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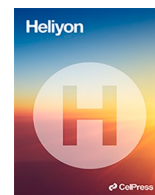
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Research article

A phenomenological exploration of experience of Syrian dentists with online Course “Traumatic dental injuries”

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ABSTRACT

Background: Several learning modalities have been implemented to improve learning about Traumatic Dental Injuries (TDIs) worldwide. Free online courses about TDIs might be an effective and convenient approach for equipping Syrian dentists with essential competencies during the Syrian crisis. Therefore, this qualitative study with a descriptive phenomenological method was undertaken to explore the lived experience of Syrian dentists enrolled in an online course about TDIs and investigate areas requiring improvement.

Methods: Ethical approval was obtained from the Faculty of Dentistry, Damascus University, and the University of Dundee. Educational contents of the TDI course were developed. About 10 dentists who completed the TDI course, were interviewed. The interviews were recorded, transcribed, and analyzed to identify emerging themes. Inductive thematic analysis was performed to extract all data.

Results: About 10 clustered categories were first developed and this has led to the emergence of 3 themes that represent the lived experience including usefulness, challenges, and recommendations. Participants were so motivated and keen to take advantage of the course despite the personal, technical problems, and crisis-related challenges. TDIs course was effective for general and specialists despite the challenges they experienced. Factors that lead to effective TDIs courses as reported by participants were flexibility in time and location, interactivity with colleagues, other commitments, quantity and quality of content, easiness, and variety of virtual environment tools. Conversely, negative attitudes were linked to factors like lack of interest, unfamiliarity with the learning environment and tools, late participation, lack of confidence, anxiety about independent learning and insufficient interactivity and engagement tools.

Conclusion: Syrian dentists can benefit from online courses if constraints and various learning needs are addressed during the design and delivery of online courses. Future work is still required to identify other effective instructional modalities that equip Syrian dentists to overcome challenges and enhance their learning.

1. Introduction

Over the past two decades, there has been a significant shift towards digital transformation in dental medicine. This shift has led educators to recommend the use of various learning modalities in dental education [1]. These methods include online learning, mobile

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learning, blended learning, e-learning, simulation-based learning, and virtual learning, all of which are technology based [2]. The purpose of these instructional tools is to make it easier for students to access knowledge without limitations [3]. They were developed to save time, reduce costs, accommodate different learning styles, allow students to learn at any time and place, address faculty shortages, and promote student-centered learning [4–6].

Dental institutions have implemented Massive Open Online Courses (MOOCs) to offer a free, open educational platform [7]. These MOOCs aim to provide accessible education to an unlimited number of participants worldwide through independent companies such as Coursera, Udemy and FutureLearn, which collaborate with higher education institutions [7].

Additionally, organizations like the American Dental Education Association (ADEA), MedEdPORTAL, and Coursera have developed various dental MOOCs, making them available to dental learners since 2015. These courses cover a wide range of current theoretical and practical topics for dental health providers [7]. However, the role of MOOCs in dentistry has been a topic of debate, particularly regarding their ability to replace traditional face-to-face clinical teaching. This debate gained significance with the onset of the COVID-19 pandemic, as dental health professionals faced increased risk of infection due to direct patient contact and the spread of disease [2].

Teaching dentistry has become highly challenging during the pandemic, requiring dental students to assume responsibility for managing oral health and acquiring the necessary technical and intellectual skills to address patients' needs in unpredictable situations [8].

The Association of Dental Education in Europe (ADEE) has addressed the need for protecting patients, students, and staff while also maintaining high-quality academic progress [9].

Researchers have provided evidence suggesting that distance learning may be the most viable option for dental students to acquire essential technical skills during the pandemic [10]. For example, studies have shown that MOOCs in dentistry experienced a significant increase in enrolment, during the pandemic, have experienced increasing percentages of enrolment, a high level of engagement, and a positive perception towards information received [7].

Singer (2021) noted that the pandemic has accelerated the recognition of technology's role in higher education by at least five years and elucidated the crucial factors contributing to successful online dental education [11].

Additionally, researchers have provided evidence regarding the benefits of MOOCs during and after the pandemic in societies facing economically and academically challenges [7], offering innovative solutions for learners, from low- and middle-income countries [12].

Given the current situation in Syria and the potential effectiveness of MOOCs in dental education, their implementation in Syria could present a significant opportunity for health dental professionals amidst the dreadful circumstances of war and the COVID-19 pandemic. It could enhance their learning during their free time, despite economic, social, and health difficulties, ultimately saving time and effort for both students and educators.

The ongoing crisis in Syria has impacted the population's health, leading to the emergence of various health issues and diseases due to war, economic difficulties, sanctions, and the breakdown of the public health system [13]. This has resulted in several societal health consequences, increased risk of communicable, and non-communicable diseases, as well as challenges related to child and maternal health, and trauma conflict-related trauma [13].

In addition, traditional education and clinical training were also affected, as they have been very dangerous, at some stages due to the lack of security and violence. It has also been ineffective and challenging due to interruption, targeting, and destruction of health facilities, shortages of staff, cost, and difficulties in transportation [13]. The quantity and quality of dental education and the future of Syrian dentists became challenging. Dental students were under high pressure and distress due to the loss of relatives, massive displacement of civilians, violence, interruption of education, lack of access to health care as well as income, poverty, and food insecurity [14].

TDIs are one of the health problems that have dramatically increased during the Syrian crisis [15]. TDIs are injuries that affect the dentoalveolar region of the face and mouth of children and young adults [16]. They cause contusions, abrasions, and lacerations of the soft tissue of the mouth and face, or can cause fracture and displacement of teeth or bone [17]. TDIs can cause pain and negatively affect occlusion, as well as dental aesthetics which can consequently affect the function and emotional and economic status of TDIs patients [16].

TDIs require urgent and appropriate management and any inadequate knowledge or experience in dealing with dental trauma can lead to serious consequences and poor outcomes [17,18]. Therefore, all dentists need to be sufficiently skilled to manage any urgent case that can have bad consequences and negatively affect the quality of life of patients and their families.

Several training approaches have been implemented worldwide to equip medical [19], dental students [20], teachers of schools [21], children [15,22] dental practitioners [23] and paediatric dentists [18] with essential knowledge and skills about TDIs. However, there is a need to make all information and guidelines about TDIs freely available so which learners from deprived areas such as Syria can enhance their learning.

In this regard, the MOOC about TDIs might enhance the learning of Syrian dentists and enable them to provide safer and optimal care to Syrian patients with TDIs. It might fill the gap in knowledge and update the skills of dentists if it is designed in a way that guarantees flexibility in the dynamic daily practice and is delivered conveniently.

A recent publication undertaken to evaluate the effectiveness and feasibility of asynchronous online course in improving the skills of Syrian health professionals in evidence-based medicine has found that the course was very effective and able to enhance positive attitudes towards asynchronous online education [24].

Similarly, developing online course about dental pain management and local anesthesia methods in developing the knowledge of Syrian dental students has been effective. Researchers suggested implementing online education courses on different topics to fill the

cognitive deficiencies of newly graduated dentists [25].

There is a need to design a TDIs online course and investigate its effectiveness in improving the learning of Syrian dentists. Therefore, this qualitative study with a descriptive phenomenological method was undertaken to explore the lived experience of Syrian dentists enrolled in an online course about TDIs and investigate areas requiring improvement.

2. Methodology

2.1. Study design

This study employs a qualitative design informed by descriptive phenomenology to explore the lived experience of dentists participating in the TDIs course.

In dentistry, qualitative research design is less common when than quantitative research [26], but it is recognised for providing rich information, and enhancing understanding of important issues by delving into people's experiences, perceptions, and feelings [26,27].

Phenomenology is an effective research approach for exploring issues in health profession education, as it foster a deeper understanding of phenomena and ensures alignment between the research question and the researcher's philosophy [28].

While the use of phenomenology in dental research is limited compared to other healthcare sciences [26], it offers two main approaches: descriptive and interpretative [26]. Descriptive phenomenology enables the description of the essence of an experience, requiring researchers to suspend their ideas and assumptions to maintain objectivity [29].

In this study, descriptive phenomenology was utilized three key phenomenological methods: Epoché, imaginative variation, and phenomenological reduction. The researchers avoided bringing their own beliefs, preconceptions, and assumptions (Epoché) by setting aside their personal experiences with online education. Furthermore, the concept of imaginative variation was applied to explore the essence of the phenomenon (online learning) and analyze the data from various perspectives and angles to obtain the structural themes from textual descriptions [30]. Additionally, the process of phenomenological reduction involved eliminating overlapping, repetition, and vagueness by employing bracketing and setting aside the researcher's everyday assumption, belief, and experience [31]. The researchers emphasized the importance of the bracketing in enhancing the rigor of the research, as it helps mitigate the impact of misconceptions on the research findings [31–35]. In the context of descriptive phenomenology, prior researchers have recommended the development of flexible topic guides and the formulation of open-ended, focused questions in advance to be posed to participants during interviews. They have emphasized the significance of open-ended questions and free-text comments [27] in enlightening issues that may not be discernible in quantitative studies and using Likert Scales [36,37]. Semi-structured interviews were found to be valuable for enabling the researcher to listen to participants as they discussed their experiences [35]. During the interview, the researcher had predefined topics to cover and questions to prompt participants for further discussion, offering more flexibility than structured interviews in terms of asking key open-ended questions without a specific order [35]. Table 1 presents questions used during the interview. Efforts were made to listen to each participant without restricting their talk, enabling a description of their thoughts and experiences and probing any interesting areas that arose during the interview [36]. Narratives were collected and responses were gathered regarding various aspects of the course, including course contents, learning method, duration, learning outcomes, organizations of activities, networking, technologies and platforms used implementation of acquired learning into practice, and suggestions for improvement. Participants were asked about the suitability of the tools and methodologies used, interview duration, and location. Consequently, all modifications related to processes were undertaken based on the feedback received.

Table 1
Open –ended questions used in the interview.

Q	open-ended questions used in the interview
Q1	Did the TDIs course cover all topics you were expecting?
Q2	Was the educational material presented clearly and comprehensively?
Q3	How did you find the course to navigate?
Q4	Did the organization of the materials and activities provided keep you engaged throughout the program?
Q5	How did you find the platform that was hosting the TDIs course? Were you able to follow the course in this environment?
Q6	Did you find the course flexible at working around your full time or clinical commitments? In what ways did this help you achieve the learning outcomes for the course?
Q7	What do you think was the most useful module on the TDI's course? In what ways was it most useful?
Q8	Did you find any modules not useful? Why did you feel this way?
Q9	Is there any topics that you feel should have been covered that were not? In what modules do you think these should have been included?
Q10	What recommendations would you make in order to improve the quality of the TDI's course?
Q11	What are the weakness and strength of TDIs course? Did you encounter any issues during the TDIs course?
Q12	Can you tell me about any key learning that you acquired throughout the course? In what ways do you intend to implement this in your daily practice?
Q13	Based on your e experience of this online course, would you enroll in another? Can you tell me why?
Q14	Any other comments or reflections that you would like to make about the TDI course?
Q 15	What is your opinion about TDIs course in general? Has this changed throughout your experience of working through this TDI course?

2.2. Hosting platform and course delivery

The Moodle, which is a free and open-source learning management system that can host the electronic contents of TDIs MOOC was utilized and customized “moodle.mdashash.com/” by the principal investigator to provide an open educational environment and access to contents to a large number of participants upon registration. CRISIS tool which was developed by Harden and Laidlaw(1992) and constitutes of seven criteria including *convenience, relevance, individualization, self-assessment, interest, speculation, and systematic* [37], was utilized when designing the TDIs course. Efforts were made to ensure that all participants could access course materials at their convenience, addressing individualization and meeting the needs of both general practitioner and dental specialists. This was achieved through the design of learner-centered, interactive, and clinically relevant materials aimed at promoting self-assessment, stimulating interest, reflection, and critical appraisal of evidence.

A 6-week online MOOC, divided into 4 modules, was designed to cover the etiology of TDIs (one week), diagnosis (two weeks), treatment (two weeks), and prognosis of TDIs (one week). The topics of the TDIs course were systematically planned, and educational materials were displayed gradually, allowing participants to complete each module and take the related quiz to gain access to the next module. The selection and organization of TDIs topics were based on essential competencies of TDIs management [38] as determined by scientific books. Additionally, content was derived from internationally published references, guidelines of the International Association of Dental Traumatology IADT, and textbooks on Dental Traumatology [39,40].

The course was delivered as videos, documents, PowerPoint presentations, publications, and links to international publications, quizzes, and final exams.

The level of commitment was tracked to observe and record the participants' progress and performance in the course, with a report on participation, logs of downloads and course progress being saved. Throughout the course, educational materials were also shared via a WhatsApp group to enhance accessibility for participants.

2.3. Participants and sampling

Previous investigators reported that selecting 10 people and performing in-depth interviews would be sufficient to explore the experience of participants and obtain information about the phenomenon [35]. Others indicated that 2–10 participants would be sufficient to reach saturation [41]. They have explained data saturation as a critical element which means discontinuing data collection and/or analysis when there is no new data, theme, or coding [42–44]. Researchers have addressed the importance of obtaining rich and thick descriptions with good quality and quantity from participants to foster further understanding of the phenomenon [44], rather than increasing the number of participants to obtain data saturation.

In this study, 50 dentists initially registered for the course. However, only 14 out of the 50 participants successfully completed the course. To be eligible, dentists were required to be residents of Syria, have no prior experience with online TDIs course, possess internet access and facilities, complete the TDIs course, and commit to further follow-up. Out of the 50 participants, 14 were excluded due to not meeting the residency requirement, and 22 did not complete the course. Ultimately, 12 out of the 14 eligible agreed to take part in the study.

This purposeful sampling approach, involving multiple interviews with knowledgeable participants willing to describe their experiences related to the phenomenon, enabled the attainment of data saturation after interviewing 10 participants [43–46].

Ethical approval

This study obtained ethical approval from the Ethical Committee of the Faculty of Dentistry, Damascus University, Syria (560/S, 4-5-2020) and the Ethical Committee of the University of Dundee, UK (UOD/SDEN/TPG/2020/016). Syrian dentists registered in the Syrian Dental Syndicate were invited to participate, and informed consent was obtained during the interviews. To address ethical dilemmas, the researcher emphasized voluntary participation and adopted methodologies to shape the roles of participants during recruitment [47]. Mutual respect was emphasized during data collection, allowing participants to share data and participate in the validation of the final report. Confidentiality, data storage and use were managed in accordance with legal issues and guidelines of the British Educational Research Association [48]. The publication of research data was conducted ethically, ensuring accuracy, authorship, and data management. All steps and methodologies used in data collection and analysis were documented for future reference. Educational contents were made freely available to interested dentists, with the course providing benefits to participants without causing harm.

2.4. Setting and data collection

Face-to-face and virtual interviews were arranged between August and December 2021, following the completion of the TDIs course. Face-to-face interviews took place in a private room within the Department of Paediatric Dentistry in the Faculty of Dentistry, Damascus University. The location was chosen due to its status as the largest dental faculty in Syria, enrolling over 1000 dental students annually and providing clinical training in Paediatric Dentistry to postgraduate dental students. The Department also handles several cases of TDIs from surrounding Syrian cities and offers free dental management for such cases. Demographic characteristics, including gender, date of birth, year of graduation, university attended, place of residence, previous experience with online courses, and prior attendance of TDIs courses, were collected at the end of each interview. All audio-recorded interviews had a duration of 30–45 min.

2.5. Data analysis

The thematic analysis, based on previous work [49,50], was inductive and focused on the lived experience of dentists in online education. Data were collected through interviews, and the themes were derived from the analysis in a data-driven manner.

The six-step model, designed by Clarke and Braun (2013) [51] and the modified van Kaam analysis by Moustakas, in 1994, was employed to identify pattern and themes in the data [51,52]. This involved familiarization with data, revision of the entire data set, searching for themes, reviewing the generated themes, naming the themes, and producing a report that reflects the interpretation of the researcher regarding the lived experience of 10 dental participants during their TDIs online course.

The analysis commenced with the collection of data extracted from the interviews, involving repeated listening to the descriptions of dentists about their experiences. The data were then entered into The QSR NVivo 10 software to store, code, and capture significant information [53], search for patterns, organize the data, and categorize them into nodes. The nodes were labelled to create categories, perform an analysis of emerged themes [54], and synthesize a comprehensive and meaningful description of online learning and the experiences of dentists in the TDIs course.

This description was structured into three themes, supported with quotes, to ensure consistency and coherence in the contents and description as recommended [50].

2.6. Ensuring quality and rigour

To enhance the trustworthiness of the research findings, the principal researcher involved the participants in reviewing the transcripts and adding comments to the final narrative. All interviews were recorded, transcribed, and cross-checked with the original recordings. The researcher listened to the recorded interviews multiple times to ensure all relevant information was extracted. Trustworthiness or rigor of qualitative evaluation means confidence in data, its interpretation, and the methods employed to ensure its quality [55]. The study adopted the consolidated criteria for reporting qualitative research developed by Lincoln & Guba, (1985), which includes credibility, dependability, confirmability, and transferability. Credibility was ensured [56,57] through prolonged engagement with participants, asking follow-up questions [58], and sharing data and findings with them. Dependability was established by using the “external audit technique” where the supervisor (RA), assessed the transparency of the study. Conformability [55], was ensured by allowing all transcripts, detailed notes, and analyses to be available for auditing. Transferability was addressed by documenting comprehensive details on the sites, participants, and data collection methods, and by providing a thorough description of all findings. Furthermore, the study followed the Standards for Reporting Qualitative Research (SRQR) to enhance confidence in the quality of the study [59], enabling readers to apply or transfer the results to their own situations, contexts, time, and populations [55, 60].

3. Results

3.1. Demographic characteristics

This study included 10 dentists who completed the TDIs course and participated in this study. The demographic data has indicated that the sample consisted of five males and five females. About five participants were between 25 and 30 years old, four participants were between 30 and 35 years old, and one was over 45 years old. Eight participants graduated from public universities, and two



Fig. 1. Themes emerged and framework.

graduated from private universities. About seven participants live in the urban areas, and three in rural areas.

The majority of participants were specialists or postgraduate students in PD (1 academic member, 2 Ph.D. 3 postgraduate students, and 2 paediatric dentists). Only one general dentist worked in oral health education in the Ministry of Education, while another had a dental specialization in aesthetic dentistry, providing a diverse perspective. Most PD specialists had previous knowledge of TDIs. Some participated in previous online courses related to COVID-19 and five had attended the online TDIs course for the first time, with varying preferences for online versus traditional face-to-face learning.

3.2. Major themes

The thematic analysis of 10 interviews provided a profound description of the lived experience of dentists during their online education about TDIs. About 10 clustered categories were first developed, leading to the emergence of three themes that represent the lived experience. Fig. 1 presents the themes and subthemes that emerged. Then, three main themes emerged from the data (usefulness, challenges, and recommendations).

3.2.1. Theme 1: usefulness

This theme expressed the lived experience of dentists attending TDIs course in which dentists described the usefulness of the course and how they achieved the learning outcomes during their experience with the TDIs online course.

3.2.2. Subtheme 1: overall experience of participants

The majority of participants expressed satisfaction with the overall experience with the TDIs course and its contents and delivery. Other participants who expressed weak points, limitations, and suggestions for improving the TDIs course were categorized into "recommendation theme". Most participants stated that the contents are clear, up-to-date, recent, interesting, and comprehensive, as they found it a good alternative method to fill the gap in TDIs knowledge during the COVID-19 lockdown. Others were satisfied with the flexibility and organization of the course, as they did not need to cancel their commitments. They believed that asynchronous learning enabled them to attend the course and to complete it despite all obstacles and challenges they faced.

"As my time will not be wasted with attendance, when I open the internet, I do not go to Facebook, WhatsApp, or anything, I will go to the course "[Participant 8].

"New information, no pressure, I have learned new things. It filled the gap in my training because of the COVID-19 lockdown since we did not cover all topics "[Participant 3].

3.2.3. Subtheme 2: content

Participants expressed satisfaction with the TDIs course content. Many found the section on the etiology of TDIs, including child abuse, intubation, and accidents particularly useful. Some gained valuable benefits from materials related to the diagnosis, while the majority expressed satisfaction with the resources on TDIs management. A minority of participants were satisfied with the contents regarding the prognosis of TDIs cases. *"It was useful the way it describe how the dentist can play a role in the abused child" [Participant 10].*

"We can tell parents of an injured child about poor prognosis so they will not raise their expectations as they can be prepared for possible failure"[Participant 5].

On the other hand, one participant reported a bad experience with online learning and was in favour of traditional learning. Other participants found insufficiency in covering some topics like endodontics, while others suggested decreasing the course contents:

"I found some repetition in the course which made some topics boring a little bit. If it is traditional, it will be more interactive, and the lecturer will avoid repetition" [Participant 9].

"I found some gaps in endodontics; the course did not extend further in endodontic treatment to cover different types of treatment of pulp necrosis" [Participant 3].

3.2.4. Subtheme 3: target participants (general practitioners- specialists in PD-other specialists)

Participants responded differently according to their experience and specialization. Generally, the majority of participants who were postgraduates or specialists in PD found the TDIs course suitable for a specialist in PD as they could refresh and update their information. Aesthetic Dentist expressed that the course was useful for general dentists, and all dental specializations rather than just PD. One participating general dentist stated that this course would be useful for advanced general practitioners rather than new general practitioners.

"For specialists, it is like" good to know education", they should always refresh their information and get up-to-date guidelines" [Participant 5].

"For the new general practitioner, it is not very useful as they need more practical training but for the advanced practitioner it is as a revision." [Participant 10].

3.2.5. Subtheme 4: implementation

Participants stated that they have already changed their way of thinking and practice after the course, and already implemented their learning in the clinic when applying splinting for a traumatized tooth presented to the clinic. In addition, other participants have added that they will recommend this course to their colleagues and will apply the learned techniques in their future daily practice. Moreover, some participants also commented that they would participate in another course in the future if it would be of similar quality and usefulness:

"I just rethought and changed my thinking about many points and many practices used to do during my practice in clinic "Actually, 5 days after the course I applied a composite splinting that I learned for a child who had injuries [participant 10].

"I already had a TDI case and I went through the materials "[Participant 8].

"The decision I made was based on the TDIs course, so I appreciate that ... now I know what I have to say to parents and what I have to do as a first-line treatment "[Participant 7].

3.2.6. Subtheme 5: virtual environment and organization

Participants described how the delivery, organization, and virtual environment were useful. Only two participants found the virtual environment and platform were not helpful and described the navigation as "confusing". They preferred more graphs and figures with everything embedded in the course and larger size of fonts:

"The stepwise approach of this course from aetiology until the prognosis was very clear and was very comfortable "[Participant 4].

"When I finish any topic I feel that the platform may take me outside and I had to go again and log in again "[Participant 9].

3.2.7. Subtheme 6: exam

Participants were also delighted with the content, timing and duration of the exam. Some participants suggested combining online quizzes and exams with face-to-face exams to assess knowledge and practical skills gained during the course. In contrast, only one participant found that the exam was not comprehensive, as it did not cover specific points.

" ... It was not just a quiz for me, it was a challenge, it is just like a game, and you want to pass a game. It was like a summary, as you collect your information in a specific way and self-assess what you already read" [Participant 2].

"One hundred percent self-assessment the timer was as logical as the participant has to answer all questions without getting information from the internet as they will not find enough time to search for the answers" [Participant 4].

3.2.8. Subtheme 7: time and other commitments

All participants indicated how they decided to select either online or traditional education. They indicated that commitments such as studying, private clinics, and work in the university prevented them from attending traditional or synchronized online courses. Participants added that the flexibility in the course helped them to get the benefit of it as they could download the content in their free time and read whenever she can. One participant added that the course helped her to invest her time and not to waste it on Facebook or social media.

"There is no time to attend the course with all these duties and to commit if it synchronized courses or face-to-face courses"[Participant 10].

"The most beautiful thing ... You do not have any problem with time. I can arrange the time of the course according to my schedule"[Participant 1].

"As I have any free time, I go to my phone, open the platform, and continue in this course as my time will not be wasted with attendance."[Participant 8].

"The online courses give too much freedom that prevents from completing the course sometimes, you become lazy and postpone reading from day to day" [Participant 3].

3.2.9. Theme 2: challenges

This theme relates to the research sub-question "What are the challenges and barriers that dentists experience with TDIs online courses?" which is further subdivided into personal, technical, or country challenges related to the Syrian crisis.

3.2.9.1. Personal challenges. Regarding the personal challenges, one participant who was a general dentist aged 49 years experienced difficulties in reading the small fonts and found the amount of content was huge. Other reported English barriers since some references were delivered in English. Some participants reported having trouble in allocating time for the course and difficulties in completing it as they joined the courses later than their colleagues did and found several difficulties in catching up without collaboration.

"When I just navigate, the fonts and the picture were small I think there was too much information which was difficult to digest" [Participant 10].

"in addition to language problems." [Participant 1].

"I had a delayed start" I am still in the diagnosis section, and people have started attending treatment sections ... I feel that I am still behind and not sure If I will be able to complete this course" [Participant 6].

3.2.9.2. Technical challenges. Some participants experienced technical difficulties with the virtual environment and being familiar with the platform. As previously mentioned, one participant found difficulties in navigation during moving to the third-party software:

"In the beginning, I was not familiar with the environment and then I got used to it and found it very easy." [Participant 1].

"I found that the navigation was confusing you have to hub from software to another one during exploring the resources included" [Participant 10].

"Sometimes, there was a pressure on the platform and difficulties in downloading" [Participant 6].

"Not all the materials were open to download at once, you need to complete the first section and then you can go on further" [Participant 3].

3.2.9.3. Country challenges. All participants considered that technical issues like interruptions in electricity and the internet were the biggest challenges they had to deal with, during their participation in the course. One participant reported that the slow internet would not help improve the course in the future, as it will prevent using more clarifying graphics.

Others had more optimistic views as they acknowledged the fact that the internet and electricity were the biggest challenges for them. However, they could work to solve the problem and find solutions. They indicated that online education would be much better than face-to-face education, which is related to other challenges such as poor transportation and the petrol crisis:

"I spent my day in clinical training in the university and then go back home to see that there is no electricity or internet" [Participant 3].

"Challenges were not related to the course itself, it is related to the country, [lugh ...]we had big problems with the electricity" [Participant 5].

"With the internet and online courses, there perhaps barriers with line speed, surfacing speed perhaps the reason for not seeing more graphics." [Participant 10].

"With the internet, but I deal with the problems" [Participant 8].

"Prefer online course as there are so many obstacles to attend lectures in far areas, we have difficulties in transportations, there are several other problems that prevent us from going outside the house even though the internet is slow" [Participant 6].

In summary, sharing the lives and experiences of 10 participants within the TDIs course indicated that online education could be implemented in Syria despite personal, technical, and country challenges. It also addressed the methods that can be utilized to solve problems and overcome challenges.

3.2.10. Theme 3: recommendations

The "recommendation" theme relates to the research sub-question "What are the recommendations that dentists suggest to improve the quality of the TDI's course?" It has four subthemes including contents, platform, time, and participants.

All participants highlighted the benefits of the TDIs online course in their descriptions. However, they generally suggested some recommendations for further improvement. Some participants suggested enriching the contents and adding topics such as gunshot management, psychological support to traumatized patients, tissue engineering topics, imaging techniques such as CBCT, revascularization, and more information about craniofacial injuries.

Others suggested adding more clinical cases, clinical scenarios, videos, pictures, more presentations with recorded voices, clinical discussions, more clinical reports, online discussions, and sessions for questions and answers. A few participants expressed their desire to see more interactive sessions and exams for sharing experiences and assessing knowledge.

One participant suggested combining online learning with face-to-face clinical training. Participants also believed that providing participants with a certificate of completion at the end of the course would be helpful. They also suggested designing other online courses with different dental topics, to keep updating the course to cover all recent information as well as keeping the contents of the course available as a reference for the future.

Participants shared ideas to enhance the course experience. Suggestions included embedding materials within to avoid external software installation, using larger fonts and graphical interfaces for participant age consideration, incorporating virtual training and artificial intelligence, organizing topics in a circular layout, hosting synchronized sessions, to encourage more dentists to participate in the course:

"The gunshots during the Syrian crisis should be covered. Also, psychological support for people with TDIs and how to deal, assure them and raise their esteem" [Participant 9].

"I recommend if there is a clinical case and clinical scenario, it will be more useful."[Participant 7].

"Providing a certificate will encourage learners. Some would be interested in improving their CV and academic achievement and this will give added value."[Participant 3].

"If we can implement artificial intelligence in TDIs course, for example, in tooth avulsion as an undergraduate dental student can replant the avulsed tooth in its place virtually ... this would be very nice"[Participant 5].

4. Discussion

Various learning methods have been utilized globally to teach about TDIs. However, due to limited resources and current circumstances, implementing these methods in Syria would not be practical. Free open courses such as MOOCs present an excellent opportunity to continue the education of Syrian dentists, making information more accessible, and providing up-to-date information and practical training to a large number of health workers [7]. Despite the existence of a few MOOCs in related fields such as orthodontics [61] and implantology [62], there were no MOOCs focused on improving competencies in TDIs. As a result, a six-week-online course about TDIs was designed to address community needs, aiming to enhance the competencies of dentists and deliver optimal oral healthcare to patients with TDIs. The course was designed to be flexible, learner-centered, interactive, and clinically relevant for both general dentists and specialists.

A descriptive qualitative study which was informed by descriptive phenomenology was undertaken to describe the essence of online learning as lived by dentists who participated in the TDIs course, explore their challenges during their participation, and investigate areas that require improvement.

A **purposive sampling** of 10 dentists who were registered in the Syrian Dental Syndicate was undertaken. Participants are dentists who deal with daily TDIs cases. In addition, they were different in their demographic characteristics, professional career, and area of residence, age, university, and experience with online education. This was very important to investigate different perceptions towards online education in the light of various circumstances, and backgrounds and identify several challenges and difficulties they had to overcome to complete the online course.

While the selection of 10 dentists provides a focused perspective, future studies could benefit from a more diverse participant pool, including dental students and educators, to capture a broader range of experiences and perceptions regarding online dental education.

Inductive thematic analysis was performed, based on the data collected from dentists through interviews about their lived experience during the TDIs course. Three main themes emerged including usefulness, challenges, and recommendations.

4.1. Theme 1: the usefulness of online course

In general, most participants found the TDIs course to be valuable, leading to increased knowledge. They also expressed that the course was comprehensive, up-to-date, and engaging for general practitioners and specialists in PD, allowing them to refresh and update their skills. Participants indicated that the course helped them bridge knowledge gaps caused by education interruptions during the COVID-19 lockdown and the Syrian crisis, enabling them to control their educational needs and engage in self-directed learning.

Another beneficial feature of the TDIs course was its organization and the ability of to save and download educational materials. Participants appreciated its flexibility and convenience, as it allowed them to invest their time in learning instead of spending it on social media. They also reported that they could access course content more efficiently compared to traditional teaching methods, thanks to their technical skills. Online education was deemed very useful for gaining knowledge and understanding, as described by general dentists and dental specialists. This study is similar to previous studies, which implemented technology for learning about TDIs.

Several instructional approaches have been suggested to educate health professionals about TDIs [2], including online learning, mobile learning [63], blended learning, e-learning, simulation-based learning [17], dental platforms [64], 3D printing [17,64] or virtual reality [18]. Researchers have indicated that these modalities can effectively enhance the diagnosis and management skills of medical students [23]. For instance, a research group from Australia addressed the need to improve the knowledge of medical students and doctors about dental trauma [19]. They found that online dental trauma course was a practical approach for medical students, improving their ability to assess and manage TDIs [65,66].

In addition, online courses in restorative dentistry, endodontics, dental trauma, and clinical management of children, were offered through telehealth centres to 220 dentists working in primary health care in Brazil, resulting in improved knowledge about paediatric dentistry including dental trauma [6].

Furthermore, Wimalarathna and co-workers (2021), found that dental students who had access to the Dental Trauma Guide (DTG) web at the University of Peradeniya, Sri Lanka, had better knowledge and obtained better results than those who had conventional learning [67].

Dental institutions have also implemented Information Communication Technology (ICTs), such as smartphone applications, to improve the knowledge of dental students and assist them in the diagnosis and management of TDIs [63]. Mobile technologies have been widely utilized to support clinical dental practice [23] due to their instant availability, even in offline modes [20]. However, the cost of smartphones may pose a barrier for professionals in low-income countries [63] such as Syria.

The use of simulation for learning about dental trauma through using the 3D printed tooth model was found to be effective in enhancing the learning experience and engagement of dental students [17]. However, these tools might not be feasible in countries

with low socioeconomic backgrounds such as Syria due to cost and economic sanctions.

To provide rapid, clear, and simple access to information about TDIs, an interactive Internet web “dentaltraumaguide.org” was designed and supported by the International Association of Dental Traumatology (IADT) to host all new information, instructions, and visualizations about TDIs according to the latest guidelines of the IADT [64].

A comparative study carried out at the University of Peradeniya, Sri Lanka [67], which stated that students who had access to the Dental Trauma Guide (DTG), demonstrated superior knowledge and obtained better results compared to those who received conventional learning about TDIs through lectures, discussions and tutorials [67].

It's worth noting that the DTG, developed by the IADT, requires a subscription and is not freely accessible. The researchers involved in this study were sponsored to undertake the investigation. Consequently, they have suggested sponsoring the DTG, offering it for free or at a low-cost during undergraduate years to enhance diagnosis and management [67]. This initiative aims to improve the competencies of dental students in underserved areas who frequently encounter cases of TDIs in their practice.

Furthermore, the researchers compared 3D printing technology and the platform, recommending this platform for new dental graduates and suggesting the use of 3D printing technology for TDIs training in dental schools [64]. The study reported a significant difference between the two groups in favour of using the online platform [64]. However, the online platform was not easily and freely accessible for dental learners, as it requires payment or a subscription which could pose a challenge for those unable to afford it.

Virtual reality has also been explored in paediatric dentistry as a promising approach for training on TDIs, allowing learners to apply skills learned in a virtual setting to real-life scenarios [18]. For example, the “Simodont® Dental Trainer” a virtual reality-based dental simulation, has been shown to enhance students' manual dexterity and facilitate learning tasks such as pulpotomy and application of stainless steel crowns [17].

These new learning modalities have the potential to enhance the competencies of dental students in TDIs. However, the cost of such tools may hinder their implementation in deprived areas.

When designing online courses, it is important to fully consider the diverse learning needs and styles of Syrian dentists to ensure the inclusivity and applicability of the courses.

In this study, participants who expressed positive views about the TDIs course strongly favored asynchronous sessions due to their flexibility and convenience in terms of time and location. They appreciated the opportunity to learn at their own pace and time. However, some participants expressed dissatisfaction as they prefer the structure of traditional courses, emphasizing the need for more interaction, and effectiveness in achieving the learning outcome. These participants suggested adding new content and advanced techniques to make the course more interactive. Older participants recommended modifications to the virtual environment, such as reducing the amount of information delivered, increasing font size, and adding more visual elements to enhance interactivity and engagement. Thus, designed courses should satisfy individual learners' needs and be inclusive of such diversity. Consideration should be taken for future courses planning.

The TDIs course has been considered an effective learning option for general dentists and other dental specialists due to several factors, including convenience for busy participants, flexibility in terms of time and location, interactivity with colleagues, quantity, and quality of content, accessibility, and a variety of virtual environment tools.

A variety of virtual environment tools should be considered in future planning to promote participants engagement and encourage communication while providing adequate support and guidance. Considering the challenging conditions of delivery, this was hard to be included this time.

Conversely, dentists have described several factors that can lead to a negative experience with TDIs online course, such as lack of interest, unfamiliarity with the learning environment and its tools, late participation, lack of confidence to complete the course, anxiety in being an independent learner and lack of interactivity.

It appears that postgraduate students, accustomed to traditional learning, may not always be familiar with self-directed learning. These students might struggle to manage their educational needs and utilize their time appropriately to achieve the required outcomes, or they may be unable to transition from their traditional instructional comfort zones to online courses. In order to best support these learners, it is important to consider ways to make new technologies interactive to motivate engagement and course satisfaction. Moreover, the online learning environment can be isolating for some learners who rely on interaction and support in order to succeed. Thus, it is imperative that social and psychological support mechanisms are in place to support these learners to succeed within the online environment. These mechanisms of support are something that should be considered in future course development. In addition, further research is needed to assess the types of support that work best within the online learning environment in order to increase confidence and reduce anxiety for learners.

Additionally, the presence of different learning styles among participants may contribute to the preference for aversion to online learning and its flexibility, as previous research has shown that different learning styles are associated with varying abilities and preferences for learning [68].

Previous research undertaken by Ganji and colleagues have shown that the learning styles of Saudi dental students can impact their academic performance and their self-directed learning [69]. Additionally, studies have indicated that students tend to select courses, or educational activities that align with their attitudes and learning styles [70]. Therefore, it is recommended that online courses be designed with a diverse range of resources and tools to engage learners with varying learning styles.

In this study, none of the participants reported issues with using computers or accessing the platform. Instead, they offered suggestions for improving navigation. In contrast, Al-Taweel, and co-workers (2021) found that Iraqi dental students exhibited low to moderate satisfaction with technology-based learning (TBL) due to the majority lacking experience in computer skills [71]. This disparity may represent a significant strength among Syrian dentists, which could be leveraged in the future for the development of other online dental courses.

4.2. Theme 2: challenges

Although the findings of this study provided evidence about the effectiveness and usefulness of online education for dental students, it also indicated that participants have faced several personal, technical and country challenges during their participation.

Personal challenges reported by participants were the inability to read small fonts and condensed content, the presence of other commitments and duties such as exams, difficulty in navigation, and the inability to collaborate with colleagues, who were in different stages in the course.

Several factors such as gender, year of study, area of residence, father's education, family income and previous attendance of online classes, home environment, sociodemographic background, and financial burden were previously reported to have a significant influence on the perception towards online learning among dental students [72]. In addition, eye fatigue and eyestrain because of prolonged use of electronic devices, were also reported by dental students at the International Islamic University in Malaysia [72].

A recent review has also indicated that boring online lectures, poor online content, and lack of interaction and support could be also important challenges of online education during the COVID-19 pandemic [73].

In this study, some participants also reported challenges with English language, and had difficulty understanding the English references provided. As a result, it is recommended that future efforts focus on addressing this issue by translating the references and recent guidelines into Arabic.

Additionally, an effective approach that can be recommended to mitigate technical and language challenges is similar to approach adopted by Syrian medical researchers at the onset of the Syrian crisis in 2012 [74], who endeavoured to see solutions for educational challenges related to Syrian crisis. Researchers collaborated with Osmosis, an online medical learning platform, to translate all disease-oriented and clinical-reasoning videos available into the local language, thereby granting free access to various medical Open Educational Resources (OERs). However, it is evident that online courses focusing to common health problems are still limited in developing countries and vulnerable areas, despite ongoing improvement and increased availability.

Previous studies have indicated that linguistic and cultural barriers can be some of the barriers that negatively affect the participation rate of health professionals from developing countries in MOOCs. Researchers found that translating online platforms into the native language of students would be effective for attracting students from developing countries and will fulfill the unmet needs of health professionals in developing countries [75,76]. The present study does not intend to explore solutions for making online courses more accessible to non-English speaking participants. However, translating online platforms into the students' native language and developing online courses designed by native speakers that tackle local health needs might be an effective solution. Future research could investigate the impact of language on learning outcomes and explore the development of multilingual educational resources.

The lack of closed communication was also reported as a challenge that faced participants in this study. This might be attributed to the lack of interactive sessions that enable eye contact and sharing opinions, as it was very difficult to create these sessions into Moodle. Rather, participants used WhatsApp for communication, and mobile phones for reading course content. Disseminating educational materials via WhatsApp has significantly boosted engagement levels and facilitated the completion of the course, ultimately enhancing the learning experience.

These findings are consistent with other studies which reported challenges related to nonverbal communication and stated that eye contact, gestures, and posture, are major parts of all communication that motivate participants to complete the course [73].

The ongoing Syrian crisis, in its eleventh year, has affected the infrastructure of the country, with severe damage to education, health, and business. People are struggling to meet most basic needs due to the economic status of people and the drop of more than 75 percent of the value of the Syrian currency and sanctions.

Electricity generation, because of the short supply of fuel and gas, decreased to 25 percent compared to the period before the crisis and has become a luxury as it often lasts for an hour or less during the day, which many families do not experience. However, the findings of the present qualitative study highlighted the value of online education despite the challenges faced during the Syrian crisis [75]. Participants, who were located in rural areas outside the capital, stated that the course has helped them to update their knowledge and skills in their homes. They could find solutions for the problems related to internet connection and heavy workload by downloading the contents, when available, and reading them in the car on the way to the university.

They preferred online education and faced the related internet and electricity difficulties rather than facing transportation, petrol problems, and insecurity associated with face-to-face education during the crisis.

Previous studies have addressed the presence of stress and feelings of frustration among students from rural areas as a result of poor internet connections, inability to engage in e-learning classes, and poor responses from governments [77,78]. It was also indicated that internet bandwidth and connection failure are the most important structural challenges of e-learning during the COVID-19 pandemic in developing countries and in some developed countries [73].

Similarly, researchers in developing countries, have also reported some technical challenges such as low internet access, lack of requisite digital equipment and accessories, high cost of efficient gadgets, and physical problems like headache and eye strain [72,73].

Participants reported their approaches and strategies to complete the online course and overcome all obstacles.

Similarly, several strategies and solutions were reported by other researchers to overcome poor internet connection and consequently make MOOCs more accessible such as locating access hubs at central locations and creating platforms that can provide educational content offline [72].

Some researchers suggested a collaboration between the university and stakeholders to provide access to main online learning applications to reduce costs and increase acceptability [76,77]. Others also suggested providing copies of educational materials to solve problems related to gadgets and electricity [77,78].

In summary, online education can be implemented in Syria despite the personal, technical and country challenges. The experiences described by participants highlighted the obstacles and challenges that the Syrian learner may face during the.

TDIs course. It also addressed the methods that can be utilized to solve problems and overcome challenges, which should be considered in designing future MOOCs to achieve better outcomes.

4.3. Theme 3: recommendations

The overall satisfaction level with TDIs online learning was found to be high despite the challenges and barriers faced. However, several suggestions and recommendations were offered by participants to improve the quality of information, skills, commitments and interaction. For instance, some participants suggested enriching the content and adding some missing topics. Others suggested improving the platform and the virtual environment of the course by embedding all materials into the learning management system, in which they will not need to install third-party software. In addition, some participants suggested more graphical interfaces and bigger fonts to take into consideration the age of participants.

To improve the practical skills of dentists, all participants noted the need for adding more clinical case scenarios, videos, and pictures, more presentations with recorded voices, clinical discussions, reports that are more clinical, virtual training session, and implementation of artificial intelligence.

Previous work undertaken by Zafar and co-workers (2020) suggested integration of virtual simulation technologies and computer-based models to improve the manual dexterity of students and facilitate their learning about paediatric dentistry through stimulation [17,18]. In addition, all participants addressed the need for improving peer interaction and interaction with a teacher through adding online discussion sessions and boards or combining online learning with face-to-face clinical training to further engage participants in the learning process and make the online course more successful.

It seemed that interaction is crucial for appropriate learning and successful course. Singer (2021) in his four developed strategies, aimed at delivering successful online dental education, suggested prioritizing interaction, creating engaging experiences, offering flexibility, and understanding student behaviour [11]. In recent research, Soundariya and Deepika (2022) have identified the key tips for providing effective and interactive online medical lectures during the pandemic. These include the need for accepting challenges, being ready to manage technical issues having alternatives, and selecting the right platform that can meet the requirements. In addition, the authors addressed the need for effective communication to increase the preparedness of participants and to design interactive sessions through interactive software, MCQ questions, quizzes, games, clinical scenarios, chat boxes, breakout rooms, and interactive whiteboard. Moreover, they have suggested enhancing student engagement by sharing the objective of the sessions with students, incorporating visual images in presentations and acknowledging student response through giving digital badges as a token of appreciation [79].

Similarly, in this study, participants also suggested providing participants with certificate of completion at the end of the course, as they believed that this would be very effective in enhancing motivation, and in increasing commitments.

The findings of this study and recommendations offered by participants would enable all course designers and instructors to improve contents and create a better educational environment. It will improve the delivery of online education in conflict areas such as in Syria and will stop the disruption of education in the World during crisis.

Undertaking this research, during the time of the COVID-19 pandemic and during Syrian crisis, has been an opportunity. Given the ongoing health and war crisis in Syria, this research has provided further understanding about the challenges, solutions, and enablers of online dental learning in a country with minimal technical capability.

Despite the effort made to implement technology-based learning to improve the knowledge, skills and attitude of health professionals about TDIs [17,23,69,71]. There is no online course about TDIs that has been designed for dental health professional, who is practising in complex and fragile contexts. One of the current study's strengths is that it reports factors affecting participant satisfaction with online courses. Participants can be satisfied with online courses and they can improve their learning if factors that have been identified, are appropriately considered. Therefore, it can be suggested that online dental education can be implemented successfully and this study would encourage the design and implementation of similar future online courses for participants with similar circumstances.

While participants were invited from several Syrian dental specializations, communities, and universities, only 14 out of 50 participants completed the course. This in turn provided insights into the limited motivation of the Syrian dental community to participate into online courses. Several reasons for the low enrolment in the course and participation in the study can be attributed to the COVID-19 pandemic and the Syrian crisis. This might be considered as a limitation. Nevertheless, it has offered enough information to reach a conclusion and to be considered as a baseline for future work. However, further evaluation, which includes deductive analysis in light of recommendations offered by participants, is still required. In addition, it is interesting to investigate the usefulness of TDIs online courses quantitatively and including different dental specializations.

The study's findings have significant implications for future practice and research, particularly in the context of the pandemic and the Syrian crisis. All Syrian dentists can benefit from online courses.

According to research findings, and insights from Syrian dentists, it is feasible to apply the proposed enhancements to the content and delivery of future online courses, regardless of the socioeconomic situation. These suggestions encompass recognizing different learning styles, providing a variety of educational contents, incorporating more real-world case studies, virtual training sessions, enhancements in user navigation, and developing effective communication plan with participants.

For technical and internet challenges, pre recorded lectures, podcasts, something to be downloadable and used later without internet/asynchronous activities can be recommended.

Thus, future research should explore more effective teaching models, while focusing on blended online and offline educational approaches to improve dentist's lifelong learning. Additionally, a comparative analysis with traditional face-to-face learning outcomes could provide additional insights into the efficacy of online learning platforms in enhancing the learning about dental trauma care. There is also a room for improvement in instructional design and the development of high-quality learning resources. Further studies, which focus on evaluating instructional effectiveness and identifying factors, that contribute to both faculty and student satisfaction are recommended.

5. Conclusion

The research has contributed to our understanding of online dental education in Syria. Despite the challenges, the TDIs course successfully enhanced knowledge and understanding among general and specialist participants. Positive attitudes towards the course were influenced by factors such as flexibility in time and location, interactivity with colleagues, quantity and quality of content, and the variety of virtual environment tools. Conversely, negative attitudes were linked to factors like lack of interest, unfamiliarity with the learning environment and tools, late participation, lack of confidence, anxiety about independent learning and insufficient interactivity and engagement tools. It is essential to address constraints, language barriers, diverse learning styles and various learning needs during the design and delivery of online courses. No single approach is comprehensive and it is hoped that future directions will further improve our understanding and identify effective online and offline modalities that enable Syrian dentists to overcome barriers and enhance their lifelong learning.

Ethics statement

This study obtained ethical approval from the Ethical Committee of the Faculty of Dentistry, Damascus University, Syria (560/S, 4-5-2020) and the Ethical Committee of the University of Dundee, UK (UOD/SDEN/TPG/2020/016).

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Availability of data and materials

The data can be available upon request from the corresponding author.

CRedit authorship contribution statement

Mayssoon Dashash: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Conceptualization. **Rania Alkhadragy:** Writing – review & editing, Validation, Supervision. **Gillian M. Scanlan:** Writing – review & editing, Validation, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

ADEA	The American Dental Education Association
ADEE	The Association of Dental Education in Europe
BERA	British Educational Research Association
CRISIS	Convenience, Relevance, Individualization, Self-assessment, Interest, Speculation, and Systematic
E-Learning	Electronic Learning
ICT	Information Communication Technology
MOOCs	Massive Open Online Courses
MOODLE	Modular Object-Oriented Dynamic Learning Environment
SRQR	Standards for Reporting Qualitative Research
PD	Paediatric Dentistry
TDIs	Traumatic Dental Injuries

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