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Integrating innovation in teaching of special care dentistry: Exploration of students' perceptions

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Abstract

Introduction: This study was undertaken to investigate students' perceptions of innovation-integrated learning, adopted as an alternative approach for special care dentistry (SCD) training.

Methods: Ninety final-year dental students from the 2021 cohort were divided into eight groups to complete an innovation project dedicated to eight categories of patients with special health care needs. Discussion and final presentations, involving related experts were conducted remotely via an online platform. Then, students were invited to answer a validated online feedback survey on their perceptions of the learning approach.

Results: The response rate for the feedback survey was 91.1% (n=82). Most students agreed that the activity was interesting, improved their knowledge and understanding of SCD, allowed engagement between peers, supported sharing of ideas and experiences, encouraged student-lecturer interactions, and enhanced knowledge integration and application. Students also expressed that the activity enhanced creativity and innovation, instilled an interest and positive attitude toward learning SCD, and encouraged teamwork. However, a few students noted facing some limitations in completing their projects (i.e., technological challenges and reduced physical access to purchase materials). Around half felt neutral about having an increased workload from this activity. Moreover, perceptions differed regarding time and financial commitments, as well as supervisors' and patients' involvement during the project development process.

Conclusion: Students perceived that the innovation-oriented learning activity, was beneficial in multiple aspects of SCD training.

Keywords: *Innovation, Learning, Dental Students, Perception*

Practice Highlights

- We have developed a new integrated teaching method via the utilisation of innovation development for special needs groups.
- Students' perceptions of this learning method were explored using both quantitative and qualitative methods via an online feedback questionnaire.
- Overall, students positively responded to the teaching method when it came to improving their knowledge and understanding of SCD, engagement between peers, sharing of ideas and experiences, student-lecturer interactions, and knowledge integration and application.
- This novel teaching method achieves the highest level of Bloom's Taxonomy which is to create something new.

I. INTRODUCTION

Special care dentistry (SCD) involves managing patients with special health care needs, such as those with physical, intellectual, psychological impairments as well as complex medical conditions (Royal Australasian

College of Dental Surgeons, 2021). At the undergraduate level, many teaching and learning activities have been conducted to provide students with learning experience in this area of patient care. These activities include lectures, community-based learning, simulation

exercises and clinical training (Ahmad, Mokhtar, et al., 2020; Mohamed Rohani & Mohd Nor, 2021). Students who received training in SCD were found to have demonstrated better comfort and attitudes in managing patients with special health care needs (Mohamed Rohani et al., 2021).

However, these learning activities may be compromised by situations that limit face-to-face interactions, either among students, between teacher and learners, as well as with the patients. Such situations may happen due to disease (such as the recent COVID-19 pandemic), geographical barriers and accessibility issues (Amir et al., 2020). It was found that limitations of dental training that requires physical contact may compromise students' learning experience, thus affecting their competency, knowledge and confidence in patient care (Chang et al., 2021).

Meanwhile, it has become incumbent on dental education providers to prepare future graduates with essential skills that are deemed beneficial for practicing health care professionals. These skills include innovation, leadership, critical thinking and entrepreneurial abilities (Malaysian Dental Council, 2021). Acquisition of these abilities have been associated with many aspects of personal and professional development including emotional intelligence and practice management (Saleem et al., 2019; Wang et al., 2020).

In view of the various challenges and demands of the current (and future) educational environment and healthcare needs, an innovation-integrated educational approach was developed and adopted as an alternative teaching and learning method to teach SCD. This approach, undertaken mostly remotely using an online learning platform, involved the integration of students' cognitive function, psychomotor ability, and affective skills through the development of innovative products to address oral health issues experienced by the different categories of patients with special health care needs. As a novel educational approach, assessment of its effectiveness is therefore essential. This study was undertaken to investigate students' perceptions of the innovation-integrated learning, conducted remotely via an online platform, developed during the COVID-19 pandemic, as an alternative approach for SCD training.

II. METHODS

A. Study design

This was a descriptive, cross-sectional, quantitative and qualitative study, using a validated online feedback questionnaire involving the final-year undergraduate

students of the Bachelor of Dental Surgery program of the Faculty of Dentistry, Universiti Teknologi MARA.

B. Study Population

Because this module is a compulsory component of the final-year undergraduate dental curriculum (Faculty of Dentistry, 2022), all students were required to be involved with the group innovation project. However, participation in the online feedback survey was voluntary. At the beginning of the semester, the students were made aware of the study and that their participation in the innovation program and the research were treated separately.

All students who agreed to participate in the online feedback survey provided informed consent, attached to the information sheet supplied to all potential participants via their official university email. To avoid coercion, students were provided with an explanation in the information sheet that their participation was entirely voluntary and anonymous. Those who wished not to participate in the online feedback survey would not be penalised, and they could withdraw their participation at any point without having to provide a justification.

C. Study Instrument

The questionnaire used for the online feedback survey was adopted from the study by Rowe and Wood (2008). It was content-validated by a panel of 2 experts in dental education before its use in the main survey. From the item-level content validity index (I-CVI) for each item as well as a summation of the I-CVI divided by the number of average (S-CVI/Ave), a score of 1 was obtained for both indices as the panelists rated all items with a score of 3 or 4. The questionnaire consisted of nine items about the perception of students towards this teaching method, measured using a 5-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree). Open-ended questions were included at the end of the questionnaire to further explore students' perceptions of the learning activities.

D. Study Conduct

For the group innovation project, all final-year students (n=90) were divided into eight groups, based on their assigned clinical groupings. Each group was assigned to an academic or clinical specialist in SCD, who acted as a supervisor. Eight categories of patients with special health care needs were identified and randomly allocated to the different groups. The categories of patients were 1) hearing disability, 2) speech disability, 3) visual disability, 4) geriatric, 5) Down syndrome, 6) autism, 7) cerebral palsy, and 8) dementia.

Students were given three months to develop innovative products. They were expected to engage with their

supervisors during the whole development process, which involved 1) identification of health complications related to the condition and its impact on oral health, 2) understanding of issues related to patients' oral health care; 3) creation of a prototype to address the related oral health-related complications. Because all students were at the time subjected to restrictions in having physical classes due to COVID-19 (Samat et al., 2020), large-group discussions and final presentations were undertaken remotely online.

At the end of this group activity, an online presentation, judged by experts in related fields, was conducted as a form of assessment, as well as constructive feedback on improvements and the marketability of the product. Students were then invited to participate in the online feedback questionnaire, which was distributed via their official university email. An English language questionnaire was used as the respondents were undergraduate dental students with a good command and understanding of the language. A reminder email was sent a week later, with another reminder sent the following week.

E. Data Analysis

To maximise the outcome, quantitative data were simplified into a 3-point Likert scale (agree, neutral, and disagree). Using SPSS version 27, the frequency of the

data was analysed to compare students' responses for each item. For analysis of the benefits, the nine items of the questionnaire were further categorised into different themes: Theme 1—Acceptance of the teaching method concept (Item 1), Theme 2—Effectiveness of teaching method (Items 2, 3, 6, and 7), Theme 3—Important role of supervisors (Items 4, 5, and 8), and Theme 4—Impact on students' workload (Item 9).

For the qualitative component, data were analysed via thematic analysis involving open and closed coding. Emerging themes were then identified based on these codes, which were then validated through comparisons amongst researchers.

F. Ethical Approval

Ethics approval was obtained from the Research Ethics Committee (REC) Universiti Teknologi MARA, Malaysia, in accordance with the Declaration of Helsinki (REC12/2021 [MR 1004]).

III. RESULTS

A total of 82 out of 90 students returned the questionnaire, giving a response rate of 91.1%. The frequency of responses for each question or item, categorised into the different themes, is shown in Table 1.

Items	Questions	Themes	Negative (%)	Neutral (%)	Positive (%)
Item 1	The program is an interesting new teaching method to learn about Special Care Dentistry.	Acceptance of teaching methods/ concept	1.2	8.5	91.3
Item 2	The program has provided me a clear understanding of the Special Care Dentistry concept.	Effectiveness of teaching method	1.2	9.8	89.0
Item 3	The teaching method managed to integrate the knowledge and clinical implication in Special Care Dentistry.		1.2	4.9	93.9
Item 6	The method of teaching allows me to interact effectively with my fellow group mate and the rest of the batch.		2.4	7.3	91.3
Item 7	The teaching method supports ideas and experience sharing between students		0.0	2.4	97.6
Item 4	The supervisors encourage and accept different opinion.	Important role of supervisors	0.0	3.7	96.3
Item 5	The teaching method provide opportunities for discussion between students and supervisors.		2.4	2.4	95.2
Item 8	The supervisors explained the purpose of the program well and structured.		0.0	7.3	92.7
Item 9	The teaching method increase the workload of students compared to classroom learning	Impact on students' workload	7.3	53.7	39.1

Table 1. Frequency of responses for items, categorised into different themes.

Overall, most students provided positive responses regarding activity acceptance and effectiveness and the supporting role of supervisors. However, slightly more than half of the students felt neutral about the learning

activity causing an increased workload compared to classroom learning.

The thematic analysis of qualitative data yielded multiple themes that can be categorised into three main areas: 1) benefits of this education method, 2) limitations of this learning intervention, and 3) differing opinions on the integration of the group innovation project into the dental curriculum.

A. Benefits of The Study

Within this area, the students expressed four main themes.

1) Enhances creativity and innovation: Most students felt that this teaching method had enhanced their creativity in finding methods to manage patients with special dental needs as well as in developing innovations for the group of interest.

“This integrated learning helps me with my creativity and critical thinking so we could create an innovation that is appropriate with the current technology.”

Student 10

2) Improves knowledge and understanding of SCD: Using innovation in teaching made students delve into the subject matter, thus improving their knowledge of their patients and gaining a deeper understanding of SCD.

“A good approach indeed. I have a chance to challenge my understanding and gain new information from my friends, supervisors, and postgraduate students. This helped me develop a new way of thinking and find good literature on SCD.”

Student 35

Subtheme 1: Encourages independent information-gathering about SCD

Some students noted that they had to rely on the resources they had and work by themselves due to the pandemic, which made them more independent when researching topics about SCD.

“In my opinion, this teaching method is helpful to help the students to understand the special needs module by asking the student to develop products according to the difficulties of the disabilities required.”

Student 25

Subtheme 2: Development of critical thinking and problem-solving skills in SCD

By giving students the task of developing information, they were forced to solve problems the special interest group faced. Therefore, students believed this made them learn better critical thinking and problem-solving skills.

“Good to brainstorm ideas and put us in their shoes in order to address their different needs.”

Student 74

3) Instils interest and positive attitudes towards learning SCD: Due to their minimal patient experience, most students felt this task made them more interested in their special interest group, which improved their attitudes to learning SCD.

“The integrated learning approach gives me ideas on how situations should be handled in real life on aspects like the expectation from special care patients and preparedness as a future dentist to have a special care patient.”

Student 12

4) Encourages teamwork: Some students noted that, even with the isolation, they felt that this type of teaching method had encouraged them to work more closely with not only their teammates but supervisors as well.

“Innovative program. Good. Made students and supervisors unite as teammates.”

Student 62

B. Limitations of this Learning Intervention

Regarding limitations, two themes were noted.

1) Technological challenges: Several students experienced poor internet connection throughout the process, which hindered their efficiency.

“Very helpful, but internet connection and environment are some of the barriers for me for not study effectively, I prefer face-to-face learning approach.”

Student 72

2) Reduced physical access to purchasing of materials: The movement control order that was implemented throughout most of the pandemic left most students restricted from being able to access appropriate materials from local or distant suppliers.

“We faced problems buying materials due to the movement control order.”

Student 77

C. Differing Opinions on the Integration of the Group Innovation Project into the Dental Curriculum

Students had differing opinions on the following aspects.

1) Time commitment and workload: Despite the lack of face-to-face sessions, some students believed they were given adequate time to create and execute ideas comfortably.

“Since the project is given so much earlier than the deadline, we are able to create a better project without feeling any burden in completing the module.”

Student 36

However, a handful of students felt they needed more time to be able to have performed better for the task.

“It is an interesting method and helpful to learn special care dentistry, but it is quite time-consuming, and we have restrictions due to COVID-19.”

Student 65

2) *Financial demands:* Depending on the type of innovation they designed, some students felt that the funding provided was not sufficient for them to prepare a good product.

“Some innovations need to create prototype only because low budget, but it is understandable.”

Student 74

However, a few students believed the financial assistance was enough for them to complete their innovation.

“The funding provided was sufficient.”

Student 43

3) *Guidance from supervisors:* Many students noted that their supervisor provided ample guidance throughout the project.

“Excellent. Students and supervisors can communicate and deliver knowledge well through this method.”

Student 19

“Our supervisor introduced us to some deaf patients. So we were able to get the patient’s feedback on our product.”

Student 52

However, some students believed the transition from face-to-face to online consultations was not ideal for the guidance they needed.

“However, there is lacking in communication and discussion between students and supervisors as this is still new to some students.”

Student 47

4) *Exposure to SCD practice:* Because the students were supposed to have exposure to special care patients in their final year, they believed that this teaching module was sufficient to help them understand patients.

“I think this method actually gives a realistic overview of how to work with patients.”

Student 43

On the other hand, a few felt that clinical sessions were more beneficial for them to apply the knowledge they have.

“In my opinion, direct exposure to SCD patients would be better so we can apply the knowledge and innovation.”

Student 76

IV. DISCUSSION

This study involved the undergraduate teaching of SCD for students in a Malaysian dental school. In Malaysia, SCD education has yet to become a compulsory component of the five-year undergraduate curriculum (Naimie et al., 2020). This may be related to various barriers to providing training in this area of dentistry, including a lack of clinical expertise and educational resources (Ahmad et al., 2014). Despite this, Universiti Teknologi MARA, Malaysia has taken a proactive approach to provide training in SCD, at both undergraduate and postgraduate levels (<https://dentistry.uitm.edu.my/index.php/en/>). For undergraduate students, teaching and learning of SCD are provided in the final year, as part of the Comprehensive Care Dentistry course (Faculty of Dentistry, 2022). Students undergo a series of lectures, hands-on demonstrations, problem-based learning, tutorials, a clinical rotation in the SCD specialist clinic, and a community engagement activity project (Faculty of Dentistry, 2022).

Although various teaching and learning interventions have been successfully conducted in the undergraduate training of SCD in previous years (Naimie et al., 2020), the transition from face-to-face training to online distance learning imposed on higher learning institutions in this country during the COVID-19 pandemic (Halim et al., 2021) may lead to compromised learning experiences. This is especially pertinent for SCD training, which involves clinical exposure to various groups of patients (Dougall et al., 2014). As clinical training was limited at that point of time, alternative teaching and learning approaches were designed to ensure students were exposed to issues in managing patients with special health care needs, which in this case was achieved by developing an innovative product to

address patients' difficulty in maintaining satisfactory oral health.

This study found that students demonstrated favorable responses toward acceptance of such an education intervention. With dental students experiencing physical and mental health deterioration with online distance learning during the COVID-19 pandemic (Lestari et al., 2022), it was encouraging to observe that students in this study found the learning activities interesting. They also opined that the educational method enhanced creativity and innovative skills, which are the highest level of learning domains (Bloom et al., 1964; Miller, 1990). Therefore, acceptance of this training approach has positive implications for its future development and implementation in the undergraduate dental curriculum.

Various benefits of this learning activity, as reported by students in this study, also further supports the use of innovation-integrated learning for teaching SCD. Participants cited improved knowledge and understanding of SCD, which has been reported as lacking among members of the dental fraternity around the world (Ahmad et al., 2015; Borromeo et al., 2018; Mandasari et al., 2021). They also opined that this learning intervention allowed integration of SCD theory and clinical practice, supporting its effectiveness, which is comparable to a similar approach previously undertaken via face-to-face learning (Ahmad, Radhi, et al., 2020).

The enhanced student attitude and interest in learning SCD reported in this study suggest a positive impact of learning that could potentially be translated into practice. Those with educational experience in SCD have been found to feel more comfortable and positive in managing patients with special health care needs (Mohamed Rohani et al., 2021). Dental practitioners who received exposure to SCD during university education were also more likely to have provided care to these patients, in comparison with their colleagues without such training experience (Alumran et al., 2018).

To further enhance students' attitudes and interest in learning, the role of academicians as supervisors is integral. Academicians who play an effective role could influence students' active engagement in learning, guide students in achieving learning goals, and enhance their overall learning experience (Sølvik & Glenna, 2021). It was evident in the present study that despite being conducted virtually, this learning activity was successful in encouraging engagement between students and supervisors. Some students also reported receiving assistance from their supervisors in gaining access to patients, whose feedback was sought for improvement of their products. This is an encouraging finding, given

previous studies reporting negative implications of virtual and remote learning on student–teacher relationships (Halim et al., 2021). To ensure that all students receive quality supervision, the faculty must monitor the roles and engagement of every academician, especially during learning activities that involve remote delivery.

Besides improving student–teacher engagement, this learning activity was also beneficial in enhancing peer interactions and teamwork, while allowing sharing of experiences and ideas between students. Although social interaction and group dynamics in learning have been reportedly compromised during the COVID-19 pandemic (Walker & Koralesky, 2021), this education activity was perceived to have overcome this issue. Enhanced teamwork and communication brought about by this activity could provide opportunities for students to develop professionalism, which is integral to the practice of dentistry. Teamwork and effective communication are especially important in the practice of SCD, where multidisciplinary collaboration is mandatory in addressing patients' complex health care needs (Glassman et al., 2016). The development of skills (e.g., independent information-gathering, critical thinking, problem-solving skills) reported by the study participants is also beneficial in preparing them as competent practitioners who can function at a high level of professionalism.

Challenges reported by students while undergoing this learning activity (technological difficulties and reduced physical access to purchase materials) demand the attention of faculty and supervisors to be more proactive in addressing the related issues. Nevertheless, with allowance of physical classes recently, this issue would not compromise students' learning experience should the faculty decide to continue such this approach. Differing opinions about time constraints, heavy workloads, and increased financial demands expressed by students in this study require further investigation and planning by the faculty to ensure that the students receive adequate assistance to support their learning process. Feedback from patients regarding the developed innovative products could be gained through the conduct of proper research that assesses the effectiveness and benefit of the intervention. Consequently, students' innovative ideas could be further developed for commercialisation, thus equipping them with entrepreneurial skills, which is highly recommended to be taught in the higher education curriculum (Tuononen et al., 2022).

This study also indicates that integrating innovation in the teaching and learning of SCD supports many aspects of student learning that targets the recommended core

contents as recommended in the IADH guidelines. These contents include 1) Identifying and addressing access and barriers to oral health faced by people with special needs (Domain 2), 2) Demonstrating appropriate communication skills when managing patients with special needs (Domain 4), 3) Understanding the impact of impairments, disabilities and systemic conditions on oral health and functions (Domain 5), as well as 4) Developing and applying effective methods when managing patient with special needs, including in planning oral health education program and designing interventions for clinical treatment (Domain 6) (Daly et al., 2014).

This study is limited by the non-participation of some students, whose responses were not included in the investigation. Nevertheless, the high response rate indicates the representativeness of the study population, hence supporting the validity of the study findings.

The results of this study provided important information for program developers, faculty, and the dental education fraternity at large. It identified the potential of innovation-integrated learning, for providing SCD training to undergraduate students, including in circumstances that may limit physical access to education.

V. CONCLUSION

Students' acceptance of this teaching method proves it is sufficient and beneficial in improving their creativity and innovation, enhancing their knowledge and understanding of SCD, instilling interest and positive attitudes in learning SCD, and encouraging teamwork and effective communication between peers and supervisors. However, they provided differing opinions on the impact of the learning activity on their workload, time and financial demands, and exposure to SCD practice. Some faced technological challenges and reduced physical access to purchase materials.

Notes on Contributors

Aminda F. Omar was involved in literature search, data acquisitions and analysis and the manuscript preparation.

Tun Yasmin Iffah Mohd Suria Affandi was involved in data acquisitions and analysis.

Mohd Isyrafuddin Ismail was involved in data acquisition.

Mas S. Ahmad was involved in study conception and design, data analysis, manuscript editing and review.

Ilham W. Mokhtar was involved in the study conception and design and manuscript review.

All the authors approved the final version of the manuscript publication.

Ethical Approval

Ethics approval was obtained from the Research Ethics Committee (REC) Universiti Teknologi MARA, Malaysia in accordance with the Declaration of Helsinki (REC12/2021 [MR 1004]).

Data Availability

As per the requirement of the local ethics, data will be kept in an enclosed and dedicated facility in the faculty building.

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Declaration of Interest

There are no conflicts of interests.

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