

Changing Landscapes in Higher Dental Education

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Abstract

Skills and development: The way undergraduate dental students have been taught and their methods of learning have evolved over decades. **Education methods and needs:** Perhaps the most rapid and exponential changes have been in the last two decades with the introduction and utilisation of digital media platforms and social media capabilities. Academic and clinical aspects of dentistry are divided within the curriculum, but less consideration and logic are exercised when focusing on the methods of delivering education and the students' own preferences, capabilities and adaptation towards learning. **Technology and dental education and what we believe:** In higher education, closed questionnaires were provided to both dental students (50) and teachers (10) relating to delivery methods and their beliefs regarding education techniques available. Opinions regarding these methods still differ amongst dental teachers and students, with an affinity from the dental students towards the use of emerging technology available in dentistry. However, the questionnaires revealed both groups preferred education via direct care on patients more than any other method of education. **Conclusion:** The literature would indicate some progress made within the dental profession relating to the use of digital media, advanced technology and improved dental software, however, this has not yet been transferred to dental higher education, despite an accessible and obvious availability of modern resources and techniques.

Keywords: dental, education, dental education, higher dental education, dental education change

1. Clinical Relevance

The possible methods of delivering and receiving dental education have undergone rapid evolution in the past decades. The merits and applicability of some of the new techniques have yet to be evaluated fully, but should the profession be readier to accept some of these revolutionary changes and tailor them into the curriculum? Or even to participate in their appraisal?

2. Objectives

- 1) To enable the reader to become familiar with the different education methods and techniques that are now available within the profession and undergraduate/postgraduate study
- 2) To help the reader identify the evolution of delivering teaching and recipient learning, the availability and accessibility of digital media and to discuss their benefits
- 3) Describing how and why digital media platforms (combined with the features of social media) cannot replace some of the physical and practical aspects that have formed the basis of dental educational development of skills since dentistry first began

3. Introduction

There are currently 16 U.K. dental schools. All of these are attached to universities. In the academic year of 2019–2020, 809 places are targeted intakes by the government (Health Education Funding, Office for Students, 2019).

Our dental students are subjected to the rigorous demands of a role that involves both the acquisition of academic knowledge and clinical proficiency. These very demanding elements have been taught in various ways throughout the years. Going back into the 1900's, self-proclaimed and self-taught competence was still accepted within some professions, but was replaced with a lengthy period of formal instruction. Later, free-standing schools were established. Now, these have been replaced by university-based dental schools (Evolution of Dental Education, PubMed, 2019). The Further and Higher Education Act in 1992 allowed 35 polytechnics to become universities,

and also enabled the creation of bodies (such as Higher Education Funding Council England—HEFCE), (Armstrong, 2010). Inevitably this also ensured a more accurate standardisation of assessment for students within the universities. Subsequently, this would mean universities ought to emphasise consideration on their teaching techniques and methods to meet the criteria. In the author's experience, these criteria continue to evolve and develop on an annual basis, with new demands of the students within the dentistry course.

4. Skills and Development

The first formal dental education institute was established in 1840, in the United States (Armstrong, 2010). The author's own experience of education within dentistry demarcates the degree into academic knowledge, clinical knowledge and interpersonal skills. The practical aspect of dentistry is a fundamental component of the trade and is absolutely vital to a dentist on a daily basis. It is therefore called upon and demanded continuously within the career of a dental professional. As a result, universities may have focused greatly on the development of this particular component of dental education—both at undergraduate and postgraduate level. In fact, the National Health Service advocated dental outreach programmes in partnership with the universities to improve oral hygiene/health, improving dental education and raising awareness for communities that suffer with poor access to dental care. In return, students will be given the opportunity to practice developing their skills and utilising the opportunity to use their already learned practical dexterities (Dagli & Singh, 2015).

5. Education Methods and Needs

Amongst some of the observations made, the majority of dental tutors are part-time staff members report a lack of critical thinking taught at the chairside (Sweet, Wilson, & Pugsley, 2009). Whether these factors are problems remains unclear. Sweet and co-authors also checked teaching structures and standards across dental schools and found that chairside teaching is performed one to one between student and tutor and that this teaching is carried out by untrained staff. Also, this analysis revealed that peer review was neglected and also staff-student ratios are not ideal. The fundamental heterogeneity that this text will discuss relates to the confirmation that technology and media are being underutilised, but there are potentially exciting new innovations being generated by the universities to facilitate teaching and education. Sweet and co-authors also suggested that mechanical repetition and “teaching by humiliation” were unpopular methods to educate students (Sweet, Wilson, & Pugsley, 2009).

For a number of years, clinical learning is focused upon provision of patient care, with an absence of logical understanding relating to the flourishing of clinical learning that is occurring. This chosen method appears to have been selected without any evidence-based data (Fugill, 2005). During the author's time at university, the emergence of mannikin heads as patient substitutes was a huge technological advancement, which brought a shift in the structural levels of clinical education for the students—inserting the extra level of learning. Students could “practice” their care and treatments on synthetic teeth and gums, before embarking on caring for and treating patients (Elliott, 2019). In theory, the insertion of this extra “level” should also assist the teacher—providing a safer route of learning for the student. It also gives the added benefit of being able to directly supervise students practically on the synthetic teeth and gums before caring for live patients. This would also include specific skills and techniques. The benefit of working on the mannikins also means that there are 32 teeth available to work on. The implication of this is that some treatments and procedures can be “practised” more than once. In the author's own experience, there was aided comfort that there were opportunities to prepare for clinical care on patients via this particular approach and then look to train further on specific treatments which may have presented specific difficulties when performed on patients.

The use of the mannikins is still popular and has evolved in some dental school universities, with some institutes using live video to enable dental teachers to demonstrate particular aspects of patient care (Alqahtani, Al-Jewair, Al-Moammar, Albarakati, & Alkofide, 2015). Again, it is in the author's experience that this method provides great benefits to dental teaching- adding another level to the learning process for students. Dental students are able to watch a particular procedure be carried out in a synthetic environment on a dental mannikin, by a teacher, before attempting it themselves (on the dental mannikin also). Following on from this, dental students will be able then to carry out the procedure on patients.

The emergence of social media over recent years, and also the existence of live video (as described above) has led to the consideration of how this can further be developed. Can dental students utilise video technology whilst away from the university setting (i.e., whilst in their selected accommodation)? This was a question that has been answered comprehensively via social media platforms such as YouTube™, Facebook™ and Instagram™ (YouTube, 2005; Facebook, 2004; Instagram, 2010). Numerous video media are available for viewing under the term “dental video” when used to search within these platforms. This enables dental students, patients and also members of the general public to easily access specific learning materials and education from computers, laptops,

tablets and smart phones. Sometimes the ease and level of this access can be very helpful, although sometimes it can be harmful—but studies in the last decade have called for urgent research into the presence of social media within the dental profession (Oakley & Spallek, 2012; McAndrew & Johnston, 2012). Some institutes are currently working to undertake this research and evaluate the potency of digital media and social media on dental education as well as the impact it has on the dental profession¹⁴, and this topic evidently needs further investigation and scrutiny relating to the influence it has on our dental students. Some authors discuss the importance of awareness and acceptance regarding the role and impact of social media within dentistry (Oakley & Spallek, 2012; McAndrew & Johnston, 2012; San Diego, 2019; Gupta, Das, & Mukherjee, 2017), but the literature only seems to conclude that further research in this area is required. Universities have not widely begun to provide or incorporate this enhanced technology across all subject areas within the dentistry course, and it can be hypothesised that the lack of conclusive evidence supporting the benefits of these new techniques may be the main reason for this.

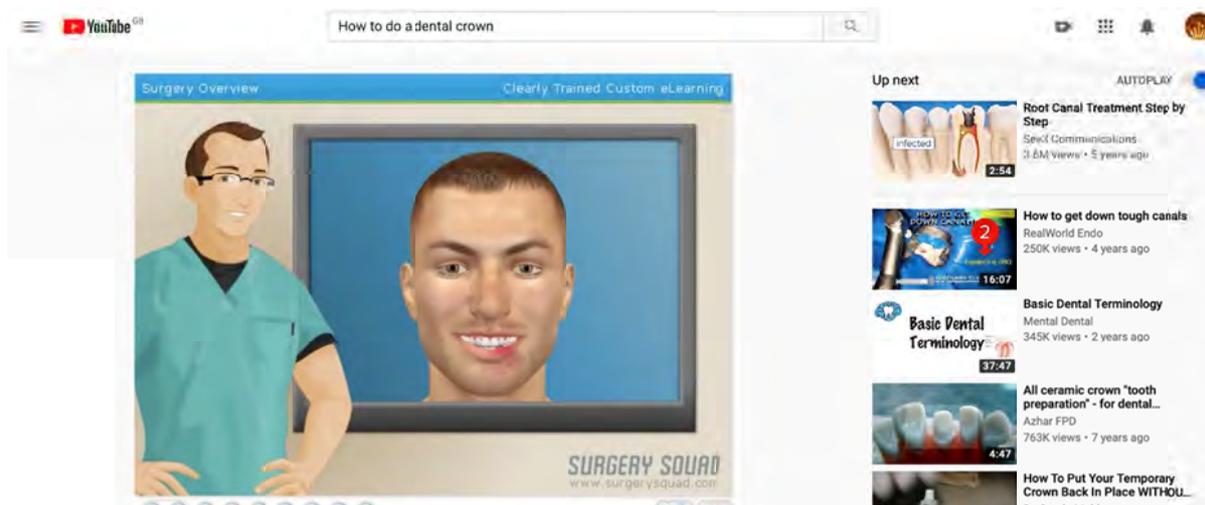


Figure 1. Easily available digital media is accessible for the entire population and can be utilised by dental students (Surgery Squad, & YouTube, 2017)

McAndrew did identify a number of barriers to implementation and use of digital and social media platforms that included, cost, institutional resistance, quality control and confidentiality/consensual issues, however, still concluded that the benefits may outweigh these barriers—deeper learning by dental students and increased engagement were two elements that had the potential to develop with the correct use and implementation of the digital and social media tools (McAndrew, 2012). The most recent research compares two very differing views and arguments on the impact of this digital media and the potential role that social media has within dental education (De Peralta et al., 2019). This evidence-based article published educational elements shown in Table 1.

Table 1. Viewpoints on the use of social media by dental students for communication and learning

Benefit student learning	Problems and risk of social media use
Improved learning across healthcare professions	Negative effects on learning
Improved peer communication in clinical education	Potential establishment of a negative digital footprint in the view of the public
Improved engagement	Privacy violation
Mechanism for safe and improved communication between the faculty and students and also students and patients	Negative psychological impact on users

Other research also supports the benefits of social media in dental education, based on student questionnaires (Sen et al., 2016). The lack of a comprehensive large-scale randomised control trial to compare teaching and learning with the aid of digital and social media technology with standard methods (or methods used previously), makes it very difficult to confidently rest on a particular conclusion relating to the impact that these methods have on our dental students. Further longitudinal and large-scale objective research is necessary, but currently absent. The recent breakthrough of digital dentistry within the U.K. now demonstrates the advancements available (and

already integrated for some dental education centres/practitioners) in the dental profession and also the need for dental students to be prepared to enhance their own knowledge to be able to “keep up to date” with these developments in patient care and dental procedures. The advent of digital dentistry has already been embraced by many within the dental profession, and will be a component of dental practice that dental students will need to be aware of (Chaffe, 2017). The advent of digital dentistry has been recognised and embraced by the profession and established dental bodies within the U.K., and worldwide (Chaffe, 2017). Implant dentistry, restorative dentistry, orthodontics and oral surgery are subdivisions within dentistry that have adopted digital technology to provide outstanding patient care, despite the obvious disadvantage of cost implications (Child Jr., 2011). Although this innovation, evolution and cutting-edge technology is being used regularly in dentistry now, universities are struggling to “keep up”. The author is aware Digital dentistry does require some expensive equipment and machinery in order for it to be utilised and put into practice and some of this equipment and machinery is yet to be purchased by a number of U.K. universities, with only very few offering any formal qualification at all (Google, Digital Dentistry in Universities, 2019). Logistically, very few universities or institutes even are in possession of a single digital scanner, and currently, at the University of Manchester, the dental school does not include the opportunity for the students to use any digital equipment, or include any digital dentistry within the curriculum. This may present another potential barrier to incorporation of the use of digital and social media platforms as education methods to facilitate learning for dental students.

The use of video channels on digital media platforms such as YouTube™ provide an excellent learning resource for dental students, that can be used easily, repeatedly and is easily accessible—from almost anywhere at any time—with internet access (Knosel, Jung, & Bleckmann, 2011). The benefits students gain from watching particular procedures or treatments (especially practical procedures or treatments), makes logical sense. In the author’s own experience, watching a procedure carried out has far greater benefit and makes for easier understanding than trying to learn from having the procedure described—these learning techniques have been described in other texts (Newton & Miah, 2017). The theory behind the concept adds yet another level to the education process—additional to what has been described above: for example, a dental student will watch a particular practical procedure or treatment be carried out via digital media first (this can be done from any location with internet access), then will watch the same procedure or treatment be carried out on the dental mannikin, they will then attempt the procedure or treatment on the dental mannikin themselves (sometimes multiple times) before working on patients. This could even be likened to synthetic, focused “work experience”, where dental students are invested in the particular procedure or treatment they’re asked to learn. Potential problems do exist with universally available and unverified or standardised public videos. YouTube™ is one platform that does not make it compulsory for the video author to advise whether what is being shown is standardised, or verified or acceptable to be used as educational material.

6. Technology and Dental Education

It is perhaps not surprising that some authors find a significant correlation between technological proficiency and pedagogical practice integration (Georgina & Olsen, 2008). It would seem quite evident that any educators that are competent when using technology for teaching would be more accepting and skilled in its incorporation into the teaching environment. In dentistry, this may now be more relevant to those who are comfortable practising digital dentistry—these practitioners are maybe more likely to be fluent and comfortable delivering dental teaching with the use of technology—these practices may not limit only to digital dentistry—they are likely to include other disciplines within dentistry. For example, implant dentistry has utilised digital technology already to great effect, and continues to improve the accuracy of surgical dental implant placement today (Zimmerman, Seitz, & Nyugen, 2014; Megagen, Digital Dentistry R2Gate, 2019). However, high quality research to demonstrate this hypothesis is required. Having great knowledge and skill in digital dentistry does not necessarily mean that one would be outstanding in being able to teach this knowledge and skill to dental students. Green and Gilbert concluded that the expectations relating to how technology may benefit higher education should remain realistic (Green & Gilbert, 1995). This would seem to be sensible, as there are likely to be large discrepancies between what those who are technologically proficient believe would be achievable with the techniques of using the technology available; and those who have not yet incorporated technology within pedagogy.

The same considerations relating to technological proficiency needs to be applied to the students who are tasked with the learning. Dental students are more recently required to be able to utilise information technology (I.T.) for clinical record keeping, diagnostic procedures, visual aids for patients, treatment planning, and construction of dental treatment plans and these components do form part of the curriculum for dental students. The dental students will acquire the required skill to practise with I.T. within the dental setting as they continue their journey through dental school, however, to this day they remain untested academically or clinically in relation to this

element of the profession. It must be remembered that the learner and the views of the learner (or potential learner) are just as important when seeking an integration of technological methods of teaching. Motivation will likely play a fundamental role in both teaching and learning—if the teacher enjoys using more advanced forms of technology to deliver their teaching, it is likely that they will be happier and more comfortable providing the teaching, and therefore more motivated. If the learner enjoys receiving the material for learning using the more advanced forms of technology, then they are more likely to have greater motivation to learn (Han & Yin, 2016).

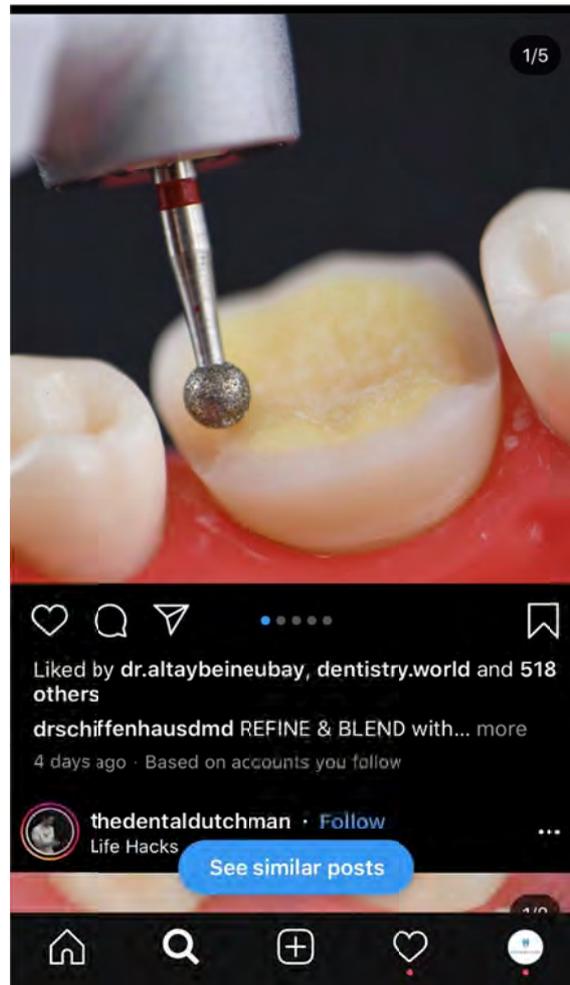


Figure 2. Some popular social media platforms are now allowing the use of education videos that can be accessed without even searching specifically for procedures and techniques

7. What We Believe

When considering methods and techniques to deliver/receive teaching, surveys were carried out amongst dental teachers/tutors/lecturers and also dental students, at University of Manchester, at the dental school—these can be found in The Appendix section.

7.1 Methodology

10 anonymous closed questionnaires were completed by dental teachers/tutors/lecturers at University of Manchester Dental School. These were made available by Google Forms™ to all teaching staff within the Dental School. Participants were made aware that the questionnaires were optional, and provided a link to these via an email sent to them from the administration staff. The results would be automatically submitted once completed, and the author would be sent an email to be made aware that a questionnaire had been completed. Participants were free to complete the questionnaires in private, in their own time. The same methodology was used to acquire information from 50 dental students also. This was double-blinded as the participants do not identify themselves on their form, and also, they do not know for whom this research and data is being gathered for.

The results of the survey are shown in Tables 2 and 3.

Table 2. 10 participants

Education method/techniques delivered to dental teachers				
<u>Which educating technique do you prefer the most when delivering your teaching?</u>	Demonstrating directly via text/presentation: 3	Allowing care on patients directly: 4	Via video presentation/observation: 2	Via virtual reality headset(s): 1
<u>Why is this?</u>	Easy and convenient: 1	Because this is the technique suits your teaching style: 2 Yes: 10	This method is how you were educated: 0	You believe this is the technique is the best for students: 7 No: 0
<u>Referring to your chosen option, do you believe this is the method that best delivers the desired education to your students?</u>				
<u>If yes, why?</u>	Students will learn most from this technique: 7	Your style of teaching will be most effective: 2	This method is how you were educated : 1	None of these options: 0
<u>If no, why?</u>	It is outdated:	You have never really considered changing it:	There are alternative more effective methods:	None of these options:
<u>Which educating technique do you believe your students would most prefer you to deliver your teaching?</u>	Demonstrating directly via text/presentation: 2	Allowing care on patients directly: 4	Via video presentation/observation: 2	Via virtual reality headset(s): 2
<u>Why is this?</u>	Easy and convenient: 2	Because this is the technique suits your teaching style: 1 Yes: 19	This method is how you were educated: 1	You believe this is the technique is the best for students: 6 No: 0
<u>Referring to your chosen option, would you ever consider using this technique to deliver your teaching to the students?</u>				
<u>If yes, why?</u>	Students will learn most from this technique: 2	Your style of teaching will be most effective: 2	This method is how you were educated: 5	None of these options: 1
<u>If no, why?</u>	It is outdated:	You have never really considered changing it:	There are alternative more effective methods:	None of these options:

Table 3. 50 participants

Education method/techniques delivered by dental students				
<u>Which educating technique do you prefer the most when being taught?</u>	Demonstrating directly via text/presentation: 5	Care on patients directly: 19	Via video presentation/observation: 11	Via virtual reality headset(s): 15
<u>Why is this?</u>	Easy and convenient: 5	Because this is the technique suits your learning style: 38 Yes: 46	This method is how you were educated: 3	Your teachers are good at delivering this method: 4 No: 4
<u>Referring to your chosen option, do you believe this is the method that best delivers the desired education to meet your needs?</u>				
<u>If yes, why?</u>	You will learn the most from this technique: 34	It is quick and simple: 2	It has benefited and succeeded for you in the past: 9	None of these options: 1
<u>If no, why?</u>	It is outdated:	You have never really considered other methods of learning: 3	There are alternative more effective methods: 1	None of these options:
<u>Considering your learning, which educating technique do you think you would like to receive the most?</u>	Demonstrating directly via text/presentation: 3	Care on patients directly: 23	Via video presentation/observation: 6	Via virtual reality headset(s): 18
<u>Why is this?</u>	Easy and convenient: 3	Because this is the technique suits your learning style: 40 Yes: 49	This method is how you were educated previously: 2	Your teachers are good at delivering this method: 5 No: 1
<u>Referring to your chosen option, would you ever consider using this technique to deliver teaching to your own students one day?</u>				
<u>If yes, why?</u>	They will learn the most from this technique: 41	It is quick and simple: 0	It has benefited and succeeded for you in the past: 8	None of these options: 1
<u>If no, why?</u>	It is outdated:	You have never really considered other methods of learning:	There are alternative more effective methods:	None of these options: 1

Table 2 focuses on questions put forward to dental teachers/tutors/lecturers. Table 3 shows results of questions answered by dental students.

10 respondents replied to the questionnaire from Table 2, and 50 respondents produced the results shown in Table 3. 70% of the dental teachers/tutors/lecturers prefer more traditional methods of teaching, and only one of those respondents preferred the use of the most advanced technology with the Virtual Reality (VR) headset? The results relating to what students would most prefer as a teaching method show varied opinions. This does demonstrate that some dental teachers/tutors/lecturers prefer some teaching techniques that they believe that their students may not necessarily also prefer them to use when delivering their teaching. There was a strong correlation between why the dental teachers/tutors/lecturers believe the chosen techniques are appropriate—with the vast majority stating that these methods are most preferred as they will benefit the students the most and they will learn more.

There was a very good response to the questionnaire from dental students. Interestingly, in relation to teaching, 49 of the 50 students would use their preferred learning method to teach dental students in the future. Most students actually were divided on learning via the VR headsets and the traditional method of working on patients directly. This would imply a discrepancy between the preferred learning method of dental students and what the dental teachers/tutors/lecturers use as their preferred teaching method.

The small sample sizes (particularly taking the views of dental teachers/tutors/lecturers) is an obvious weakness and makes it difficult to generalise the results to any other dental school. The questionnaires also only provide a

“closed question” style method of acquiring information and there is no opportunity to collate subjective information. Determining teaching outcomes by means of a survey doesn’t seem to be the most effective method of standardising teaching proficiency in higher education, or evaluating the appropriateness, strengths, weaknesses, advantages, disadvantages, risks, benefits, positives and negatives of each of the methods and techniques being considered here. The “closed questions” would need to ideally consider all of these elements relating to each method described and of course do exclude the ability to acquire valuable subjective evidence. Consideration also needs to be given to standardising how each technique is evaluated in any further research in the future.

8. Conclusion

The differences outlined above between what dental teachers/tutors/lecturers prefer to use as their chosen teaching method, their belief of which technique students would benefit most from; and how the dental students actually would like to be taught demonstrate clearly that there is still a gap between what teachers and learners perceive as a preferred and best method. This in itself may present as a barrier to embracing and allowing technology into dental higher education, as well as other barriers discussed within this text. It is not clear which one of these groups (teachers or learners) influence how teaching is delivered in higher education and what techniques are used, however, this research and the literature would indicate some progress made within the dental profession relating to the use of digital media, advanced technology and improved dental software. This has not been transferred down to higher education at the same level or magnitude, and does not seem to provide dental students with the same knowledge or understanding of these newer methods, using advanced technology. There are available methods and techniques that will provide dental students with additional levels of learning prior to performing procedures and treatments on patients—of which there is still no substitute—as also seems to be the belief of the dental students as per the results of the questionnaires. It would appear both traditional methods and more modern technological techniques would both have instrumental roles in delivering the best education, from our dental teachers/tutors/lecturers, to our dental students.

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Appendix A

Item 1: Survey to assess opinions of dental teachers on methods and techniques delivered to dental students

Education method/techniques delivered to dental students

Dental education and the way it is delivered has changed dramatically in the last 20 years, and will undergo further changes no doubt in the next 20 years with the advent of digital dentistry and it’s breakthrough.

As a clinical teacher/tutor/lecturer, I would appreciate your views on the following questions, please **underline** the most appropriate option to express your opinion (please select a single answer):

1) Which educating technique do you prefer the most when delivering your teaching?

Demonstrating directly via text/presentation Allowing care on patients directly

Via video presentation/observation Via virtual reality headset(s)

2) Why is this?

Easy and convenient Because this is the technique suits your teaching style

This method is how you were educated You believe this is the technique is the best for students

3) Referring to your chosen option, do you believe this is the method that best delivers the desired education to your students?

Yes No

4) If yes, why?

Students will learn most from this technique Your style of teaching will be most effective

This method is how you were educated None of these options

5) If no, why?

It is outdated You have never really considered changing it

There are alternative more effective methods None of these options

6) Which educating technique do you believe your students would most prefer you to deliver your teaching?

Demonstrating directly via text/presentation Allowing care on patients directly

Via video presentation/observation Via virtual reality headset(s)

7) Why is this?

Easy and convenient Because this is the technique suits your teaching style

This method is how you were educated You believe this is the technique is the best for students

8) Referring to your chosen option, would you ever consider using this technique to deliver your teaching to the students?

Yes No

9) If yes, why?

Students will learn most from this technique Your style of teaching will be most effective

This method is how you were educated None of these options

10) If no, why?

It is outdated You have never really considered changing it

There are alternative more effective methods None of these options

Item 2: Survey to assess opinions of dental students on methods and techniques delivered to them

Education method/techniques delivered by dental teachers

Dental education and the way it is delivered has changed dramatically in the last 20 years, and will undergo further changes no doubt in the next 20 years with the advent of digital dentistry and it's breakthrough.

As a dental student, I would appreciate your views on the following questions, please **underline** the most appropriate option to express your opinion (please select a single answer):

1) Which educating technique do you prefer the most when being taught?

Demonstrating directly via text/presentation Care on patients directly

Via video presentation/observation Via virtual reality headset(s)

2) Why is this?

Easy and convenient Because this is the technique suits your learning style

This method is how you were educated previously Your teachers are good at delivering this method

3) Referring to your chosen option, do you believe this is the method that best delivers the desired education to meet your needs?

Yes **No**

4) If yes, why?

You will learn the most from this technique

It is quick and simple

It has benefited and succeeded for you in the past

None of these options

5) If no, why?

It is outdated

You have never really considered other methods of learning

There are alternative more effective methods **None of these options**

6) Considering your learning, which educating technique do you think you would like to receive the most?

Demonstrating directly via text/presentation **Care on patients directly**

Via video presentation/observation

Via virtual reality headset(s)

7) Why is this?

Easy and convenient

Because this is the technique suits your learning style

This method is how you were educated previously

Your teachers are good at delivering this method

8) Referring to your chosen option, would you ever consider using this technique to deliver teaching to your own students one day?

Yes **No**

9) If yes, why?

They will learn the most from this technique

It is quick and simple

It has benefited and succeeded for you in the past

None of these options

10) If no, why?

It is outdated

You have never really considered other methods of learning

There are alternative more effective methods **None of these options**

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