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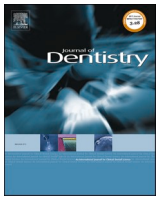

Reviewing assessment strategies in European dental schools

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ABSTRACT

Objectives: Effectively assessing dental students' knowledge and skills is an important part of their education. Assessment techniques available to teachers, have become more diverse as new technologies are introduced. This study aimed to investigate what dental educators thought about current and future assessment techniques.
Methods: This was a mixed method study; quantitative data being collected at an annual dental educators' conference, via on-screen questions requesting: i) demographic information; ii) type of student assessment currently used; iii) impact of Covid-19 on student assessment, and iv) future perceptions of assessment. Questions were posed in real time using the 'Vevox' platform. Descriptive statistical analysis was employed. Qualitative data were collected on 'post-its' and analysed thematically.
Results: 101 participants attended the study. 59.1% ($n = 60$) had >11 years' experience. 64% ($n = 55$) considered their summative and formative assessments were effective in developing student learning. Few participants reported students' involvement in creating their own assessments ($n = 8$; 9.75%). 41.68% ($n = 36$) participants agreed it was a good idea for students to be involved in developing assessments, but only 9.75% ($n = 8$) reported it was already happening. Qualitative data indicated a reluctance to wholeheartedly embrace technology (including AI) when planning assessments. Most participants were not in favour of Co-creation or the use of some technologies.
Conclusions: Participants, reflected on the challenges of adopting a universal assessment approach. Dental educators should be given the institutional support and autonomy to implement the best assessment methods for their students. Most of this cohort of experienced dental educators reported that assessments facilitated student learning.
Clinical significance: The role of assessment for dental students is essential as dental educators must ensure that dental students graduate with appropriate knowledge and technical skills to be safe when in general dental practice. The use of various assessment techniques needs to reflect the diversity of skills the students need to demonstrate.

1. Introduction

Effectively assessing students' knowledge and skills is an important part of education as it enables teachers to evaluate their students' understanding and awareness of specific subject areas; and to smooth the way for students to learn throughout life both in formal and informal settings [1]. There are many different modes of assessment, depending on the knowledge and skills being tested.

The use of virtual reality (VR) and augmented reality (AR) within tablet-based applications were found to be effective in teaching and assessing medical students in the subject of anatomy [2]. The use of traditional essays was deemed to be a favourable mode of assessment [3], and was considered as "indicative of deep strategic understanding….. a valid assessment tool in many dental schools" [4]. The combined use of Multiple-Choice Questions (MCQ) with essays was considered to be a valuable tool to effectively assess a broad spectrum of knowledge [4]. Objective Structured Clinical Examination (OSCE) assessments have also been comprehensively and successfully utilised in medical and dental education to measure clinical competence [5]. Additionally, in the context of postgraduate dental education, OSCE

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assessments have motivated and reassured students to seek further knowledge through Continuing Professional Development (CPD) [6].

From the students' perspective, assessments drive standards upwards, ensure competence, allow opportunities to provide feedback, and guide ongoing learning [7]. However, dental students throughout their dental education have varying perceptions of the effectiveness of the assessment methodologies adopted by their teachers; combined with a common desire for more feedback on their performance to guide future learning [7].

The growth in co-creation has enabled dental students to contribute to the design of their assessment strategies. Co-creation can enhance the student/teacher relationship, empowering students to take greater ownership of their curriculum and assessment methodologies [8]. However, amongst medical students, this partnership has also been critically viewed, "as input information to the educational design process rather than inviting them [the students] to the more pronounced role as partners" [9].

Whilst the use of Artificial Intelligence (AI) in medical and dental student assessment has been negatively perceived by some teachers, there is evidence demonstrating the benefits of its use in surgical training [10]. The assimilation of AI into dental education has the potential to revolutionise the way students learn about oral health sciences. Natural language processing tools driven by AI technology, such as ChatGPT™, can serve as virtual teaching assistants, providing students with detailed and relevant information and perhaps eventually interactive simulations. AI has the potential to increase medical student engagement and enhance their learning [11], although further research is needed to substantiate this. The challenges and limitations of AI include consideration of ethical issues and potentially deleterious effects [12]. It is crucial for dental and health care educators to keep pace with technological advances and their impact on curriculum design, assessment strategies, and teaching methods.

The aim of this study was to investigate the perceptions of a cohort of European dental educators with respect to dental student assessment strategies.

2. Methods

This was a mixed method study incorporating both quantitative and qualitative data generated by dental educators attending a keynote Special Interest Group Workshop (SIG), which reviewed dental student assessment strategies at a recent European dental educators' conference. Ethical approval for this study was granted by UCL Research Ethics Committee (6552/014).

The workshop participants were asked to respond to a series of on-screen questions about their undergraduate and postgraduate dental student assessment strategies, including: i) demographic information; ii) the type of student assessment currently in use; iii) the impact of Covid-19 on student assessment, and iv) future perceptions of student assessment. The questions were posed in real time using the 'Vevox' platform (an interactive AI driven live polling tool) and participants responded using their mobile phones. This technique facilitated data collection allowing the participants to immediately see their collective responses and allowed subsequent discussion of the results. In addition, the participants were invited to give further written comment on each question using 'post-it' notes, which were collected at the end of the workshop.

Analysis of the quantitative data was undertaken using descriptive statistics. A thematic approach was adopted to analyse the qualitative data, following collation and presentation within a Framework™ spreadsheet.

3. Results

Although an overall total of 101 dental educators participated in the workshop, it was clear that not all participants responded to every question. The number of non-respondents for some questions is indicated below, where appropriate.

3.1. Quantitative results

Over half of the participants reported being involved in dental education for 11 years or more ($n = 60$; 59.1%), whilst approximately one in four reported up to five years' experience (Fig. 1). Almost half of the participants taught only undergraduate students ($n = 48$, 47.7%). 13 (12.5%) were heads of department, although it was unclear whether they also had a teaching role. When asked whether participants would still be involved in teaching dental students in 5 years' time, two thirds indicated affirmatively ($n = 66$; 65.4%) (Fig 2).

Approximately two thirds of the participants considered that the methods of assessment they currently used, for both a summative and formative purposes, were effective in facilitating student learning ($n = 64$; 63.4%) (Fig 3).

When asked if the participants thought the methods of summative assessment in their schools were effective in testing students' knowledge and competency, 55 (63.9%) considered they were effective. A significant number of participants had some reservations ($n = 31$; 36%) about the effectiveness of summative assessments. Very similar numbers were reported when the participants were asked about the effectiveness of formative assessments on facilitating student learning (Effective $n = 55$; 63.3%; Reservations $n = 30$; 34.5%). 14 participants did not respond to these questions (Fig 3).

When asked whether students were currently involved in designing assessments, very few participants reported affirmatively ($n = 8$; 9.75%) (Fig 4). Participants were further asked whether engaging with students to design assessments was a good thing; $n = 36$ (41.68%) agreed that it was a good idea, (Fig 5), whereas only $n = 8$ (9.75%) reported that their students were already involved in designing assessments (Fig 4). 15 participants did not respond to these questions.

Almost half ($n = 40$; 49.38%) of participants expressed concern about the use of AI in the assessment of dental students (Fig. 6). 20 participants did not respond to this question.

When asked about the impact of the Covid-19 pandemic on assessment strategy, 77 (76%) reported that they had made changes to their assessments and 82 (81%) reported that they had returned to their original assessment approaches. A small minority indicated that they had maintained their Covid-19 influenced assessment approaches, mainly in the form of online methods, after the pandemic was over.

3.2. Qualitative results

Written comments generated by participants on 'Post-it' notes and in open questions were collated and analysed thematically (Table 1).

Theme 1. Methods of assessment

The use of different modes of assessment were reported by the

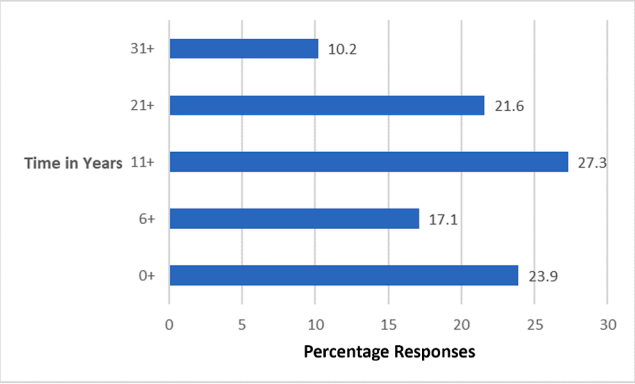

Fig. 1. The number of years participants have been involved in teaching.

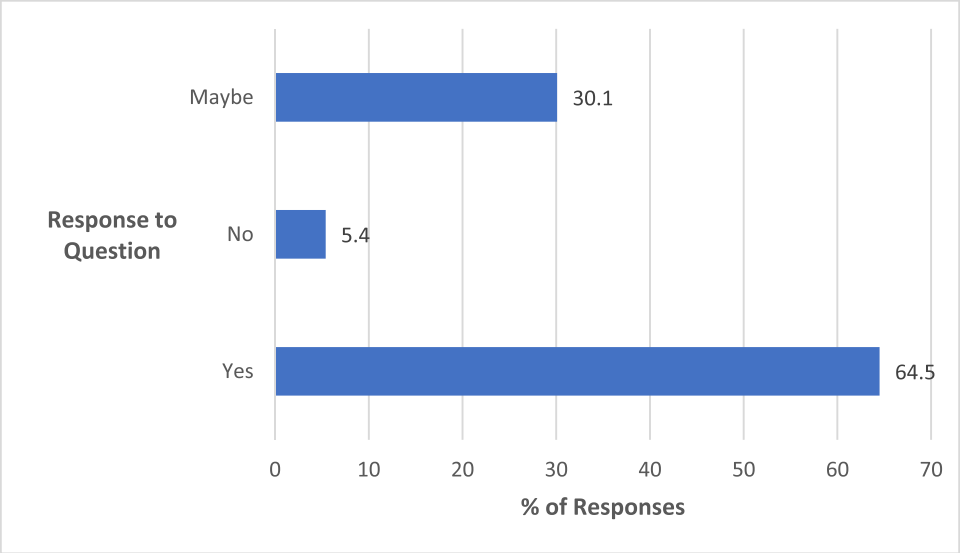

Fig. 2. Whether participants will still be involved in dental education in 5 years' time.

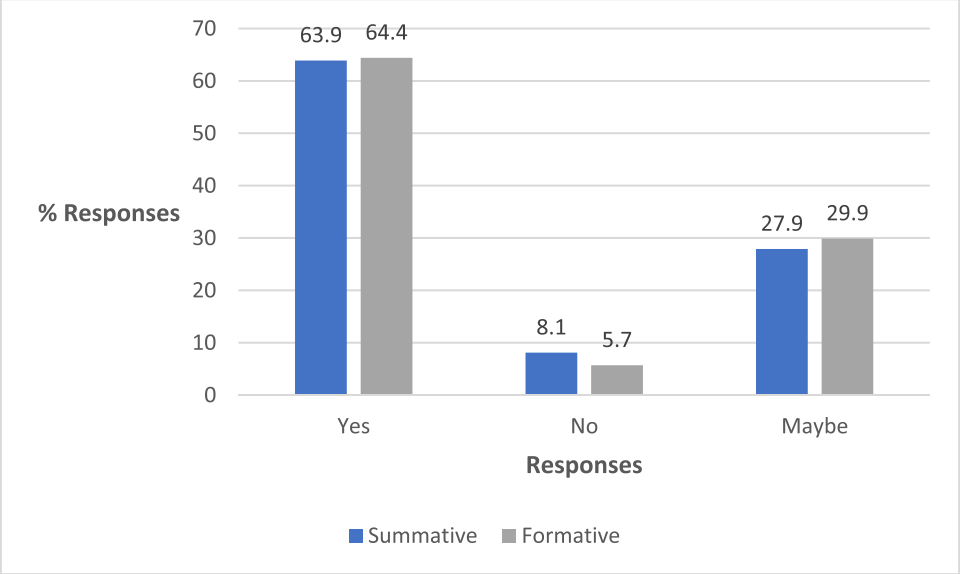

Fig. 3. Whether the method of assessment used is effective in facilitating student learning.

participants, who indicated a need for a standardised, holistic and a targeted approach to assessment.

"[Standardised] Useful for a large group of students"

"MCQs SBA easy and we can assess, write objectively the competencies & it's the same

assessment for all students"

"[Holistic] Clinical competences: to assess understanding, to assure satisfactory level of patient care before graduation"

"OSCE: phase of execution allows multiple assessments on the same day"

"ESA: Students are able to apply their knowledge and this clearly distinguishes different levels of student knowledge and competence".

"[Specific] Vivas-opportunity to bring out students' knowledge"

"Written exam for students' to show their theoretical knowledge"

Higher cognitive learning"

"Methods of summative assessment arevarious and fitting for purpose"

Theme 2. Feedback:

Feedback from teachers to students clearly has a significant role to play following an assessment. It can be delivered in several ways and different dental educators will have varying ideas as to what constitutes good feedback.

"Immediate feedback to students with a chance for discussion with students"

"Allows for bidirectional feedback contemporaneously (chairside formative)"

"Prefer to speak/verbalise with students rational for an answer"

"The feedback is essential to the students and they accept this assessment method

& learn with it"

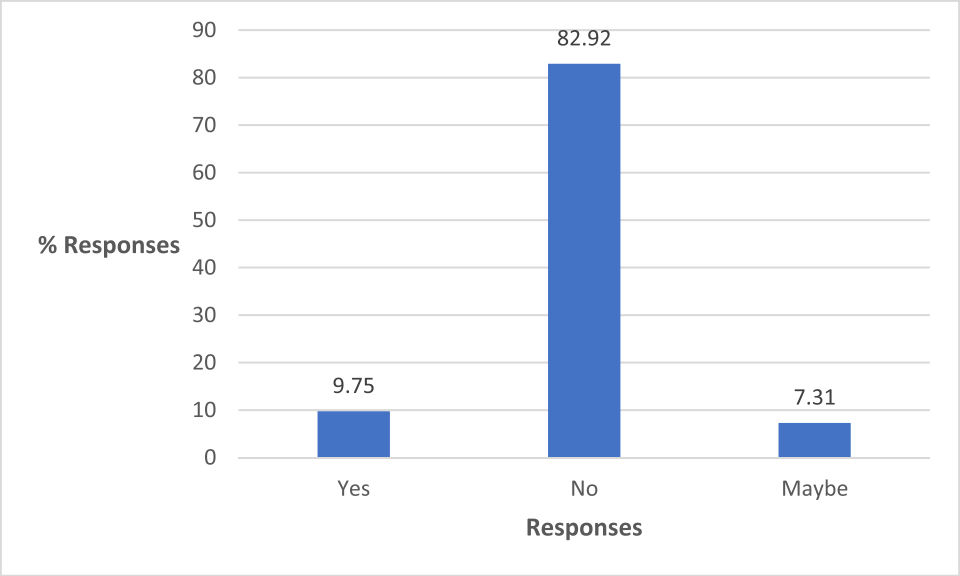

Fig. 4. Whether students are involved in Co-Creation.

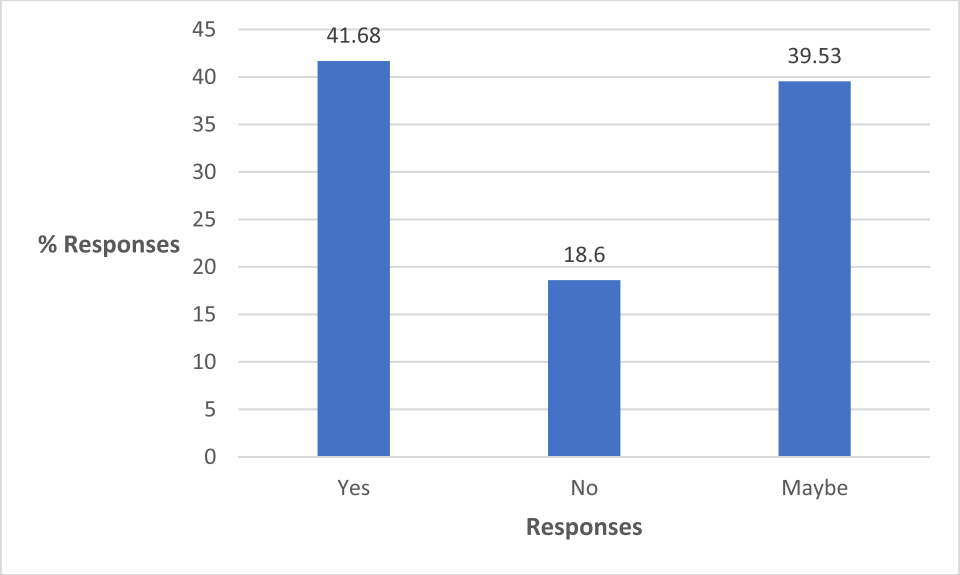

Fig. 5. Whether engaging students to design assessments is a good idea.

"Provide instant feedback, invite discussion on the matter, initiating reflection by the student"

Theme 3. Student engagement:

The degree of student engagement was enhanced following the delivery of post assessment feedback.

"Good students engage and do well. Poor students: poorly engaged- they need most [help]. Don't take [feedback] seriously"

"Students only use feedback for assessment when they are marked. If you do not grade tests, students do not like them"

"Formative works for good students who benchmark their progress, but weaker students perform for the assessment but do not maintain the clinical skills; some students do not take it seriously as it does not count to overall grade"

"Students do not engage well with formative assessment. They put less effort and weighting behind [these] assessments"

Theme 4. Co-creation:

Participants had mixed thoughts about the use of co-creation when assessing student knowledge, with equal number expressing positive or negative views.

Examples of negative thoughts about co-creation were:

"Have tried this but the consistent response from students was wanting a copy of the questions bank in advance which isn't feasible"

"Maybe. It is an interesting idea but wonder how much students input would improve assessment"

"Students would make the assessment easier; they don't know what to assess"

On the other hand, some participants looked upon co-creation

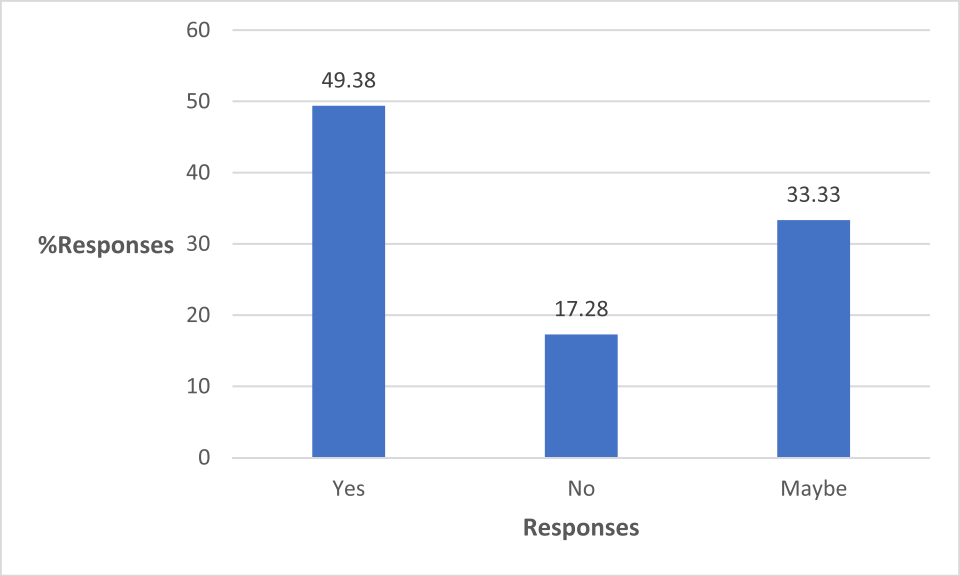

Fig. 6. Whether participants were concerned about the use of AI for dental student assessment.

Table 1
Thematic analysis.

Theme	Sub-theme	Sub-sub-theme
1. Methods of assessment	• Positive • Negative • Style • Post Covid-19	• OSCE, MCQ, Written exam • More summative • None
2. Feedback	• Feedback for improvement	
3. Student engagement	• Positive • Negative	
4. Co-creation	• Positive • Negative	
5. Technology	• Online assessment	• Examsoft™ • Liftupp™ • Canvas™ • Haptics • None

positively:

"We should develop assessments to involve students"

"Students can outline accessibility needs of equality & diversity, can be addressed rather than sticking to the outdated methods"

"It is important to get student's perspective, how they are evaluated and get their opinion"

"Helps in grading. Keeps track of student assessments and more for formative"'

Theme 5. Technology:

Although there were several examples of software packages used to facilitate student assessment and feedback, including, 'ExamsoftTM', 'LiftuppTM', 'BlackboardTM' and 'CanvasTM', most participants expressed concern about the use of technology, particularly AI, in relation to students generating plagiarised work.

"Students using it [technology] instead of writing their own essay"

"Maybe. If used in the wrong way students may take shortcuts and not learn for themselves"

"Yes. Thoughtless reliance on AI will impede the student's natural intelligence"

"For example Chat GPT can form a nice & tidy essay for e.g. canine eruption but filled with factual

errors. Students need to have knowledge to spot disinformation, otherwise AI can be a game

changer in good and bad [ways]"

"Online exams are easy to execute even though there is a risk of cheating. I think nowadays it is important to pick information that is accurate rather than memorising everything"

4. Discussion

Delegates attending this annual European education conference workshop were a representative group of predominantly experienced dental educators and leaders whose opinions reflected the perceptions and thoughts of dental educators in Europe. Workshop participants were invited to complete a live online, AI driven polling tool (Vevox) to simultaneously collect quantitative and qualitative anonymised data [13]. Feedback data were immediately displayed in response to each question for the audience. This approach encouraged the contemporaneous and spontaneous thoughts of the audience and maintained their attention throughout the workshop, generating rich qualitative and quantitative data.

Although two thirds of the dental educators reported that they would still be teaching dental students in 5 years' time, a concerning one third indicated otherwise. Such a potential loss of teaching expertise and experience would be a concern for dental schools and the dental profession, particularly when the recruitment of younger teachers is currently challenging [14,15,16]. The reasons for this worrying trend are complex and may include a loss of interest in teaching, changes in career direction, demotivation and a lack of organisational support [17]. This phenomenon is also common in other areas of higher education, and in particular Jaaskela, Hakkinen, Rasku-Puttonen (2017) [18] reported teacher concerns due to a lack of institutional support which can mitigate the continuing impact of technology on pedagogic developments. This could potentially lead to disillusioned and de-motivated teachers, further contributing to them leaving dental education, and thereby adversely impacting on the education of the future dental workforce.

The concept of co-creation [19] polarised the dental educators in this study. Whilst many participants expressed approval and positive aspects

of co-creation, others disagreed, citing this to be risky or unproven. In truth though, the literature illustrates that encouraging learners to be involved in the design of teaching and learning can enhance the quality of education, by addressing the perspectives of different stakeholders and stimulating teachers' academic development [19]. According to Cook-Sather et al. (2014) [20], co-creation "motivates learners by enhancing their feelings of engagement, ownership, and empowerment". Improvements in educational practice also require delivering meaningful feedback to the educators [21]. It is still common practice for learners to provide feedback to teachers through anonymous written surveys at many higher education institutions [21], which will facilitate equitable and effective practice of co-creation in dental education.

The dental educators in this study expressed concerns about the consequences of using AI in the assessment of dental students. Although Arthur C Clarke envisaged "Any teacher who can be replaced by a machine should be!" [22], the fact remains that dental educators still prevail in the early 21st century, delivering essential dental education using traditional lectures, seminars, clinical skills laboratories and patient clinics. Masters (2019) [23] speculated that, "AI will impact directly on every aspect of our lives, and there is no reason to believe that medicine and medical education will be spared", and by necessary logical extension, dentistry should be no different.

Although AI has been a feature of higher education for 30 years [24], it remains unclear how educators in general can take best pedagogic advantage of it. Dental education is currently struggling with similar issues [25]. There will inevitably be a need to update dental school curricula "as advanced deep-learning approaches take over the clinical areas of dentistry and reshape diagnostics, treatment planning, management, and telemedicine screening" [25]. Continued research and evaluation are necessary to ensure the optimal integration of AI-based learning tools in dental education.

The apparent reluctance by some dental educators to change their current assessment practices in this study reflects their perceptions that existing methods of assessing dental students have been successful, and therefore there is no need for change. The use of technology in the assessment of dental students can lead to a greater degree of examiner consistency, rather than a dependence on traditional rubric-based assessment methods [26]. Miyazono et al. (2019) [26], also reported that "the use of the PrepCheck™ software program greatly improved intra-and inter-grader agreement during grading in a student simulation laboratory". The reluctance to change and to adopt technology in higher education could well be because teachers do not identify themselves with the classic teacher-centred/student-centred philosophies [26].

It has also been reported that "teachers are aware implicitly, if not explicitly, that their own motives and curriculum decisions are complex" [27]. Laurillard (2013) [28] stated that in higher education, the introduction of learning technologies and by association their role in student assessment, should be based upon the presence of adequate supportive evidence before they are introduced. Laurillard (2013) [28] also argued that using technology in teaching changes the nature of learning, and therefore a more innovative approach to assessment may be adopted rather than the ubiquitously used multiple-choice questions. This approach is particularly relevant in the assessment of dental students in clinical scenarios because it replicates a more problem-based approach akin to patient treatment. Digital technology can also allow dental students to learn how to self-critique and thereby self-assess competently, as part of their overall assessment and professional development [29].

The mixed methods approach adopted in this study allowed for triangulation of the results and enhanced the analysis of the data [30]. The thematic analysis revealed five distinct themes, which provided in-depth ideas, perceptions, and concepts relevant to clinical dental practice [31]. The contrasting views expressed by dental educators in this study, emphasised the value of qualitative data and added to the diversity of the findings [32].

4.1. Limitations

Although a significant proportion of conference delegates attended the workshop, the 101 dental educators who contributed to this study may not necessarily represent all dental educators in Europe.

Although the AI driven online polling tool used in this study proved to be effective and efficient, it was not possible to discriminate between those who did not wish to respond to some of the questions, those who perhaps did not have sufficient time to respond or those participants who might have had intermittent Wi-Fi connection issues.

In addition, this study did not consider the possible impact of potential cultural differences amongst European dental educators as a potential confounding factor when assessing dental students.

5. Conclusions

The use of an AI driven polling tool has effectively generated rich mixed data. Although challenging for many teachers, the increased use of modern technologies in student assessment needs to be further embraced throughout Europe and beyond. However, traditional assessment methods are still widely in use amongst the study participants, reflecting the challenges of adopting a universal assessment approach. Dental educators should be given the institutional support and autonomy to implement the best assessment methods for their students. Most of this cohort of experienced dental educators reported that assessments facilitated student learning.

CRediT authorship contribution statement

C. Louca: Conceptualization, Data curation, Investigation, Methodology, Resources, Visualization, Writing – original draft. **P. Fine:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft. **I. Tonni:** Data curation, Formal analysis, Investigation, Resources. **A. Leung:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Writing – original draft.

Declaration of competing interest

None of the authors have any conflict of interest, during the data collection, preparation, writing and production of this manuscript. No fees were involved in this research project.

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