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Enablers and Barriers to Achieving Clinical Competency among Dental Students: Lessons for Teaching and Learning

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ABSTRACT

Adaptations to the teaching and learning during the pandemic affected dental students' ability to achieve clinical competency. This study aimed to (a) assess the self-reported competencies of dental students affected by the pandemic; (b) describe the enablers and barriers to achieving clinical competency among these students; and (c) to elucidate factors related to the resilience of the teaching and learning system during the pandemic for future adaptations and implementations. A questionnaire consisting of eight domains with forty-three questions was sent to Universiti Kebangsaan Malaysia's (UKM) recent dental graduates from the 2021 cohort. Eight students from the cohort were also interviewed. The semi-structured, in-depth interviews were recorded and transcribed. A total of fifty-six questionnaires were returned, resulting in a 100% response rate. Seven out of the eight studied domains had a high self-perceived competency score, while only six of the forty-three skills had a self-perceived competency score of less than 80%. Eight participants were interviewed for the second part of the study. Multiple enablers and barriers were identified and categorised into five themes, which were clinical time, student mental health, clinical teaching, cross-infection protocols and communication and other faculty policies. Dental graduates affected by the COVID-19 pandemic had a good level of self-perceived clinical competency. The multiple factors identified as enablers and barriers to achieving clinical competency can be utilised as references in curriculum development, planning and policymaking, especially with regards to adaptations made to the undergraduate dental curricula worldwide .

Keywords: *clinical competence, loss of clinical time, self-reported, undergraduate, blended learning, sustainable dental education*

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INTRODUCTION

The World Health Organization (WHO) declared COVID-19 a global health emergency on the January 30, 2020 (1). The COVID-19 pandemic initially caused the complete closure of dental education institutions. Later, the gradual opening of these institutions was carried out in stages and brought unprecedented changes to their curricula and policies. These included the teaching method being changed to a hybrid model, adaptations being made to clinical sessions to better comply with cross-infection policies, changes to competency assessments and clinical requirements and the use of novel intelligent technologies for teaching and learning (2, 3).

Dental education can broadly be categorised into three different categories (2), with the first being didactic or problem-based learning. This form of dental education is typically taught via lectures, seminars and group presentations. This category was mostly conducted online through different web-based software and systems during the pandemic. The second category of dental education involved the simulation laboratory, where dental students practise and sharpen their fine motor skills and practical knowledge on models. During the pandemic, this was ideally done utilising virtual reality (VR). However, this facility is not yet widely available. An alternative method was relied upon, whereby students were scheduled to enter and utilise the simulation laboratory in batches and on rotation, with appropriate measures being taken to prevent cross-infection (4). The third category is the clinical skills training which is the most important part of the dental education. This category typically takes the bulk of the education in the dental schools. Clinical skills training must be done with the patients, dental instructor and students being in close contact and, thus, was the most affected of the three categories (2).

To date, different parts of the world have transitioned out of the pandemic based on their policies, healthcare capacity and severity of disease experienced by the individual countries. This has led to the reversal of many of the changes and innovations that were brought about by the pandemic in dental schools. Most institutions worldwide are now reopening and returning to their pre-pandemic operations, where the implementation of flexible learning models and pathways adopted during the pandemic are now variable and institution-based (5-7).

While the adaptations to teaching and learning during the pandemic were unfortunate necessities due to the specific global situation, they also offered unique opportunities for dental students to experience different forms and methods of education that were not available to their predecessors. It is currently unknown if and how these changes have affected these students' ability to achieve clinical competency and which of these changes can continually be implemented post-pandemic. Hence, this study aimed to (a) assess the self-reported competencies of dental students affected by the pandemic; (b) describe the enablers and barriers to achieving clinical competency among these students; and (c) elucidate factors related to the teaching and learning system's resilience during the pandemic for future adaptations and implementations.

METHODOLOGY

Study Design

This was an explanatory study that utilised a mixed methods sequential design. Ethical approval for the study was obtained from the Research Ethics Committee of the UKM (UKM PPI/111/8/JEP-2020-715). The purposive sampling method was relied upon, where all undergraduate students from the graduating class of 2021 were invited to participate in this study. A self-administered questionnaire was first utilised to assess the competency of the participants. Data from the questionnaire was then

analysed and used to construct the interview questions. Participants from the same graduating batch were then invited to participate in structured in-depth interviews. Figure 1 shows the flow of the participants through each stage of this study. The consolidated criteria for reporting qualitative research (COREQ) were applied to this study's report (8).

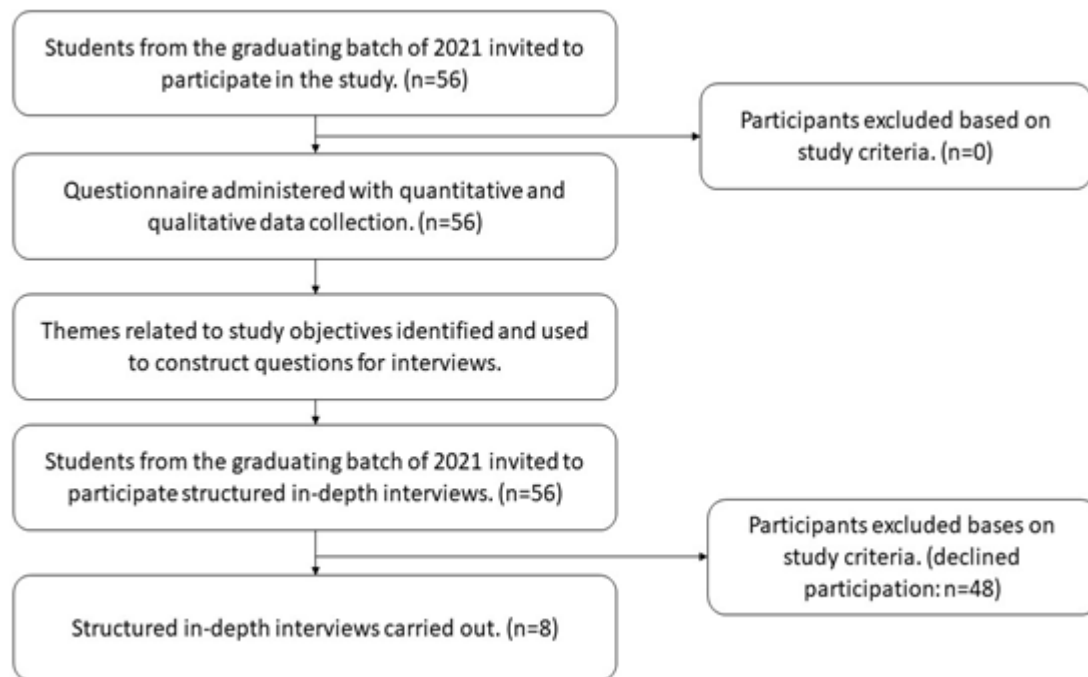


Figure 1: Flow of the participants through each stage of the study

Participants

The graduating class of 2021 from the Faculty of Dentistry, Universiti Kebangsaan Malaysia was selected as the cohort to be investigated in this study due to the COVID-19 pandemic's considerable impact on their education. This cohort was beginning their fourth year, out of five total years, of undergraduate study when the pandemic was announced. They had one year of clinical experience during the year 2019 through 2020 before the pandemic hit. They then experienced two years of study during the pandemic, both during the complete shutdown and later during the reopening of dental schools. All fifty-six students in this graduating class were invited to participate in the quantitative and qualitative sections of this study. When this study was conducted, the students had just graduated and had yet to start work. Invitations were sent to the participants via messages sent to their mobile phones. Informed consent was obtained from each participant prior to data collection.

Instrument

This study's instrument comprised two parts. The first was a self-administered questionnaire and the second were in-depth interviews.

Questionnaire

The questionnaire utilised in this study was a modification of Yusof et al.'s instrument, which was validated and used in previous studies (9-10). It consists of eight domains with forty-three questions

aimed at assessing perceived competencies. Participants were required to self-evaluate and rate their competencies using a five-point Likert scale, where 1 = 'highly incompetent', 2 = 'incompetent', 3 = 'somewhat competent', 4 = 'competent', 5 = 'highly competent' and NK/NR = 'not known/not relevant'. The responses were categorised as 'incompetent' if the score was either 1, 2 or 3, whilst scores 4 and 5 were categorised as 'competent'.

A separate section consisting of three questions aimed at evaluating satisfaction with clinical teaching and supervision, requirements and assessment and cross-infection control were also included. This section utilised a five-point Likert scale ranging from 1 ('strongly disagree') to 5 ('strongly agree'). A score of 4 or 5 was grouped as 'satisfactory', and a score of 1, 2 or 3 was grouped as 'unsatisfactory' to the aspects assessed. Finally, four open-ended questions were asked to obtain qualitative responses to different aspects of the curriculum and their effect on self-perceived competency.

Structured In-Depth Interviews

For the in-depth interviews, a female independent researcher (JCSM, PhD) not involved in the participants' education was selected as the interviewer. The participants did not know the interviewer prior to the study's commencement. The interviews were carried out following an open-ended, piloted interview protocol, and the participants were informed of the study's objectives prior to the interview. The protocol was developed based on the 'Guide on Conducting In-Depth Interviews' (11). A semi-structured interview approach with open-ended questions was used. An interview guide was created (Appendix 1) based on the findings and analysis of the questionnaire's responses. It was then piloted on one final-year student and one researcher (NMNA). Pilot interviews were utilised to improve the interview guide and were not included in the final analysis.

The participants were recruited via text messages sent to their mobile phones. Interviews were carried out using the Zoom application and recorded. The participants were alone in their homes during the interviews. The interviews were then fully transcribed verbatim, with participant anonymity being maintained. Factors considered during the sample size determination were the study's relatively narrow scope, the obvious nature of the topic and the similar experiences of participants who attended the same dental school. It was estimated that at least fifteen participants would be needed to achieve saturation (12). Interviews were carried out until data saturation was achieved. Saturation is defined as the point where a full understanding of the researched issue is achieved and when no further dimensions, nuances or insights are found (13). No repeat interviews were carried out. Data collected from the interviews were returned to the participants for corrections and comments.

Data Analysis

Statistical analysis of the quantitative data was performed using the IBM SPSS version 28.0 (IBM Co., Armonk). Data was presented as frequencies (%) for all discrete variables. For the qualitative data, a six-step thematic analysis (14) was utilised, with NMNA open-coding the raw data and themes, while BB reviewed the codes and themes. An inductive approach was used to derive the study's themes. A conventional content analysis was carried out, where coding categories were derived directly from the text data, based on Hsieh and Shannon's (2005) methodology (15). Enablers and barriers were coded together and were assigned to more than one themes if it suited multiple themes. Any disagreements or discrepancies surrounding the categorisation of factors was settled via consultation with a third researcher, DA.

RESULTS

Response Rate and Demographic Distribution

All fifty-six invited participants agreed to participate in the first part of the study and returned the completed questionnaire, resulting in a 100% response rate. The participants were mostly female (n=42; 75.0%). Ethnically, the respondents were mostly Malay (n=25; 44.6%), followed by Chinese (n=20; 35.7%) and then Indian (n=11; 19.6%). All participants were local students.

Ratings across Domains

The distribution of responses categorised as ‘competent’ (scores 4 and 5), ‘somewhat competent’ (score 3) and ‘not competent’ (scores 1 and 2) for all domains (A-H) and their specific skills are shown in Table 1. Domain F, ‘Management and Administrative’, had the lowest score, with 78.1% of respondents scoring themselves as ‘competent’ in this domain. All other domains had over 80% of the respondents scoring themselves as ‘competent’ in them.

Ratings across Specific Skills

Six skills had less than 80% of the respondents giving them a score of 4 or 5, which were Q9, Q15, Q28, Q29, Q30 and Q37. Q37 had the lowest score, with only 26.8% of respondents rating competence in this skill. This is followed by Q15 with only 58.9% of respondents having self-perceived competence in this skill. The skills with the highest levels of self-evaluated competence were Q11 and Q21, with all but one respondent scoring either a 4 or 5 in these two skills.

Table 1: Comparison of self-reported responses categorised into “competent” (scores 4 and 5), “somewhat competent” (score 3) and “not competent” (score 1-2) for all domains (A-H) and their specific skills.

	Competent (Score 4-5)		Somewhat Competent (Score 3)		Not Competent (Score 1-2)		Not Known/ Not Relevant	
	n	%	n	%	n	%	n	%
Domain A: Gathering information at chairside	108	96.43	4	3.57	0	0	0	0
Q1. obtain and record the relevant medical, dental and social history	54	96.43	2	3.57	0	0	0	0
Q2. perform clinical examinations, intraoral radiographic and other necessary investigations	54	96.43	2	3.57	0	0	0	0
Domain B: Diagnostic skills	152	90.48	16	9.52	0	0	0	0
Q3. integrate findings of a comprehensive examination to make a diagnosis	53	94.64	3	5.36	0	0	0	0
Q4. apply clinical reasoning skills in decision making	52	92.86	4	7.14	0	0	0	0

for oral healthcare delivery								
Q5. apply an evidence-based approach in the practice of dentistry¥	47	83.93	9	16.07	0	0	0	0
Domain C: Treatment planning	247	88.21	33	11.79	0	0	0	0
Q6. formulate an appropriate treatment plan based on clinical examinations and investigations	52	92.86	4	7.14	0	0	0	0
Q7. practice patient care by taking into consideration their intellectual and socio-emotional characteristics	52	92.86	4	7.14	0	0	0	0
Q8. engage patients and/or their parents, guardians or caregivers in their oral health care	49	87.50	7	12.50	0	0	0	0
Q9. respond to patients' expectations, demands, needs and attitudes with regards to oral health care	44	78.57	12	21.43	0	0	0	0
Q10. follow the requirements for informed consent and confidentiality of the patient record	50	89.29	6	10.71	0	0	0	0
Domain D: Treatment and prevention	741	88.21	97	11.55	1	0.12		
Q11. perform simple restorative procedures in primary and permanent dentition including pulp management of single-rooted teeth	55	98.21	1	1.79	0	0	0	0
Q12. perform complex restorative procedures in primary and permanent dentition including onlays, single crowns, short-span bridges and root canal therapy of uncomplicated multirooted teeth	45	80.36	11	19.64	0	0	0	0
Q13. perform simple removable prosthetic procedures for replacement of missing dentition	48	85.71	8	14.29	0	0	0	0
Q14. perform non-surgical management of periodontal conditions	54	96.43	2	3.57	0	0	0	0
Q15. carry out Basic Life Support (BLS) in the management of medical emergencies in dental practice	33	58.93	22	39.29	0	0	1	1.80
Q16. manipulate commonly used dental materials in dental practice	52	92.86	3	5.36	1	1.80	0	0
Q17. perform administration of local and topical anaesthesia and manage their potential complications	54	96.43	2	3.57	0	0	0	0
Q18. perform simple oral surgical procedures including exodontia	46	82.14	10	17.86	0	0	0	0

Q19. manage simple orthodontic treatment including removable appliances	45	80.36	11	19.64	0	0	0	0
Q20. display the good doctor-patient relationship in the delivery of oral health care	54	96.43	2	3.57	0	0	0	0
Q21. perform appropriate methods of infection control in clinical practice	55	98.21	1	1.79	0	0	0	0
Q22. carry out the prevention methods of common orofacial diseases and conditions based	50	89.29	6	10.71	0	0	0	0
Q23. recognise the limitations of their clinical skills to refer accordingly	51	91.07	5	8.93	0	0	0	0
Q24. perform an appropriate referral of a patient based on professional judgement	47	83.93	9	16.07	0	0	0	0
Q25. prescribe and advise the use of common pharmaceutical agents related to dentistry	52	92.86	4	7.14	0	0	0	0
Domain E- Community-based	191	85.27	29	12.95	0	0	1	0.12
Q26. practice health promotion skills	52	92.86	4	7.14	0	0	0	0
Q27. implement preventive measures for individuals and the community according to the risk assessment	54	96.43	1	1.79	0	0	1	1.80
Q28. organise a community programme to improve the oral health of the public	43	76.79	12	21.43	0	0	1	1.80
Q29. collaborate with other health professionals and relevant agencies in health promotion and disease prevention in the community	42	75.00	12	21.43	0	0	2	3.60
Domain F: Management and administrative	350	78.13	94	20.98	4	0.79	0	0
Q30. lead the team members in any situation	38	67.86	17	30.36	1	1.80	0	0
Q31. explain concepts in planning and management of general dental practice in compliance with relevant regulations, policies and protocols	47	83.93	9	16.07	0	0.00	0	0
Q32. demonstrate ethical values and professional behaviour towards patients, members of the dental team and other healthcare personnel	53	94.64	3	5.36	0	0	0	0
Q33. practice ethical values and professionalism within the confines of the laws in the provision of dental service	52	92.86	4	7.14	0	0	0	0
Q34. comprehend the Code of Professional Conduct	50	89.29	5	8.93	1	1.80	0	0

from the Malaysian Dental Council								
Q35. comprehend the laws and regulations related to the practice of dentistry in Malaysia	51	91.07	4	7.14	1	1.80	0	0
Q36. explain the role and function of professional organisations and regulatory bodies	44	78.57	11	19.64	1	1.80	0	0
Q37. comprehend the professional duties of care in dentistry in line with the Patients' Charter	15	26.79	41	73.21	0	0	0	0
Domain G: Communication	150	89.29	18	10.71	0	0	0	0
Q38. communicate effectively and demonstrate leadership skills to function in a multicultural society and work environment	48	85.71	8	14.29	0	0	0	0
Q39. communicate with the dental team, patients and other healthcare personnel to	52	92.86	4	7.14	0	0	0	0
Q40. explain the principles of managing an oral healthcare programme	50	89.29	6	10.71	0	0	0	0
Domain H: Personal management and professional development	142	84.52	26	15.48	0	0	0	0
Q41. use current information technology resources in contemporary dental practice.	48	85.71	8	14.29	0	0	0	0
Q42. recognise the resources for lifelong learning	47	83.93	9	16.07	0	0	0	0
Q43. acquire knowledge and scientific evidence	47	83.93	9	16.07	0	0	0	0

Ratings for Clinical Teaching and Supervision, Requirements and Assessment and Cross-infection Control

The three specific questions on satisfaction with clinical teaching and supervision, requirements and assessment and cross-infection control had **98.2%**, **75.0%** and **92.9%** of the proportion of participants giving them a score of either 4 or 5 respectively.

In-Depth Interviews

Interviews were carried out on volunteers until data saturation was achieved. Eight respondents were interviewed. All participants were within the same age range of 20-24 years old. There were more male (n=5) than female (n=3) participants. All participants (n=8) successfully graduated in 2021 during their first attempt at the examination, without any fails or repeats.

The coding of the dataset into themes and sub-themes is shown in Appendix 2. There were five themes identified. The themes that emerged from the interviews were categorised and are shown in Figure 2. No enablers were assigned to Theme 1 or 5, and no barriers were assigned to Theme 3.

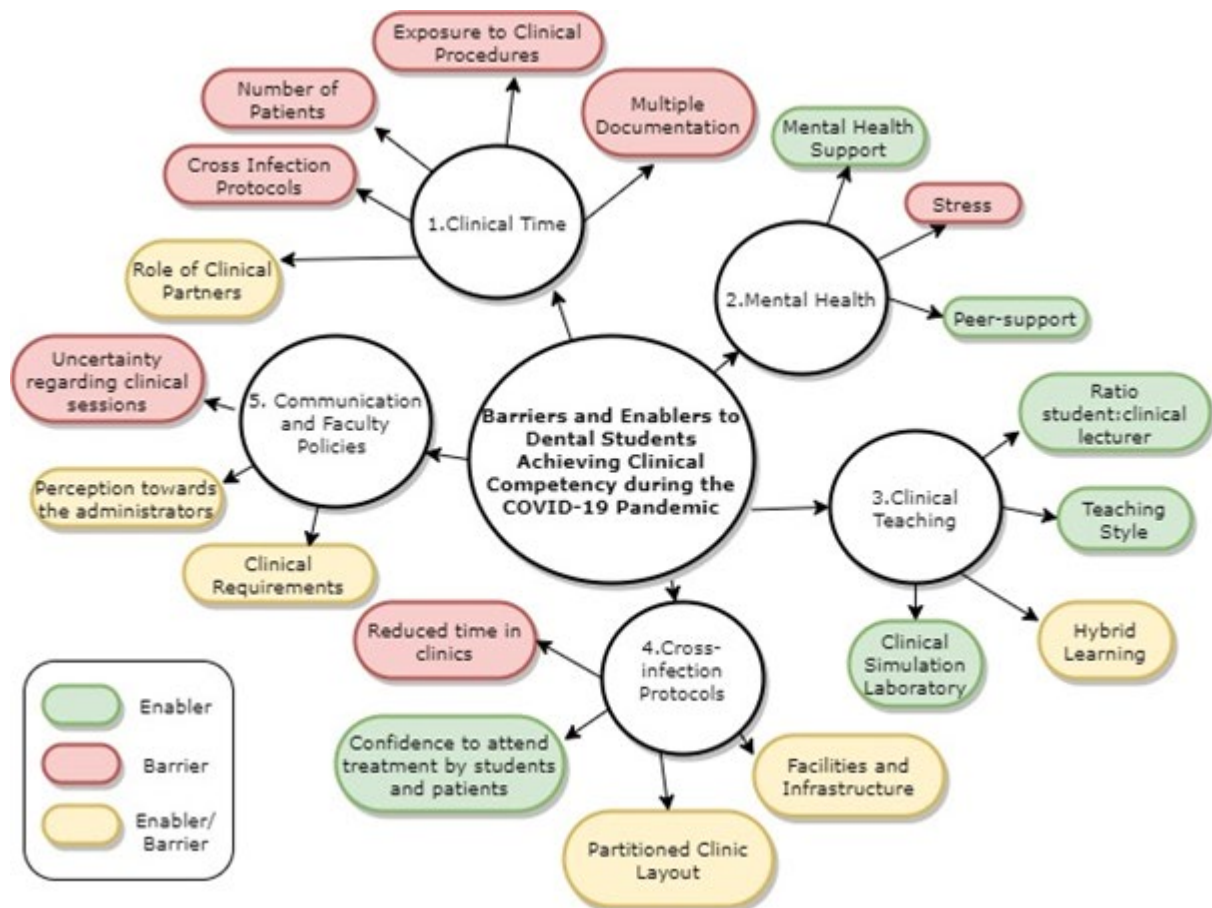


Figure 2: Themes and sub-themes for the enablers and barriers to achieving clinical competency.

Theme 1: Clinical Time

All participants described the reduced clinical time as a barrier to their clinical training. This includes the reduced sessions during the pandemic, as well as other limitations, such as the shorter duration of clinical time owing to the need to disinfect the utilised space after each session, as per cross-infection protocols. Certain specialties also had severely reduced sessions, such as hospital attachments in operating theatres.

The fourth year and fifth year (of dental school) are challenging (because) sometimes, in the beginning of our fifth year (of) study, we needed to close our faculty and study at home about one month. We did not have any clinical sessions and had to wait because the faculty needed to close. [Participant 01]

The clinical session become shorter; we needed to disinfect everything, so everything needs time, and the session all gets reduced so that's the main problem actually. That's the problem that (was) faced by everyone, but the more challenging part is that some patients that we have

already started (treating) during my fourth year before the pandemic, then, suddenly, the pandemic hits then the patient doesn't want to come anymore. [Participant 05]

Due to the pandemic, participants were organised into groups of three and had to work together with their partners during clinical sessions. This was an enabler for certain groups, where they learnt to synergise and optimised their sessions, but for others, it served as a barrier when they were not able to work well together.

We need one operator, one assistant and one runner, so we are three people in the group. So the clinical session is already less (because) we need to rotate between three people ... the clinical session for three people is worse because not everybody is able to voice their opinions, so sometimes, we see some people got bullied by their clinical partners, especially when paired with more dominant clinical partner. [Participant 05]

In my final year, because we all need to rush, so my partner and I had this agreement whereby, whenever we are the assistant, we need to know better about that particular procedure than the operator himself. So, if I'm the assistant and my partner need to do a root canal treatment on a patient, I need to know better than him because I'm the assistant. So, I needed to study, too, and not just go in with a blank mind. [Participant 02]

Students need to ensure that the clinical sessions' paperwork and documentation, including patient folders and logbooks, are signed by the supervising clinician. This also affected the amount of time students had in clinics.

Theme 2: Mental Health

The circumstances arising from the pandemic adversely affected the students' psychological and mental health. The participants described the role of faculty members and their peers in helping them address these mental health issues. This was mostly viewed as an enabler of competency, as students were given the appropriate support to deal with their issues.

A lot of things to think about after clinical session, and we also had simulation clinic so everything will become very packed, and, at that time, COVID-19 hit. Everything becomes haywire and then, afterwards, we actually miss out part of our fourth year so during the final year we have to rush everything. That's the most stressful time that especially until they're worried that was very near to our exam, so I can see a lot of people very stressed out and including me. [Participant 05]

I rented a condominium with a few of my friends. Six of us stayed together, and it really helped me a lot. If I didn't have these housemates, right, a lot of time, I wouldn't be able to know how am I going to handle the stress... I think going back to the condominium and then we just sit down have a chat, other than that moral support I think it also helped. [Participant 02]

Theme 3: Clinical Teaching

The supervising clinician-to-student ratio decreased during the pandemic and was repeatedly cited as an enabler. This is because it permitted the clinician to more frequently demonstrate techniques to and teach students one-on-one. It also allowed for a more thorough discussion with the students chairside.

...and also, the lecturer is able to spend more time for each student. From my experience, they are actually more patient and also they get to discuss things with us (in a) more detailed (manner), and also we get to discuss more about the treatment planning. [Participant 02]

Different teaching styles were both an enabler and a barrier during the pandemic. Some participants reported that case discussions done in the lecturer's room rather than in clinics were an enabler for them while others mentioned that issues with the lecturer's teaching style posed barriers for them.

There are few lecturers that I (was) really looking up to. What I used to do is (that) I would go up to them and straight away discuss the case in their room instead of just in the clinic. I would discuss beforehand. I would text (the) Dr, and (the) Dr would help for each time I approached them. So, from there, I could actually plan according to my schedule. In one session, what I should do first, what I should do next, and I am aware of some unexpected events that would happen so the lecturer can actually tell me first, so I know what to do and what to prepare. [Participant 07]

We can only start to work after, like, the treatment plan has already been discussed and agreed, but my partner wasted a session because of her (clinical supervisor's) impatience and also condescending nature. [Participant 06]

The pandemic led the faculty to shift didactic lectures and seminars to various online platforms. This was reported by the participants to be both an enabler and a barrier to their education. Some found the online classes useful as they were able to rewind and listen to lectures in their own time. The convenience of attending classes from home was also mentioned. However, others felt that they were unable to concentrate and self-regulate during these online classes.

I feel online learning to learn the theory is okay. (It is) a good platform to learn the theory stuff; for example, like, medicine or pathology, online is very good... It's because the lectures are recorded, and then you can slow down, you can rewind, and then sometimes, lecturer don't provide lecture notes in live class, but then online (classes), they're forced to give the lecture notes so that is a plus point for online classes. And then I really prefer online lectures because I can take notes easier because I won't bring my laptop to class so this I can just, like, screenshot and then write down. [Participant 03]

I think online class it's very dependent on the students own self-discipline. You know, for me, I don't have that much of self-discipline so online class, I mean, during my final year, the whole year, all my online classes were not okay. I don't think I was able to absorb half of the things taught by the lecturer because sometimes, when you are having a class and you have clinic thirty minutes later, you need to go there and prepare your instruments and all that so you just be joining that class, but then you are walking around walking on the street; you are doing something else. [Participant 02]

Reduced clinical time led some participants to look for clinical videos online to increase their knowledge and skills. This was an enabler for most participants to achieve clinical competency. They also stated that this sharpened their ability to discern the reliability of different sources of online information.

Theme 4: Cross-infection Protocols

The strict cross-infection protocols based on the standard operating procedures by the authorities were mostly described as enablers because it allowed the students and patients to be confident to attend the clinics during the pandemic. Time spent adhering to the protocols, however, reduced clinical time.

I think our university has done quite a good job, which has been COVID-free for a certain period, including our practice time which up to one year then it started up with some staffs getting COVID. But what I have been told that the standard operating procedure is quite safe. There is no infection where patient get from the clinician. [Participant 07]

Partitions were put up in the open-layout clinics to prevent cross-infection between the different cubicles. The partitions were mostly seen as enablers as they gave both students and patients the privacy they needed, as well as prevented what was happening in the other cubicles from affecting them. However, it also reduced learning opportunities, as students were no longer able to observe their colleagues carrying out treatment or discuss cases in clinics while waiting for patients or clinicians.

I think there's good and there's bad. The good, the good is that, of course, you reduce the infection risk, and the second is that I think patient quite like it when you have all the compartment because... I don't know. If I'm a patient, I don't like people looking at me undergoing dental treatments. [Participant 06]

I actually prefer to see what others are doing because sometimes, when you're waiting for your patient then you got nothing to do, you can see how others are doing; but now, it's like you need to wait in your own cubicle. But you still can prepare the instrument and prepare what to do later. [Participant 04]

Theme 5: Communication and Faculty Policies

The changing faculty policies depended on the current pandemic situation and were based on decisions made by the authorities. This was viewed as a barrier by some participants due to the uncertainty and perceived lack of information given. However, others also described certain members of the faculty who were helpful when faced with the changing policies.

Sometimes, I feel that the faculty is giving even more burden to us and, like, making the situation worse. I think they even add to our pressure, and they just being never update us on anything, then suddenly, one day before the event itself, they say be doing certain things so it's always inconsistent and indecisive. It actually makes the situation worse, but, yeah, it's the faculty I'm saying. Certain lectures are really very good. [Participant 02]

One day, we had a meeting with the faculty, they announced that they will do whatever they can to help us push the requirements and, yeah, that's really helpful. Certain lectures are really helpful, like even in the management of the faculty. Also a few lectures are very helpful. They keep asking us if there is anything that stops you from completing your requirements and how can they help us. [Participant 02]

The monitoring of the faculty requirements allowed them to be aware of their own and other colleagues' progress and help in the clinics. The participants were satisfied that the requirements pushed them to achieve better clinical skills.

That I feel compared to other universities, sometimes, because of COVID, they did not get forced to do enough crowns something like that, so they graduated with the minimum. So, in that aspect, I am grateful that our faculty (for) allowing me to complete requirements on real patients, and then even though we were stressful at that time, you are forced to finish your requirements, but, then again, if you look back at it, actually it's for our (own) good. [Participant 03]

DISCUSSION

The self-reported competency among the investigated dental graduates who were affected by the pandemic was high, with seven out of eight domains reporting over 80% 'competent' responses. Thirty-seven out of forty-three assessed skills also had high self-perceived

competency, with more than 80% of the participants giving a score of 4 or 5 for these skills. Other studies done in Serbia (16), Jordan (17), Italy (18) and Malaysia (19) reported lower levels of confidence in performing dental procedures and preparedness to practice among dental students affected by the pandemic. These differences can be attributed to the different responses and mitigation protocols set by the institutions during the pandemic. Factors, such as the duration of the closure of the clinics, the types of treatment allowed to be carried out and cross-infection protocols, may all potentially influence the competency of dental graduates (20).

Comparisons made between the cohort investigated in this study with earlier cohorts from the same institution showed that the graduating batch of 2021 had similar levels of competence as the 2019 cohort and a higher level of competence than the 2020 cohort (21). The different cohorts experienced the pandemic at different points in their training. The 2021 cohort had resumed their clinical training in their final year of study, whereas the 2020 cohort was affected by COVID-19 in their fourth and final years. The faculty was also better prepared in 2021, as the 2021 cohort was the second batch of final-year students trained under pandemic conditions. This may explain why the 2021 cohort had self-reported competency levels that were similar to the 2019, pre-pandemic cohort.

Of the thirty-seven investigated skills, Q37, 'Comprehend the professional duties of care in dentistry in line with the Patients' Charter', and Q15, 'Carry out Basic Life Support (BLS) in the management of medical emergencies in dental practice', received low ratings, with only 26.8% and 58.9% of respondents having self-perceived competence in these skills respectively. This can be due to the limited exposure of the students to these two skills. Although the rating for Q15 was low, it was relatively high compared to those of cohorts 2019 (37.0%) and 2020 (22.2%), as previously reported by Nik-Azis et al. (2022) (21).

To our knowledge, this is the first study to identify the enablers and barriers to achieving clinical competency among dental students during the pandemic. In the field of medical education, Reinhart et al. (2021) describes five major themes contributing to the successful usage of clinical competency-based e-learning under lockdown, which are communication (with teachers, students and patients), mental well-being, structure and self-organisation, technical issues and learning and commitment (22). The themes are similar to those described in the present study. Generally, the respondents were able to effectively make use of learning opportunities by utilising the various resources available to them, including online tools, simulation laboratories, case studies and the traditional resources provided by the faculty. This is in concordance with a review by Melo et al. (2021) on the dental education profile during the pandemic, where blended teaching methodologies showed promising outcomes (23).

The reduced teacher-to-student ratio during clinic sessions was described as an enabler that facilitated discussion and learning. At the investigated faculty, the ratio was 1:2 or 1:3 during the pandemic. Other studies reported that a minimum teacher to student ratio of 1:4 or less for clinical sessions can improve the effectiveness of teaching (24). Other reported ratios in past literature include 2:1 to 8:1 in Saudi dental schools (25). While a reduced ratio can enhance the learning experience, the increased workload on the faculty and supporting staff, as well as the resources needed to support this, must be taken into consideration (7).

The national dental clinical requirements were revised during the pandemic, and the dental schools then revised their own requirements accordingly, based on their individual circumstances. The strict requirements were mostly viewed as enablers by students as these provided them with a guide for the minimum competency levels required during a pandemic.

75.0% of the participants also graded the requirements set by the faculty as 'satisfactory', with a score of 4 or 5 on the Likert scale in the questionnaire. Students were motivated to work hard to qualify for their final examinations. The simulation laboratory was utilised to practise their practical skills, in lieu of clinical practice, if the circumstances did not allow for patients to be seen in the clinics. Despite the stress brought about by these requirements, the students still viewed them positively.

The open-plan layout plan of dental clinics, which was modified to include partitions, was described as both an enabler and a barrier by participants. The perceived lack of privacy during treatment, as well as when receiving feedback from the clinical supervisor, was highlighted. While the disadvantages in terms of aerosol contamination are evident (26), the advantages and disadvantages of open-plan clinics in teaching and learning have not been widely discussed. Future considerations of the appropriate method to deliver dental education should consider the benefits of having separated cubicles for a better learning experience and privacy.

The barriers described in this study include reduced time in clinics, mental health concerns, lack of ability to concentrate with the hybrid learning model, communication issues and limitations caused by the facilities and infrastructure. These were similar to those previously reported by other studies on clinical academic performances (27-29). While these barriers are not entirely a direct result of the pandemic itself, the crisis magnified them and brought them to the forefront of public consideration. For example, open communication, readily available and accurate information and quick dissemination of important information would be important under all circumstances. However, in a crisis, these are indispensable to allay student fears and enable them to better focus on their studies (20).

The hybrid learning model in clinical teaching, which utilises both face-to-face and online learning, surged in usage during the pandemic. Some dental schools even fully shifted to a digital method of teaching during this time (30). While online learning is convenient and allows for self-directed, lifelong learning, this study expounded on some of the barriers posed by the online learning model. This includes the lack of internal motivation and the inability to concentrate and self-regulate. These findings are comparable to reports by medical students who utilised online learning during the pandemic (31-33). The promotion of online learning post-pandemic should, hence, consider these barriers, and adopting a hybrid model would be advisable to balance the advantages and disadvantages of online learning.

The reopening of dental schools in Iran, Brazil and Malaysia after the pandemic has been discussed, with focus given to clinical teaching and learning; infrastructure and facilities; and clinical services (5-7). The lessons from the innovations during the pandemic that is related to the resilience of the teaching and learning system for the future of clinical teaching in dentistry has yet to be extensively discussed. This study elucidated some of these factors, such as the hybrid teaching model, utilisation of technology and other online resources, reduced ratio of clinical teacher to students and open-plan clinics.

CONCLUSION

Dental graduates affected by the COVID-19 pandemic from the graduating batch of 2021 had a good level of self-perceived clinical competency. Factors, such as the clinical time, mental health of students, clinical teaching, cross-infection protocols and communication and other faculty policies,

were identified as important enablers and barriers to the achievement of clinical competency in undergraduate dental education. Lessons from the adaptation of the delivery of dental education during the pandemic should be utilised post-pandemic to achieve a better dental education system worldwide.

APPENDIX

1. Interview Guide
2. Coding of Thematic Analysis

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