

Impact of COVID-19 Pandemic on Dental Curriculum Achievement by Undergraduate Dental Students in Taif University

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Abstract

Purpose/Objectives: The Bachelor of Dental Medicine and Surgery program at Taif University is a comprehensive six year program with one year of compulsory Field Experience. Many of the courses and Preclinical/clinical activities were conducted online in the academic year 2020-21 due to COVID-19 pandemic restrictions. Aim of this study was to identify the Impact of COVID-19 Pandemic on Dental curriculum achievement at Taif University. **Methods:** The scores and passing percentage of undergraduate dental students for the Academic year 2019-20 and 2020-21 were compared and analyzed. All courses were grouped into five categories- theoretical, theoretical-practical, theoretical-clinical, pure clinical and Interactive learning courses. A minimum of 60% aggregate score in each course was mandatory for a student to pass in the exam. **Results:** The results of all the exams were entered in SPSS, Version 21.0. The performance of the students were assessed and compared for both academic years using Chi square test. A p-value of less than 0.05 was considered significant. Considering the passing percentage of students, the performance of students in 'Clinical' courses was better in AY 2019-20 as compared to AY 2020-21. The difference in the mean scores for these two years was statistically significant across 'theory+clinical' category. **Conclusion(s):** The performance of students was much affected after the imposition of Covid-19 pandemic restrictions, where the courses had clinical component. In rest of the categories, students performed better in AY2020-21. A hybrid mode of Dental Education may be beneficial.

Keywords: COVID-19, Dentistry, Curriculum, Clinical Skill, Dental Education.

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INTRODUCTION

COVID-19 is an infectious disease caused by the coronavirus (SARS-CoV-2), which is transmitted through aerosols produced by the respiratory tract or contaminated surfaces [1]. The outbreak began in December 2019 in China, and on March 11, 2020, the World Health Organization declared COVID-19 a pandemic. In response, the Ministry of Education in the Kingdom of Saudi Arabia announced the suspension of physical presence in educational institutions, leading to a shift to online learning platforms.

Healthcare education programs were significantly impacted, as many courses could not be effectively transitioned to distance learning [2]. Clinical activities, preclinical simulations, and laboratory exercises were halted in most U.S. dental schools, severely affecting students' clinical skill development [3]. For example, at the "G. D Annunzio" University of

Chieti-Pescara Dental School in Italy, the absence of practical training during the pandemic severely impacted dental curriculum achievements and disrupted the structure of their curriculum [4].

Research conducted in Italy revealed that interruptions in clinical and practical training adversely affected both educational achievements and self-confidence of dental students [5]. Similar findings were reported in a German dental school, where online lectures proved valuable, yet the lack of practical training compromised curriculum effectiveness [6]. The pandemic also influenced final-year dental students at the School of Dental Medicine, University of Belgrade, leading to significant differences in self-confidence and highlighting the need for additional educational support during the postgraduate period [7].

To adapt to the pandemic, dental educators were required to modify curriculum models and integrate technology to maintain educational continuity. Intensive training was necessary to help students regain self-confidence and incorporate into medical and social care delivery models [8]. Although electronic distance learning and assessments for theoretical courses were effective, disruptions in practical and clinical education presented significant challenges [9].

The Bachelor of Dental Medicine and Surgery program at Taif University spans six years, including a compulsory Field Experience. The curriculum integrates both curricular and extracurricular activities. However, many of these activities were either canceled or transitioned to online formats during the 2020-21 academic year due to pandemic restrictions. The primary challenge was the disruption of practical exercises and direct patient care, essential components of dental education, which necessitated careful management to avoid delaying graduation.

This study aims to evaluate the impact of the COVID-19 pandemic on the dental curriculum achievement of undergraduate students at Taif University, comparing the academic years 2019-20 and 2020-21 in theoretical, theoretical-practical, theoretical-clinical, clinical, and interactive learning courses.

MATERIAL AND METHODS

Study Design and Sampling Procedures

The study was approved by the Ethics Committee at Taif University, accredited by the National Committee for Bioethics (HAO-02-T-105) with approval number 46-039, dated September 24, 2024. This cross-sectional observational study collected and analyzed data from undergraduate dental students for academic years 2019-20 and 2020-21 at the Faculty of Dentistry, Taif University. Scores and passing percentages were compared across the two academic years, with the pandemic restrictions affecting AY 2019-20 from March 2020 onward, and the entire AY 2020-21.

All examinations were conducted using the "Examsoft" software, with theoretical components assessed through mid-term and final term exams. Other assessment methods included practical evaluations, group discussions, clinical performance, and presentations, which were adapted to suit online and virtual formats due to pandemic restrictions.

In compliance with the Ministry of Education's directives, all courses were delivered online from March 2020 onward, suspending in-person classes for all levels. Taif University utilized the "Blackboard" platform for online lecture delivery, where each faculty member created sessions according to the timetable and assigned student groups. Students attended lectures as per schedule, with provisions for Q&A sessions in an

audiovisual format. Lecture notes and assignments were posted on the same platform.

Each course was delivered over 15 weeks, divided into two semesters. Courses included mid-term (7th - 8th week) and final term exams (16th - 17th week). For analysis, all courses from AY 2019-20 and AY 2020-21 were categorized into five groups: theoretical, theoretical-practical, theoretical-clinical, pure clinical, and interactive learning courses. A minimum score of 60% was required for passing. Results were obtained from the examination unit of the Faculty of Dentistry. Care was taken to anonymize student identities in the dataset. Only the final exam results were considered for students who retook courses. For clinical courses, students unable to meet requirements were marked as failed.

Data were analyzed using SPSS Version 21.0. Descriptive analysis was performed, and the performance of students was compared across categories for both academic years using the Chi-square test, with significance set at $p < 0.05$.

RESULTS

The Bachelor's in Dental Medicine and Surgery program at Taif University includes a comprehensive six-year curriculum followed by one year of compulsory Field Experience. The courses consist of theoretical, theoretical-practical, theoretical-clinical, pure clinical, and interactive learning components, along with extracurricular activities such as community service and research. This study assesses the impact of the COVID-19 pandemic on dental curriculum achievement for undergraduate dental students across these categories.

The distribution of courses across various categories for AY 2019-20 and AY 2020-21 is summarized in **Figure 1**. The number of courses categorized as 'Theory + Practical' and 'Interactive Learning' was higher in AY 2019-20 compared to AY 2020-21. Due to pandemic restrictions beginning in March 2020, more clinical courses were delivered in AY 2020-21.

The passing percentages for students in AY 2019-20 and AY 2020-21 are presented in **Table 1**. The percentage of students passing in various categories showed significant differences for AY 2019-20, including theoretical courses (Chi-square = 18.632, $p = 0.001$), theoretical + practical courses (Chi-square = 41.394, $p < 0.000$), and interactive learning courses (Chi-square = 16.286, $p = 0.001$). In AY 2020-21, significant differences were observed in theoretical + practical courses (Chi-square = 38.720, $p < 0.000$) and clinical courses (Chi-square = 5.444, $p = 0.020$). Overall, the comparison as seen in **Table 2** revealed that the performance of students in clinical courses was better in AY 2019-20.

Tables 3 gives details of the marks of the students across courses in all categories for AY 2019-20 and AY 2020-21. Maximum number of exam takers were seen in Theory + practical courses in both the academic years. The scoring of the marks of students ranged from 0 to 98 in AY 2019-20. The difference in scores of the students was statistically significant in 3 categories- Theoretical (Chi square value= 347.742, p value= 0.000), Theoretical +Practical (Chi square value= 1559.789, p value= 0.000) and ‘Interactive Learning’ (Chi square value= 283.306, p value= 0.000) for the AY 2019-20. For the AY 2020-21, the minimum score was 60 in 2 categories- ‘Theoretical’ and ‘Interactive Learning’. The difference in scoring of the students was statistically significant across all categories for AY 2020-21. When the mean scores of students across categories were compared for AY 2019-20 and AY 2020-21 as in **Table 4**, the difference was statistically significant across ‘Theoretical +clinical’ category only (Chi square value= 712.062, p value= 0.022). The performance of students was better in AY 2019-20 compared to AY 2020-21 in 2 categories- ‘Theoretical +clinical’ and ‘Clinical’. This can be attributed to the Covid- 19 pandemic restrictions from march of 2020 onwards, which affected the delivery of

clinical courses. For the AY 2020-21 students fared better in ‘Theoretical’, ‘Theoretical +Practical’ and ‘Interactive Learning’ courses than in AY 2019-20, as these were not much affected by the Covid-19 pandemic restrictions.

Fig 2 is a comparison of number of students across categories for AY 2019-20 and AY 2020-21. More number of students appeared in AY 2019-20 compared to AY 2020-21 in all categories except clinical courses. All students whose clinical courses continued since the Covid- 19 restrictions in the second term of 2019-20 continued them in the AY 2020-21.

Overall it was observed that the performance of the students was much affected after the imposition of Covid-19 pandemic restrictions, where the courses had clinical component. In rest of the categories, though the delivery was shifted to online mode, the students performed better in AY2020-21 compared to AY 2019-20.

Tables And Figures

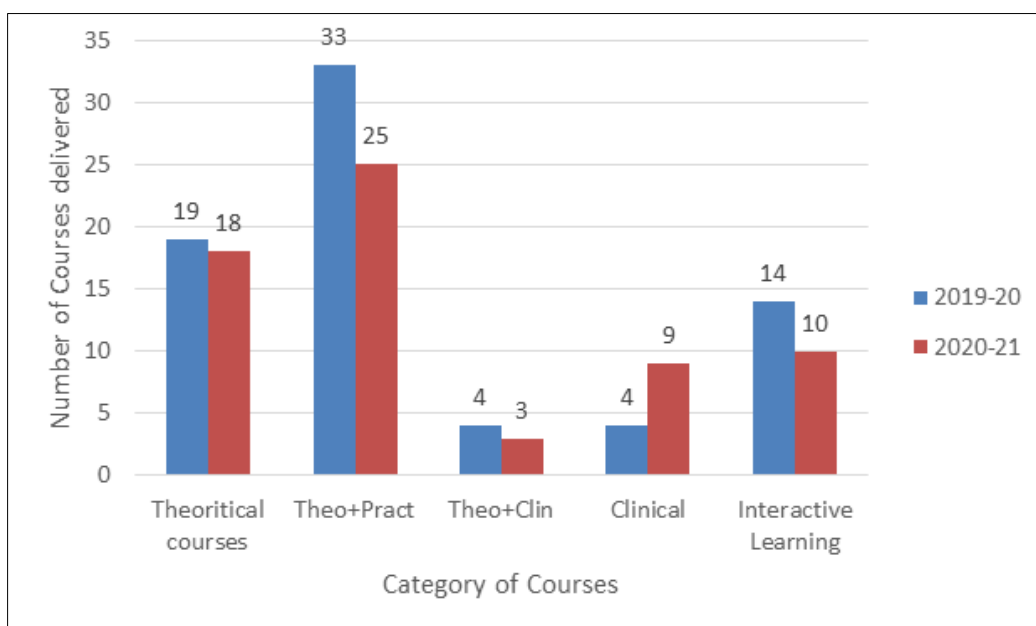


Fig. 1: Distribution of courses according to categories across all years of study for Academic Years 2019-20 and 2020-21

Table 1: Distribution of the percentage of students who passed (Scored a minimum of 60 marks out of 100) in all categories for AY 2019-20 and AY 2020-21

		No. of Courses	Mean	Std. Deviation	Minimum	Maximum	Chi square Value	p value
AY 2019-20	Theoretical	19	92.35	22.642	0	100	18.632	0.001*
	Theoretical +Practical	33	89.11	28.787	0	100	41.394	0.000*
	Theoretical +clinical	4	95.00	0.000	95	95	Constant	NA
	Clinical	4	70.24	47.041	0	100	0.500	0.779
	Interactive Learning	14	98.47	2.522	94	100	16.286	0.001*
	Theoretical	18	100.00	0.000	100	100	Constant	NA

		No. of Courses	Mean	Std. Deviation	Minimum	Maximum	Chi square Value	p value
AY 2020-21	Theoretical +Practical	25	99.38	2.293	89	100	38.720	0.000*
	Theoretical +clinical	3	98.15	3.210	94	100	0.333	0.564
	Clinical	9	11.11	33.333	0	100	5.444	0.020*
	Interactive Learning	10	100.00	0.000	100	100	Constant	NA

Table 2: Comparison of the percentage of students who passed (Scored a minimum of 60 marks out of 100) in all categories for AY 2019-20 and AY 2020-21

		Mean	Std. Deviation	Minimum	Maximum	Chi square	P value
Theoretical	AY 2019-20	92.35	22.642	0	100	No statistics are computed because Passing % for AY 2020_21 is a constant	
	AY 2020-21	100.00	.000	100	100		
Theoretical +Practical	AY 2019-20	89.11	28.787	0	100	15.217	0.055
	AY 2020-21	99.36	2.378	89	100		
Theoretical +clinical	AY 2019-20	95.00	.000	95	95	No statistics are computed because Passing % for AY 2019_20 is a constant.	
	AY 2020-21	98.00	3.464	94	100		
Clinical	AY 2019-20	70.24	47.041	0	100	No statistics are computed because Passing % for AY 2020_21 is a constant	
	AY 2020-21	11.11	33.333	0	100		
Interactive Learning	AY 2019-20	98.47	2.522	94	100	No statistics are computed because Passing % for AY 2020_21 is a constant	
	AY 2020-21	100.00	0.000	100	100		

Table 3: Marks across courses in all categories for AY 2019-20 and AY2020-21

		No. of Exam takers	Minimum	Maximum	Mean	Std. Deviation	Chi Square value	p value
AY 2019-20	Theoretical	387	0	96	75.73	18.807	347.742	0.000*
	Theoretical +Practical	639	0	98	77.09	14.295	1559.789	0.000*
	Theoretical +clinical	80	0	95	80.58	19.459	35.575	0.034
	Clinical	43	0	87	74.30	21.027	11.000	0.857
	Interactive Learning	242	0	96	77.44	12.179	283.306	0.000*
AY 2020-21	Theoretical	323	60	98	79.91	9.331	169.087	0.000*
	Theoretical +Practical	479	0	95	79.59	8.306	451.877	0.000*
	Theoretical +clinical	72	49	90	74.18	12.161	43.000	0.000*
	Clinical	241	0	90	32.05	38.331	1766.734	0.000*
	Interactive Learning	200	60	96	84.54	6.570	181.840	0.000*

Table 4: Comparison of Marks across courses in all categories for the AY 2019-20 and AY 2020-21

		Minimum	Maximum	Mean	Std. Deviation	Chi Square Value	p Value
Theoretical	AY 2019-20	0	96	75.73	18.807	1255.011	0.984
	AY 2020-21	60	98	79.91	9.331		
Theoretical +Practical	AY 2019-20	0	98	77.09	14.295	1390.732	0.137
	AY 2020-21	0	95	79.59	8.306		
Theoretical +clinical	AY 2019-20	0	95	80.58	19.459	712.062	0.022*
	AY 2020-21	49	90	74.18	12.161		
Clinical	AY 2019-20	0	87	74.30	21.027	184.091	0.546
	AY 2020-21	0	90	32.05	38.331		
Interactive Learning	AY 2019-20	0	96	77.44	12.179	1204.333	0.887
	AY 2020-21	60	96	84.54	6.570		

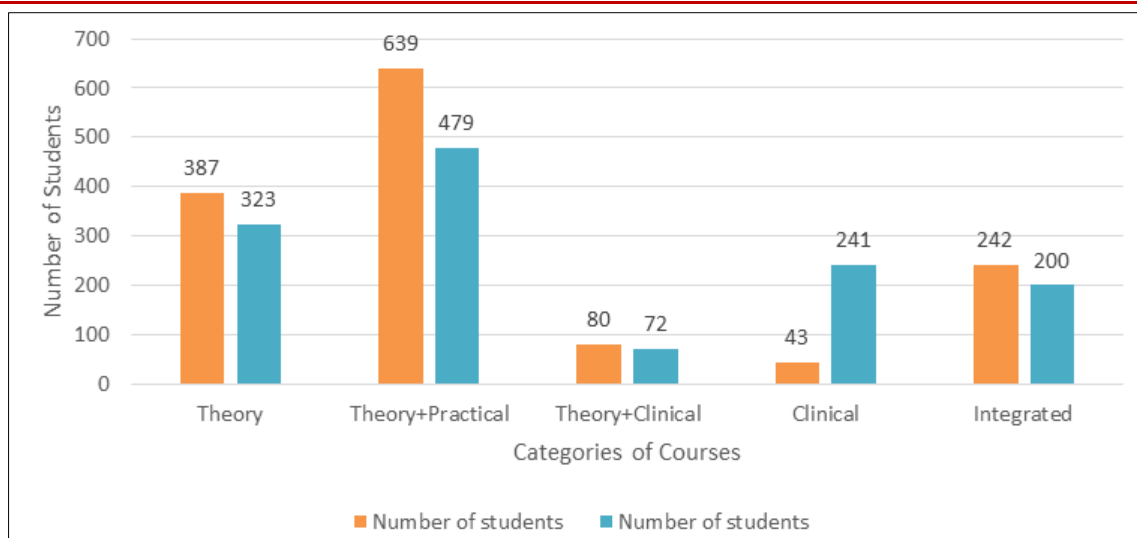


Fig. 2: Number of students across categories of courses in AY 2019-20 compared to AY 2020-21

DISCUSSION

The findings of this study underscores the significant impact of COVID-19 pandemic on the dental education curriculum at Taif University. There are numerous studies reported on the impact of Covid 19 pandemic on Dental Education [1-28], but none have assessed this effect based on the marks/ scores of the students. The present study is a very objective and focused attempt to report this impact based on the performance of the students in the assessments during this period.

As in the present scenario, Dental schools all over the world had to modify the teaching and learning methodologies as well as assessment systems to suit the pandemic restrictions. Educational methodology for distance learning have been adopted for synchronous teaching for critical thinking skills, asynchronous teaching to facilitate collaborative learning as well as Blended learning as in clinical scenarios such as dental emergencies [11, 12]. Modifications have been reported for various other forms of teaching/ learning methods as well such as for flipped classrooms and Problem Based Learning. Didactic classes have been found to be the easiest to adapt to online mode and VoiceThread (VT) an excellent cloud-based program has been suggested for videos and PowerPoint to be incorporated into presentations [13, 14]. There is also use of digitization for Preclinical didactic and case-based exercises, presented as videos featuring embedded quiz questions through a platform like EDpuzzle [15]. Faculty also have created clinical videos that enriched the learning experience [16]. At the faculty of Dentistry in Taif University, Blackboard software provided by the university was used to deliver all teaching and learning activities. Students could review and revise the recorded live lectures repeatedly at their convenience.

Studies have reported Assessment strategies involving formative exams being conducted on learning

management systems such as Canvas [17], along with summative exams using ExamSoft [18]. Online proctoring could be facilitated through third-party services like ProctorU [19], Honorlock [20], Respondus Monitor [21], and Examity [22]. In the present study all assessments were carried out using Examsoft. The impact of the restrictions were such that the time to adapt to distance mode of assessments had to be made in a very short span of time. Though, a lot of variants for assessments carried out during the Pandemic restrictions are available, none has claimed superiority over other methods so far. A study has indicated that the COVID-19 confinement might have a positive impact on students' performance [23]. The results of the students based on their scores in the present study indicate that while theoretical knowledge was relatively maintained during the transition to online learning, students experienced notable deficiencies in clinical skills development, a critical component of dental training. Specifically, the significant drop in performance in clinical courses during AY 2020-21 highlights the challenges posed by the pandemic-induced restrictions on hands-on training and direct patient interactions. Increasing evidence suggests that e-learning is as effective as traditional methods [24]. A review examining the barriers and facilitators of e-learning found that remote education could improve learning and performance thanks to its flexibility and accessibility [25].

The data from our study revealed that students achieved better outcomes in clinical courses during AY 2019-20 when traditional in-person learning methods were employed. This aligns with previous research suggesting that dental education, which relies heavily on practical experience, cannot be effectively replicated in a fully online environment [10]. The decline of approximately 25% in clinical course performance between the two academic years emphasizes the necessity of in-person training for the development of

essential skills and confidence in students. Though studies have assessed the acceptability and perception of students to Distance mode of education and assessments during the Pandemic restrictions, none of them have considered the marks of the students before, during or after imposition of the restrictions to make objective comparisons.

In response to these findings, the academic unit conducted a thorough analysis of the defects in student achievement throughout their academic study. This analysis highlighted the urgent need to address the gaps in clinical training, particularly for students in their final year. A strategic plan has been formulated to cover these defects, prioritizing the educational needs of sixth-year students to minimize graduation delays while ensuring that they achieve all course outcomes and program learning outcomes (CLOs and PLOs). These amendments should not be confined to a particular school or scenario, but on a broader aspect it reflects on the universal need for Dental schools worldwide to be prepared for unforeseen circumstances. This global change may foster momentum for us to exchange ideas, share practices, and collaborate on valuable strategic initiatives [26]. The plan includes intensified clinical training sessions and workshops designed to enhance practical skills and restore self-confidence among students. By offering additional hands-on experiences and tailored support, the academic unit aims to bridge the gap created by the pandemic. Furthermore, the institution will implement regular assessments to monitor student progress and provide timely feedback, enabling faculty to adjust teaching strategies as needed to meet students' evolving needs. Innovative solutions like simulation and virtual reality systems could serve as promising alternatives [10-27].

Moreover, the feedback gathered from students pointed to significant concerns regarding their readiness for clinical practice after graduation. This sentiment is echoed in the literature [10-28], which indicates that students' self-confidence in their clinical abilities can be severely affected by the lack of practical training during crucial educational periods. The challenges faced by the dental students at Taif University reflect a broader trend observed in dental schools worldwide, where similar disruptions have been reported.

The findings of this study suggests that a hybrid mode of education could offer a viable path forward, integrating both online and traditional learning elements to enhance educational outcomes. Such an approach could allow for the flexibility required to address future disruptions while ensuring that essential hands-on skills are adequately taught. Faculty and educational leaders should consider developing strategies that effectively combine technology with practical experiences to foster a more resilient educational framework.

In conclusion, this study provides critical insights into the impact of the COVID-19 pandemic on dental education, specifically within the context of Taif University. As dental education continues to evolve in response to ongoing challenges, it is imperative that educators prioritize the integration of effective teaching methods that balance theoretical knowledge with the essential practical experiences necessary for cultivating competent and confident dental professionals.

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