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Impact of COVID-19 on perception and preparedness among clinical year Malaysian undergraduate dental students – A cross-sectional study

# Impact of COVID-19 on perception and preparedness among clinical year Malaysian undergraduate dental students – A cross-sectional study

Avita Rath[1], Melissa Wong Li Zheng[1], Claudio Mendes Pannuti[2]
[1]Faculty of Dentistry, SEGi University, Malaysia
[2]Departament of stomatology, University of São Paulo, Brazil

## Abstract

**Objectives:** This study aimed to evaluate how quarantine affected final-year dental students' self-perceptions of preparation and assess how online training affected clinical students' education at SEGi University.

**Methods:** Year 3 to 5 students (n=140) were asked to fill up an online questionnaire. The first part included the effects of online education experience between the academic years. The second section assessed the graduating class's self-perceived readiness in cognitive, communication and professional abilities. The Chi-square test was used to analyse the association between the groups regarding academic years, gender, and family income.

**Results:** Year 3 students missed educational experiences during lockdown significantly more than years 4 and 5 (p<0.001). In addition, 86% of year 5 students (p< 0.001) felt that online assessment was not a suitable evaluation method compared to the other clinical years. About two-thirds of the 5th year dental students were unsure of their confidence in their skills before graduation. Around half of the final-year students said they were unsure about starting their practice following graduation. After graduation, 80% of respondents preferred to spend a year in residence with sufficient training.

**Conclusions:** Although students' self-perceived preparation was generally positive, they expressed reservations about the independent practice after graduation

**Keywords:** dental education; COVID-19; undergraduate; online; Malaysia; Educational Technology

## INTRODUCTION

The COVID-19 pandemic shook the world in early 2020, bringing it to a near-standstill [1]. To curb the spread of infection, most countries imposed drastic social distancing measures, such as stay-at-home restrictions, travel bans, shutting off offices and educational institutions [2-3]. Albeit the closing of educational sectors for the safety of students and academicians proved to be effective, and it led to significant challenges for everyone involved [4]. One of the most challenging problems, particularly for professional courses like dentistry, has been eliminating direct patient care, an essential part of the dental curriculum. Although there are some procedural variances in curricula and methodology between numerous dental schools around the world, didactic lectures and clinical training remain a crucial component [5].

Many dental schools across the world incorporated Problem-based Learning, Case-based Learning, and community-based clinical activities. However, due to lockdowns and directions from national, regional and local officials to prevent the transmission of COVID-19 while examining adjustments in dental education curricula, most dental schools initially sent students home [6-9]. Dental schools responded to COVID-19 by introducing alternative forms of education and evaluation, such as live and pre-recorded online lecturers, virtual problem-solving activities and computer-based reports and exams, which were previously thought to be insufficient to compensate for the loss of clinical training exposure [10-11].

As of 1 April 2020, there were 1.598 billion students from 194 countries who were forced to stay at home owing to the shutdown of their educational institutions on all levels [12]. Technology served as a boon during these times, but it did involve a learning curve for both students and academicians. It was vital to find a balance between synchronous and asynchronous online teaching and learning in an emergency like the pandemic, to communicate distance education etiquette and traditions to students while being adaptable enough to deviate from the intended material delivery schedule [13].

This situation was no different in context to Malaysian dental universities students. Many students and educators had to adapt to a drastic transition to distant online teaching and learning (e-learning) to ensure students were not left idle during this pandemic lockdown. Due to constant change of directives by the Government, as a result of spikes of infections, lockdowns were implemented, drastically affecting the learning time of clinical year students [14].

SEGi University has begun to combine e-learning and blended learning into specialized courses, similar to other universities. In this way, several disciplines looked to work well in this manner. Students in areas where patient care is a fundamental requirement, on the other hand, must be present in clinics to provide patient care while honing their clinical skills.

Even if new technologies like simulation and virtual reality become more popular, they will never be able to replace direct in-person interaction.

Curriculum design, training model, teaching methods and the general educational environment all have an impact on the goal of generating competent dental students. Many research has looked at the efficiency of online learning since the emergence of COVID-19. During the COVID-19 pandemic, a great deal of research found that online learning was beneficial. Secondary students may benefit from online, indoor, and desk-based learning, which will allow them to learn efficiently and continuously throughout the COVID-19 pandemic lockdown. Most studies have reported positive online learning effectiveness during the COVID-19 pandemic [15]. Given the advantages and limitations of online learning, which is extensively employed during this tough COVID-19 pandemic period, it is important to investigate its efficacy. Nonetheless, we recognise that our graduating students' overall competence and confidence may be reflected in their current lack of adequate undergraduate preparation.

The purpose of this cross-sectional survey was to monitor how the student's intellectual abilities and future ambitions were affected by the abbreviated and modified scholastic year. The first objective was to investigate the effectiveness of online learning from the perspective of students, as well as to determine the most influenced qualities, whether clinical, cognitive or behavioral. The second objective was to assess students' self-perceptions of their readiness in terms of cognition, communication, and professional competencies.

## MATERIALS AND METHODS

The study design is a cross-sectional questionnaire-based study that uses a self-administered questionnaire to evaluate the different experiences and perceptions regarding distant online learning due to the COVID-19 pandemic among clinical dental students in SEGi University, Malaysia. The study was conducted between February 2021 and May 2021. The study included n=140; year 3 to year 5 undergraduates from the Faculty of Dentistry, SEGi University. Prior to the start of the research, the institutes' review board granted ethical approval (No.SEGiEC/StR/FOD/32/2020-2021). The questionnaire briefly explained the objectives of the survey, and the students were informed that their participation was completely voluntary and anonymous. Submission of the questionnaire, on the other hand, implied consent.

The questionnaire was adapted from Hattar et al [16]. It was developed in Google Form (Google Inc., Mountain View, CA, USA) and was electronically disseminated for data collection. The questionnaire comprised two main parts. The first part comprised background and demographic details of the participants, such as the age, gender, current academic year, race

and family income. In addition, family income was dichotomized into 2 categories such as high (> RM 5000 per month) and low (≤ RM 5000 per month). The second part addressed two subsections. The first subsection, which was distributed to third, fourth and final year students aimed to look into students' opinions toward online learning. This segment consisted of 9-close ended questions about their educational experience with e-learning, including the systems' efficacy, level of involvement, collaboration with colleagues, the system's value compared to traditional techniques, and the assessment methods used. The last two questions asked about unpleasant experiences with various types of learning, and identified which dentistry disciplines were considered negatively impacted by the pandemic. This sections' responses were rated on a four-point Likert scale (strongly agree, agree, disagree, strongly disagree).

The second section investigated how prepared students thought they were for a career in dentistry. Only the graduating students of 2021 (5th year, N=50) received this part of the questionnaire. It was divided into two main categories. The first category included 17 items drawn from a previously validated scale that examines a wide variety of skills and qualities required of dental students upon graduation [16]. There were 3 categories for these 17 indications of cognition, communication, and professional skills: "no experience",

which received a score of zero; "Mostly", which received a score of one; and "Always", which received a score of two. Thus, the self-perceived preparation measure had a total score range of 0 to 34.

The second category comprises of 4-closed ended questions with the options of "yes", "no", and "unsure" that focused on students' perceived readiness for a dental practice in terms of confidence in skills acquired prior to graduation, preference for being monitored after graduation, readiness for independent practice, and preference for a well-structured year of residency. For internal consistency and clarity of the questionnaire, pre-test analysis was done on 10 randomly selected final year students who answered the questionnaire. Since there was no significant feedback from the students, the questionnaire was used as it is. Two reminders were sent to participants at the beginning and end of April 2021 between data collection to complete the questionnaire.

*Statistical Analysis*

The completed questionnaires were analyzed with SPSS statistical software, version 26.00 (SPSS Inc., Chicago, IL, USA). The consistency and reliability of the questionnaire were assessed through pre-test analysis and Cronbach's alpha. Descriptive statistics were used to express the results as percentages for qualitative variables or in means and standard deviation for quantitative variables. The Chi-square test was used to

analyze the association between the groups in terms of academic years, gender and family income. Alpha was set at 5% in all tests.

**RESULTS**

We sent the questionnaire to 140 students from the third to final year. Of these, 139 responded, yielding a response rate of 99.2%. Out of 139 (100%) students, 51(36.7%) were males, and 88(63.3%) were females. The mean age of the cohort was 24.02±0.7. About 14.4% of the students were Malay, 18.7% were Indians, 66% were Chinese, and 2.9% belonged to other ethnicities. The majority of the students belonged to a high family income, 97(69.8%). (Table 1) Cronbach's alpha was 0.76, indicating good internal consistency within the questionnaire.

*Section 1: Effects on dental education based on students' perceptions regarding online learning.*

The educational impact of COVID-19 on 3rd, 4th and 5th year dental students is shown in Table 2. The majority of the students felt that the lockdown caused them to miss educational opportunities, with year 3 dental students (100%) agreed significantly more than year 4 and year 5 students (p<0.001).

When compared to year 3 and year 4 students, the majority of year 5 students (86%) (p<0.001) believed that online assessment was not a viable evaluation approach. On the other hand, year 3 and 4 dental students, thought that online

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assessment was an excellent way of evaluation, with year 3 students (86.8%) strongly agreeing much more than year 4 students (56.9%). All year 3 and final year students agreed to a small group discussion on e-learning for clinical cases and scenarios. Students in their last year were substantially more motivated and engaged (p<0.001). However, only 2% of year 4 students had a negative outlook on group discussion on e-learning compared to year 3 and 5 students.

There was no significant difference between all the three academic years regarding their collaboration with colleagues. Most of the 4th and final year students (84.3% and 94%, respectively) showed a lack of motivation through distant e-learning as compared to the 3rd year students (p<0.001). In addition, the majority of the year 3 and 5 students (year 3 = 100%, year 4 = 90.2%, year 5 = 100%), preferred online lectures more than the year 4 dental students (p=0.01). A significantly higher percentage of 5th year dental students (90.0%) and 3rd year students (86.6%) compared to 4th year dental students (62.7%) strongly agreed with the technology-based education (p = 0.01).

Table 3 shows the various types of experiences influenced by quarantine among the clinical year dental students. All of the year 3, 4 and 5 dental students (100%) strongly agreed that clinical, lab sessions and hospital postings were greatly affected. Regular lectures were missed significantly by the year 3 dental students compared to the 4th year students (p = 0.004). In contrast, year 4 students reported that research projects were considerably affected compared to the final year students (p<0.001). A higher percentage of year 3 (57.9%) and year 4 (54.9%) dental students felt that seminars were not significantly disrupted during quarantine as compared to the year 5 students (p = 0.006). When asked about their experiences with case-based learning, most of the students, especially the 4th year dental students (72.5%), felt that it could be done online. Therefore, it is not affected during the quarantine period compared to the 3rd and final year students (p = 0.004).

The dental subspecialties most negatively affected by quarantine are shown in Table 4. All year 3 dental students (100%) strongly agreed that general medicine and general surgery were greatly affected during the quarantine. Oral diagnosis experiences among year 3 and 4 dental students were more negatively affected among the year 3 (p<0.001), while the year 4 felt that community oral health was affected more compared to the year 3 dental students (p = 0.02). The final year students felt that periodontology was significantly affected compared to the year 3 and 4 students (p <0.001). 4th and final year dental students struggled with prosthodontics significantly compared to 3rd and 5th year students (p<0.001). Conservative dentistry and endodontics among the year 3 students were affected least significantly in comparison to the 4th and final year students (p<0.001). Year 5 dental students (76%) were significantly more confident in paediatric dentistry than year 3 (26.3%) and 4 (47.1%) (p<0.001). Orthodontics was negatively affected among the year 5 students, followed by the year 4 and year 3 (p<0.001). Oral surgery demonstrated no significant difference among all the years.

*Section 2: Comparing the effects of dental education according to students' attitudes towards online learning between the genders and family income.*

The impact on dental education among the genders is shown in Supple.Table 1. There was no significant association between gender and the responses regarding all 7 components of the questionnaire. Nonetheless, regarding the experiences mostly affected by quarantine, there was a significant association between gender and the responses as regards seminar, i.e., 58.8% of males strongly disagreed that seminars were the experience that was affected mainly by quarantine, as compared to 38.6% of females (p = 0.02) (Table 5). Male students (60.8%) agreed that orthodontics was affected as compared to female students (40.9%)

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**Table 1. Background characteristics of the participants (¥n = 140, N=139)**

| CHARACTERISTICS | N (%) | MEAN(SD) |
|---|---|---|
| **GENDER** | | |
| • MALE | 51(36.7) | |
| • FEMALE | 88(63.3) | |
| **AGE** | | 24.02 (0.7) |
| **YEAR OF STUDY** | | |
| • YEAR 3 | 38(27.3) | |
| • YEAR 4 | 51(36.7) | |
| • YEAR 5 | 50(36) | |
| **RACE** | | |
| • MALAY | 20(14.4) | |
| • CHINESE | 89(66) | |
| • INDIAN | 26(18.7) | |
| • OTHERS | 4(2.9) | |
| **FAMILY INCOME** | | |
| • **LOW (≤ RM5000/MONTH)** | 42(30.2) | |
| • **HIGH (> RM5000/MONTH)** | 97(69.8) | |

¥= Total sample

(p = 0.001), while no significant difference was noted among the other subspecialties shown in Table 6. There was no significant association between the students' family income and dental education impact (Supple.Table 2).

*Section 3: The final year students' self-perceived preparation in cognition, communication, and professional abilities.*

Table 7 shows the responses of 5th year dental students to 17 measures of self-perceived preparedness relating to cognition, communication, and professional abilities. The 50 final-year students' overall self-perceived preparation mean score (TPS) was 22.5 (SD ±1.92). In general, most students believed they were entirely or mostly equipped in their professional and communication skills. However, a large number of final-year students found it challenging to evaluate new dental materials using an evidence-based approach, according to our research (66%). Almost half (54%) said they did not have enough evidence-based knowledge of scientific principles to support their practice. Furthermore, nearly two-thirds of the students (62%) said they regularly reflect on their clinical practice to address their learning requirements. However, the study reported that female final year students were significantly better in managing patients' expectations for their treatment than their male counterparts (p=0.04). Furthermore, the female 5th year students were perceived to communicate with their patients more effectively (p=0.01) with procedural risks (p=0.02) significantly better than the male students shown in Table 8. There was no significant association between the family income and most of the self-perceived preparedness of the final year students except for evaluating new dental materials or products using an evidence-based approach, where the lower-income group of students were significantly higher than the higher income group (p=0.03). In addition, the higher income group recognizes their limitations in clinical practice significantly higher than the lower income group of students (p=0.02) illustrated in Table 9.

The general practice readiness among the final year students was evaluated and shown in Table 10, and it is not

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**Table 2: Impact of COVID-19 on dental education among year 3,4 and 5 dental students**

| Questions | Academic Year | Strongly Disagree % | Disagree % | Agree % | Strongly Agree % | P-value |
|---|---|---|---|---|---|---|
| Do you feel that you missed educational experiences because of the lockdown? | 3 | - | - | 31.6 | 68.4 | <0.001* |
|  | 4 | 5.9 | 39.2 | 37.3 | 17.6 |  |
|  | 5 | 2.0 | 22.0 | 46.0 | 30.0 |  |
| Do you think online assessment is a good method for evaluation? | 3 | - | - | 13.2 | 86.8 | <0.001* |
|  | 4 | - | - | 43.1 | 56.9 |  |
|  | 5 | 28.0 | 58.0 | 8.0 | 6.0 |  |
| Do you think group discussion posted on E-learning such as clinical cases and scenarios had a positive value on your education? | 3 | - | - | 60.5 | 39.5 | <0.001* |
|  | 4 | - | 2.0 | 31.4 | 66.7 |  |
|  | 5 | - | - | 16.0 | 84.0 |  |
| Did this quarantine increase your collaboration with your colleagues? | 3 | - | 5.3 | 18.4 | 76.3 | 0.054 (N.S) |
|  | 4 | - | 3.9 | 21.6 | 74.5 |  |
|  | 5 | - | 10.0 | 40.0 | 50.0 |  |
| Did you feel more engaged and motivated in following up with distant e-learning? | 3 | - | 63.2 | 36.8 | - | <0.001* |
|  | 4 | 35.3 | 49.0 | 13.7 | 2.0 |  |
|  | 5 | 32.0 | 62.0 | 6.0 | - |  |
| Do you prefer online lectures compared to face to face lectures? | 3 | - | - | 28.9 | 71.1 | 0.01 |
|  | 4 | - | 9.8 | 27.5 | 62.7 |  |
|  | 5 | - | - | 44.0 | 56.0 |  |
| Do you feel comfortable with all this technology-based education? | 3 | - | - | 13.2 | 86.6 | 0.01 |
|  | 4 | - | - | 37.3 | 62.7 |  |
|  | 5 | - | - | 10.0 | 90.0 |  |

P-value was determined with Chi square test, P-value<0.05 was considered significant* Highly significant; N.S: Not significant

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**Table 3: Experiences mostly affected by quarantine among year 3,4 and 5 dental students**

| What is the experience that was mostly affected by your quarantine? | Academic years | Strongly Disagree % | Disagree % | Agree % | Strongly Agree % | P-value |
|---|---|---|---|---|---|---|
| *Clinical/Lab Sessions/Hospital Postings* | 3 | - | - | - | 100 | - |
| | 4 | - | - | - | 100 | |
| | 5 | - | - | - | 100 | |
| *Regular Lectures* | 3 | 39.5 | 47.4 | 13.2 | - | 0.004 |
| | 4 | 60.8 | 39.2 | - | - | |
| | 5 | 54.0 | 46.0 | - | - | |
| *Research Projects* | 4 | - | 5.9 | 88.2 | 5.9 | <0.001* |
| | 5 | - | 10.0 | 8.0 | 82.0 | |
| *Seminars* | 3 | 57.9 | 42.1 | - | - | 0.006 |
| | 4 | 54.9 | 45.1 | - | - | |
| | 5 | 28.0 | 72.0 | - | - | |
| *Case-based learning* | 3 | 55.3 | 44.7 | - | - | 0.004 |
| | 4 | 72.5 | 27.5 | - | - | |
| | 5 | 40.0 | 60.0 | - | - | |

P-value was determined with Chi square test, P-value<0.05 was considered significant* Highly significant; N.S: Not significant

significant among the genders demonstrated in Table 11. Approximately two-thirds of the 5th year dental students were unclear of their trust in their acquired abilities prior to graduation. After graduation, the vast majority (94%) opted to be mentored or indirectly supervised. About half of the final year students (56%) said they were unsure about starting their own practice following graduation. The vast majority (80%) choose a well-structured year of residence followed by excellent post-graduation training (Supple.Table 3). There was no significant association between the family incomes and the general practice readiness among the final year students in Supple.Table 4.

All supplementary files can be assessed via
https://osf.io/d8p2a/files/

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**Table 4: Subspecialties most negatively affected by quarantine among year 3,4 and 5 dental students**

| Subspecialties | Academic years | Strongly Disagree % | Disagree % | Agree % | Strongly Agree % | P-value |
|---|---|---|---|---|---|---|
| *General Medicine and General Surgery* | 3 | - | - | - | 100 | - |
| *Community Oral Health* | 3 | 52.6 | 47.4 | - | - | 0.02 |
| | 4 | 29.4 | 70.6 | - | - | |
| *Oral Diagnosis* | 3 | - | - | 81.6 | 18.4 | <0.001* |
| | 4 | - | 25.5 | 74.5 | - | |
| *Periodontology* | 3 | 5.3 | 94.7 | - | - | <0.001* |
| | 4 | 17.6 | 82.4 | - | - | |
| | 5 | 4.0 | 18.0 | 24.0 | 54.0 | |
| *Prosthodontics* | 3 | - | 68.4 | 31.6 | - | <0.001* |
| | 4 | - | - | 43.1 | 56.9 | |
| | 5 | - | 40.0 | 56.0 | 4.0 | |
| *Conservative Dentistry and Endodontics* | 3 | 36.8 | 63.2 | - | - | <0.001* |
| | 4 | - | - | 39.2 | 60.8 | |
| | 5 | - | - | 18.0 | 82.0 | |
| *Paediatric Dentistry* | 3 | 26.3 | 71.1 | 2.6 | - | <0.001* |
| | 4 | 47.1 | 52.9 | - | - | |
| | 5 | 76.0 | 24.0 | - | - | |
| *Oral Surgery* | 3 | 50.0 | 50.0 | - | - | 0.73 (N.S) |
| | 4 | 56.9 | 43.1 | - | - | |
| | 5 | 50.0 | 50.0 | - | - | |
| *Orthodontics* | 3 | 31.6 | 68.4 | - | - | <0.001* |
| | 4 | - | 49.0 | 51.0 | - | |
| | 5 | - | 18.0 | 82.0 | - | |

P-value was determined with Chi square test, P-value<0.05 was considered significant* Highly significant; N.S: Not significant

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### Table 5: Experiences mostly affected by quarantine based on Gender profile

| What is the experience that was mostly affected by your quarantine? | Gender | Strongly Disagree % | Disagree % | Agree % | Strongly Agree % | P-value |
|---|---|---|---|---|---|---|
| *Clinical/Lab Sessions/Hospital Postings* | Male | - | - | - | 100 | - |
| | Female | - | - | - | 100 | |
| *Regular Lectures* | Male | 52.9 | 45.1 | 2.0 | - | 0.73 (N.S) |
| | Female | 52.3 | 43.2 | 4.5 | - | |
| *Research Projects* | Male | - | 5.1 | 51.3 | 43.6 | 0.69 (N.S) |
| | Female | - | 9.7 | 46.8 | 43.5 | |
| *Seminars* | Male | 58.8 | 41.2 | - | - | 0.02 |
| | Female | 38.6 | 61.4 | - | - | |
| *Case-based learning* | Male | 51.0 | 49.0 | - | - | 0.35 (N.S) |
| | Female | 59.1 | 40.9 | - | - | |

P-value was determined with Chi square test, P-value<0.05 was considered significant* Highly significant; N.S: Not significant

### Table 6: Subspecialties most negatively affected by quarantine based on gender profile

| Subspecialties | Gender | Strongly Disagree % | Disagree % | Agree % | Strongly Agree % | P-value |
|---|---|---|---|---|---|---|
| *General Medicine and General Surgery* | Male | - | - | 11.8 | 88.2 | 0.40 (N.S) |
| | Female | - | - | 17.0 | 83.0 | |
| *Community Oral Health* | Male | 25.5 | 37.3 | 15.7 | 21.6 | 0.98 (N.S) |
| | Female | 25.0 | 39.8 | 13.6 | 21.6 | |
| *Oral Diagnosis* | Male | - | 49.0 | 49.0 | 2.0 | 0.06 (N.S) |
| | Female | 8.0 | 35.2 | 50.0 | 6.8 | |
| *Periodontology* | Male | 11.8 | 64.7 | 7.8 | 15.7 | 0.75 (N.S) |
| | Female | 8.0 | 61.4 | 9.1 | 21.6 | |
| *Prosthodontics* | Male | - | 29.4 | 45.1 | 25.5 | 0.70 (N.S) |
| | Female | - | 35.2 | 44.3 | 20.5 | |
| *Conservative Dentistry and Endodontics* | Male | 7.8 | 15.7 | 21.6 | 54.9 | 0.87 (N.S) |
| | Female | 11.4 | 18.2 | 20.5 | 50.0 | |
| *Paediatric Dentistry* | Male | 56.9 | 43.1 | - | - | 0.52 (N.S) |
| | Female | 48.9 | 50.0 | 1.1 | - | |
| *Oral Surgery* | Male | 52.9 | 47.1 | - | - | 0.93 (N.S) |
| | Female | 52.3 | 47.7 | - | - | |
| *Orthodontics* | Male | 15.7 | 23.5 | 60.8 | - | 0.001 |
| | Female | 4.5 | 54.5 | 40.9 | - | |

P-value was determined with Chi square test, P-value<0.05 was considered significant* Highly significant; N.S: Not significant

**Table 7: Self-perceived preparedness related to cognition, communication and professional skills of the final year dental students**

| Questions | No Experience % | Mostly % | Always % |
|---|---|---|---|
| I evaluate new dental materials/products using evidence-based approach | 66 | 34 | - |
| I have sufficient evidence-based knowledge of scientific principles to support my practice | 54 | 46 | - |
| I reflect on my clinical practice in order to address my learning needs | - | 38 | 62 |
| I can manage patient's expectations for their treatment | - | 20 | 80 |
| I am able to refer patients with complex treatment needs | 22 | 68 | 10 |
| I feel comfortable asking for help from supervisor/ colleague if needed | - | 16 | 84 |
| I maintain accurate records of my clinical notes | - | 48 | 52 |
| I restrict my relations with my patients to a professional level | - | 44 | 56 |
| I take responsibility for my continuing professional development | 36 | 46 | 18 |
| I take appropriate measures to protect patient confidentiality | - | 50 | 50 |
| I can communicate potential procedural risks to my patients | 8 | 66 | 26 |
| I can obtain informed consent from my patients | - | 6 | 94 |
| I can motivate my patients to maintain good oral/ general health | - | 62 | 38 |
| I am aware of my legal responsibilities as a dental professional | 52 | 44 | 4 |
| I recognize my personal limitations in clinical practice | - | 40 | 60 |
| I can communicate appropriately with my colleagues | - | 14 | 86 |
| I can communicate effectively with my patient | - | 32 | 68 |

**Table 8: Self-perceived preparedness related to cognition, communication and professional skills based on gender profile among the final year students.**

| Questions | Gender | No Experience % | Mostly % | Always % | P-value |
|---|---|---|---|---|---|
| I evaluate new dental materials/products using evidence-based approach | Male | 68.4 | 31.6 | - | 0.70 (N.S) |
| | Female | 64.5 | 35.5 | - | |
| I have sufficient evidence-based knowledge of scientific principles to support my practice | Male | 57.9 | 42.1 | - | 0.66 (N.S) |
| | Female | 51.6 | 48.4 | - | |
| I reflect on my clinical practice in order to address my learning needs | Male | - | 47.4 | 52.6 | 0.28 (N.S) |
| | Female | - | 32.3 | 67.7 | |
| I can manage patient's expectations for their treatment | Male | - | 5.3 | 94.7 | 0.04 |
| | Female | - | 29.0 | 71.0 | |
| I am able to refer patients with complex treatment needs | Male | 31.6 | 52.6 | 15.8 | 0.18 (N.S) |
| | Female | 16.1 | 77.4 | 6.5 | |
| I feel comfortable asking for help from supervisor/ colleague if needed | Male | - | 15.8 | 84.2 | 0.97 (N.S) |
| | Female | - | 16.1 | 83.9 | |
| I maintain accurate records of my clinical notes | Male | - | 47.4 | 52.6 | 0.94 (N.S) |
| | Female | - | 48.4 | 51.6 | |
| I restrict my relations with my patients to a professional level | Male | - | 42.1 | 57.9 | 0.83 (N.S) |
| | Female | - | 45.2 | 54.8 | |
| I take responsibility for my continuing professional development | Male | 42.1 | 42.1 | 15.8 | 0.70 (N.S) |
| | Female | 32.3 | 48.4 | 19.4 | |
| I take appropriate measures to protect patient confidentiality | Male | - | 36.8 | 63.2 | 0.14 (N.S) |
| | Female | - | 58.1 | 41.9 | |
| I can communicate potential procedural risks to my patients | Male | 21.1 | 52.6 | 26.3 | 0.02 |
| | Female | - | 74.2 | 25.8 | |
| I can obtain informed consent from my patients | Male | - | 5.3 | 94.7 | 0.86 (N.S) |
| | Female | - | 6.5 | 93.5 | |
| I can motivate my patients to maintain good oral/ general health | Male | - | 68.4 | 31.6 | 0.46 (N.S) |
| | Female | - | 58.1 | 41.9 | |
| I am aware of my legal responsibilities as a dental professional | Male | 63.2 | 31.6 | 5.3 | 0.38 (N.S) |
| | Female | 45.2 | 51.6 | 3.2 | |
| I recognize my personal limitations in clinical practice | Male | - | 36.8 | 63.2 | 0.72 (N.S) |
| | Female | - | 41.9 | 58.1 | |
| I can communicate appropriately with my colleagues | Male | - | 21.1 | 78.9 | 0.26 (N.S) |
| | Female | - | 9.7 | 90.3 | |
| I can communicate effectively with my patient | Male | - | 52.6 | 47.4 | 0.01 |
| | Female | - | 19.4 | 80.6 | |

P-value was determined with Chi square test, P-value<0.05 was considered significant* Highly significant; N.S: Not significant

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**Table 9: Self-perceived preparedness related to cognition, communication and professional skills based on family income of the final year students.**

| Questions | Family Income | No Experience % | Mostly % | Always % | P-value |
|---|---|---|---|---|---|
| I evaluate new dental materials/products using evidence-based approach | Low | 42.9 | 57.1 | - | 0.03 |
| | High | 75.0 | 25.0 | - | |
| I have sufficient evidence-based knowledge of scientific principles to support my practice | Low | 35.7 | 64.3 | - | 0.10 (N.S) |
| | High | 61.1 | 38.9 | - | |
| I reflect on my clinical practice in order to address my learning needs | Low | - | 28.6 | 71.4 | 0.39 (N.S) |
| | High | - | 41.7 | 58.3 | |
| I can manage patient's expectations for their treatment | Low | - | 14.3 | 85.7 | 0.52 (N.S) |
| | High | - | 22.2 | 77.8 | |
| I am able to refer patients with complex treatment needs | Low | 21.4 | 71.4 | 7.1 | 0.90 (N.S) |
| | High | 22.2 | 66.7 | 11.1 | |
| I feel comfortable asking for help from supervisor/ colleague if needed | Low | - | 14.3 | 85.7 | 0.83 (N.S) |
| | High | - | 16.7 | 83.3 | |
| I maintain accurate records of my clinical notes | Low | - | 50.0 | 50.0 | 0.86 (N.S) |
| | High | - | 47.2 | 52.8 | |
| I restrict my relations with my patients to a professional level | Low | - | 35.7 | 64.3 | 0.46 (N.S) |
| | High | - | 47.2 | 52.8 | |
| I take responsibility for my continuing professional development | Low | 50.0 | 42.9 | 7.1 | 0.30 (N.S) |
| | High | 30.6 | 47.2 | 22.2 | |
| I take appropriate measures to protect patient confidentiality | Low | - | 57.1 | 42.9 | 0.52 (N.S) |
| | High | - | 47.2 | 52.8 | |
| I can communicate potential procedural risks to my patients | Low | 7.1 | 57.1 | 35.7 | 0.62 (N.S) |
| | High | 8.3 | 69.4 | 22.2 | |
| I can obtain informed consent from my patients | Low | - | 7.1 | 92.9 | 0.83 (N.S) |
| | High | - | 5.6 | 94.4 | |
| I can motivate my patients to maintain good oral/ general health | Low | - | 57.1 | 42.9 | 0.65 (N.S) |
| | High | - | 63.9 | 36.1 | |
| I am aware of my legal responsibilities as a dental professional | Low | 64.3 | 28.6 | 7.1 | 0.35 (N.S) |
| | High | 47.2 | 50.0 | 2.8 | |
| I recognize my personal limitations in clinical practice | Low | - | 64.3 | 35.7 | 0.02 |
| | High | - | 30.6 | 69.4 | |
| I can communicate appropriately with my colleagues | Low | - | 7.1 | 92.9 | 0.38 (N.S) |
| | High | - | 16.7 | 83.3 | |
| I can communicate effectively with my patient | Low | - | 35.7 | 64.3 | 0.72 (N.S) |
| | High | - | 30.6 | 69.4 | |

P-value was determined with Chi square test, P-value<0.05 was considered significant
* Highly significant; N.S: Not significant

**Table 10: Practice readiness of the final year dental students**

| Questions | Yes % | Not sure % | No % |
|---|---|---|---|
| Do you have confidence in the skills acquired before graduation? | 40 | 60 | - |
| Do you prefer to be mentored or indirectly supervised following graduation? | 94 | 6 | - |
| Do you have confidence in starting an independent practice after graduation? | - | 44 | 56 |
| Do you have preference for a well-structured year of residence, with proper training? | 80 | 20 | - |

**Table 11: Practice readiness based on gender among the final year dental students**

| Questions | Gender | Yes % | Not sure % | No % | P-value |
|---|---|---|---|---|---|
| Do you have confidence in the skills acquired before graduation? | Male | 52.6 | 47.4 | - | 0.15 (N.S) |
| | Female | 32.3 | 67.7 | - | |
| Do you prefer to be mentored or indirectly supervised following graduation? | Male | 94.7 | 5.3 | - | 0.86 (N.S) |
| | Female | 93.5 | 6.5 | - | |
| Do you have confidence in starting an independent practice after graduation? | Male | - | 57.9 | 42.1 | 0.12 (N.S) |
| | Female | - | 35.5 | 64.5 | |
| Do you have preference for a well-structured year of residence, with proper training? | Male | 84.2 | 15.8 | - | 0.56 (N.S) |
| | Female | 77.4 | 22.6 | - | |

P-value was determined with Chi square test, P-value<0.05 was considered significant
* Highly significant; N.S: Not significant

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## DISCUSSION

Within the span of two decades, the world has witnessed three outbreaks related to the coronavirus, which were severe acute respiratory syndrome (SARS) back in 2002, the Middle East respiratory syndrome (MERS), which emerged around 2012 and the recent pandemic caused by the novel coronavirus, famously known as Covid-19 [17-21]. The pandemic has taken a toll on the majority of the sectors on a global scale, including education. Dental education is unique in that it requires a combination of both didactic learning and hands-on training to produce a well-rounded and competent dentist in providing appropriate treatment and dental care to the public.

Currently, there is insufficient evidence regarding the effects of the pandemic on tertiary education. As per our knowledge, this is the first study carried out to assess clinical year dental students' perception of the impact of the COVID-19 pandemic. However, a review was done by Halim et al. based on educators' perspectives on ways to improve dental education in Malaysia during the lockdown period [14]. A study reported that quarantining during the pandemic might positively impact students' performance as it encourages students to be more efficient and productive with their learning strategies [22]. On the contrary, most of the final two academic year students felt less motivated. They reported being at a

disadvantage in terms of their clinical skills due to distance learning compared to the 3rd year dental students. They reported that clinical and lab sessions were greatly affected. They miss the way regular education was carried out before the lockdown. However, the 3rd and 5th year students yearn for their education to return to normal significantly compared to the 4th year. This can be explainable as the 3rd year students are excited to begin their clinical year by treating patients for the first time. As for the final year students, they have to balance completing their minimum clinical experience (MCE) along with the uncertainty of the lockdown period. Similarly, various studies have reported an increased stress level among students due to the lack of clinical exposure in these uncertain times [16,23-25].

Our study reported a significant difference between the year 5 and 4 students regarding research projects. The majority of the year 4 dental students struggled because most of their research topics had to be amended, making it feasible to be implemented during this pandemic. Usually, research topics and commencement of the research projects begin while the students are in their 4th year. Most final year students have completed and presented their research projects at various scientific conferences; therefore, most of their attention was focused on other areas of their education.

Almost all of our students were comfortable using technology-based education, significantly supported by the final year students. Didactic classes are the easiest to execute online via a flipped classroom platform, positively affecting dental education [26]. This is reflected in the present study, where most students appreciated regular lectures, seminars and case-based learning (CBL) conducted through E-learning platforms. The majority of them preferred having online lectures compared to face-to-face with no significant difference among the genders. A recent review reported that distant learning enhances students' learning ability due to its flexibility and accessibility [27]. Academicians have to adapt and adjust their teaching methods by taking advantage of asynchronous learning, which is best carried out on a digital platform, giving them more room to breathe [28]. Various studies conducted reported satisfying responses through distant e-learning methods, with clinical sessions being irreplicable remotely [29-31]. However, our 3rd year dental students reported being significantly more affected in online lectures than the 4th and 5th years because they are at the beginning of their clinical year, which preferred more face-to-face interaction with their lecturers. There is a significant difference between female and male students regarding online seminar sessions where the male students struggled significantly lesser than the female students. The principal reason for this difference

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might be that males tend to appraise themselves to have higher computer skills than females [32]. Females have a better engagement which can be attainable through onsite teaching and not online, as seen in a recent study [15].

Our study had noticed that the lockdown had enhanced their interaction with their colleagues, especially among the 4th year dental students, which differs from the findings reported by Hattar et al. in Jordan, where the final year students were able to interact with their colleagues significantly better [16]. One of the sound reasoning for this finding is that year 4 is the middle clinical year. Due to the current situation, the attention was shifted mainly towards the final graduating year and the 3rd year dental students, who have just entered their clinical postings. Assessing the current graduating senior batch during this pandemic, the significant collaboration with their classmates within the 4th year students could be a sign of their preparedness for them to completing their MCE in case the lockdown prevails longer so that they are not far behind in their clinical skills when they reach their final year.

The mode of assessment and evaluation of our students were greatly affected as well. The majority of our students, especially the final year students, did not agree that online assessment is a suitable evaluation method compared to the 3rd and 4th year dental students.

Usually, Objective Structured Clinical Examinations (OSCEs) was performed to assess dental students' clinical critical reasoning skills. These exams are no stranger in the medical tertiary education sectors as they contain a high educational value [32-33]. However, this year, OSCEs exams were cancelled due to various reasons. Unfortunately, the 1st semester examination period of the academic year falls during the lockdown period. Therefore, examinations can only occur in prominent venues such as multipurpose halls to abide by the social distancing protocol proposed by the Government. Students' clinical sessions were happening concurrently with the exam period to catch up with their clinical work, making up for a lost time. Hence, logistics became a factor as to why it is not practical to carry out OSCE examinations. The finding in the present study was in accordance with the results reported by Hatter et al [16].

Regarding the subspecialties most negatively affected by the quarantine, our findings noted that conservative dentistry & endodontics and orthodontics had a significant detrimental outcome followed by periodontology among the 5th year dental students. Similarly, dental students in Jordan also stated that conservative dentistry was the subspeciality mainly affected [16]. This is explainable since most final year students' clinical sessions revolve around more complicated procedures in the mentioned subspecialties. Comparably the year 3 dental

students stated that general medicine and general surgery, oral diagnosis and paediatric dentistry were greatly affected. The 4th year had prosthodontics followed by conservative dentistry and endodontics and orthodontics. Being new to the clinical settings, most clinical hours for the 3rd year dental students involve subjects such as oral diagnosis and paediatric dentistry. It serves as a basis for them to learn how to carry out various investigative tools to diagnose cases in dentistry. Since the pandemic, government hospital postings for general medicine and general surgery have been temporarily ceased as they are involved in housing COVID-19 positive patients. Furthermore, oral surgery was the only subspecialty where all clinical year students felt no unfavourable effects, especially the 5th year dental students. There is a possibility because the year 4 and 5 students had sufficient exposure in their previous academic years, hence boosting their confidence and competence; nonetheless, usually for oral surgery postings, 3rd year students were not required to carry out treatments on patients yet. It is confirmed by a study done by interviewing students, where the authors concluded that the amount of clinical exposure plays a crucial role in affecting the students' preparedness and confidence before graduation [34]. There was no significant difference between the genders in most subspecialties except for orthodontics, where the male dental students were greatly affected. The

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plausible explanation for this is supported by a study done on dental students' knowledge, attitude and perception of orthodontic treatment. The author concluded that female dental students had a better attitude and knowledge regarding dental esthetics through orthodontic treatments [35].

Only the year 5 dental students' readiness for general dental practice related to their cognition, communication and professional skills were asked through a self-perceived questionnaire. The present study demonstrated acceptable outcomes through the broad range of aspects in the questionnaire. Our final year respondents rated confident in their overall professionalism, communication skills, and continuous development, which agrees with previous studies [16,36-39]. Nevertheless, most of them reported the lack of knowledge in critical appraising in terms of their utilization of evidence-based approach, which is concurrent with studies done worldwide [38,40-42]. Hence, it is vital to incorporate or emphasise an evidence-based approach to the dental curriculum, further increasing students' critical appraisal skills and integrating them into their practice after graduation. We found that female 5th year students were significantly better than their male colleagues in communicating with their patients regarding the procedural risks. They perceived to be able to handle patients' expectations better. This is greatly supported by

previous studies, where they affirmed that females tend to communicate better by engaging in more positive talks in encouragement. They were rated with higher empathy, leading to longer consultation time with their patients compared to males [43-45]. When comparing the family monthly income with the self-perceived preparedness of the final year students, the lower-income group tend to evaluate new dental materials or products using an evidence-based approach more than the higher-income group. The probable reason for this is that dental materials in the market are not cheap, especially for students to purchase. Therefore, they tend to resolve with the utilization of the evidence-based approach available through various online journals provided by the university to learn more about the materials instead of experiencing it hands-on compared to the more affluent students. However, students from the higher income group tend to recognize their personal limitations in clinical practice significantly more frequently. One study done in a dental school in South Africa reported that dental students from high social-economic status have better clinical reasoning, which may be related to our study as they tend to self-perceive their clinical skills more often [46]. However, there was not much data on the association of family income with self-perceiving of clinical skills among dental students, and further research into this component may be required.

The majority of the graduating students are somewhat confident in carrying out appropriate treatments before graduating but still prefer having some form of mentorship or indirect supervision after graduation, similar to findings in previous studies [16,39,47]. Almost half of our respondent was conflicted regarding starting up an independent practice. Therefore, mentoring or any form of communication with academicians will undoubtedly help their confidence in their future practice since they have suffered greatly during the final year [16]. Clinical exposure cannot be entirely replaced by distant online learning; hence, extra precautions must be taken into account to ensure a safe working and learning space for faculty staff members and students. It is the responsibility of the faculty to ensure that sufficient personal protective equipment (PPE) is available, along with assembling patient triage to identify high-risk individuals [29]. In addition, dental institutions should work hand-in-hand with the government body by emphasizing and encouraging staff and students to get vaccinated to achieve herd immunity at a faster rate.

The current study serves as a development of further investigations. However, it comes with a few limitations. A direct limitation is noted due to the study's cross-sectional design performed in a single dental institute. Different dental students from different dental schools will have a different experience during this unrivalled time. It would be

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illuminating to obtain information from other dental institutions in Malaysia to make a comparison to get a better viewpoint, which may serve as a benefit further to improve the dental education system during this global change [48].

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