required for each curriculum even after the subsided of the pandemic

2-The impact on the research and the researchers in that issue:

The COVID-19 epidemic shows the necessity for greater research in this area in order to better teach our youngsters. In this new reality, our educational governing bodies should be encouraged to develop institutional rules that provide new possibilities for students and faculty. Finally, the obstacles in emerging countries will be larger. Uneven student access to high-speed internet can jeopardize success in distant activities. To resume clinical activity, significant expenditures in dentistry school facilities must be produced in order to adjust to the changing biosafety realities of the post-pandemic phase.

3-The change on the skills of the teaching staff

The COVID-19 outbreaks have made it impossible to provide clinical dentistry and teaching in the field. Dental educators, on the other hand, now have potentials and tools to update their teaching methods by incorporating new digital conceptual to enhance internet communication. It is necessary to make adequate preparations for a probable second wave or another infection. The COVID-19 crisis has also revealed that the significance of facilities and novel technology in e-oral health programs and support, as well as tele-dentistry, is grossly underestimated.
With both the creation and development of research approaches, tele-dentistry, and clinical studies with adaptable strategies to solutions, pandemic will leave a permanent change in dental education. The pandemic's consequences are far-reaching, and they may permanently alter how future dentists are educated.

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