

**Review Article**

# Exploring E-Learning as a Tool in Dental Vocational Training - A Response to COVID-19 and Beyond?

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## Abstract

**Introduction:** In the UK, dental graduates almost invariably complete a 12-month period of Dental Vocational Training (DVT). This is tailored to allow trainees to make the transition to general dental practice. Positive attitudes towards e-learning in dental education has led to wide adoption across dental schools in the UK. However, at present its use in DVT is limited, although in the midst of the COVID-19 pandemic, adoption of this modality for teaching delivery presents an opportunity to limit the impact on delivery of DVT.

**Aim:** The aim of the present study is to explore how e-learning is perceived in DVT.

**Method:** An online e-learning package was made available to trainees with an attached questionnaire evaluating their experience. Additionally, trainers and trainees (Vocation Dental Practitioners - VDPs) were invited to participate in focus group discussions to explore in-depth their attitudes towards e-learning.

**Results:** Responses were mainly positive towards the content of the online e-learning package. However, despite VDPs and trainers being aware of the potential offered by e-learning, they suggested that this approach does not fulfill the needs of the VDP in relation to clinical dentistry.

**Conclusion:** an e-learning approach may still be welcomed as long as it is tailored to VDPs needs and supplements their training.

**Keywords:** E-learning; Online learning; Dental vocational training

## Introduction

In general, electronic learning (e-learning) is an approach to teaching and learning, in which the educational content is delivered in an electronic form via electronic devices or networks [1]. Terms such as computer-assisted learning and computer-assisted instruction were once used to describe this approach in education. However, other terms have emerged which accurately refer to e-learning applied today, such as Web-based learning, online learning, and Internet-based learning [2]. The shift to an online environment has truly expressed the notion of “anytime, anywhere” access to educational material. Online e-learning programs provide a number of advantages over traditional lecture-based teaching. They offer more flexibility by providing interactive multimedia, containing hyperlinks, visual presentations, sound and animations [1,2]. From a user point of view, individuals benefit from personalizing their learning process to accommodate their preferred study pace and place [3]. E-learning can transform learning from teacher-centered to active learning by the student [4]. From an institutional perspective, e-learning has the potential to reduce cost and mitigate logistical challenges, such as staff shortages and teaching large numbers of students across different locations [4].

**Citation:** Alqahtani S, McAllan W, McLean W, McKerlie R. Exploring E-Learning as a Tool in Dental Vocational Training - A Response to COVID-19 and Beyond? *Dentist*. 2020; 2(1): 1016.

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**Publisher Name:** Medtext Publications LLC

**Manuscript compiled:** Sep 14<sup>th</sup>, 2020

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The advantages of e-learning have been recognised within dental education, and has become considered essential [5]. This method of teaching has been reported to be better than, or at least as effective as, traditional lecture-based teaching [3,6]. Combining e-learning with traditional teaching methodologies allows exploitation of complimentary benefits [3,7,8]. There is consistent testimonies of positive dental student attitudes towards e-learning [3-5,8]. The flexibility offered by e-learning has made it widely acceptable by graduate professionals [2,9,10]. With their prior knowledge and experience, they seek specific knowledge tailored to their individual needs, or information to maintain competency in their practice through educational opportunities aimed at continuing professional development [2]. E-learning offers the opportunity to meet these needs whilst balancing their learning development with personal and work commitments.

A further potential advantage of E-learning presents itself in the current COVID-19 pandemic. The interruption of dental services across the UK has created significant challenges for the delivery of DVT. This has led to a cohort of VDPs that have had their experiences curtailed and a prospective cohort that will certainly have a delayed start to their experience and eventually a “new normal”. What this “new normal” will look like and how long it will persist is uncertain. The resultant impact on training opportunities equally remain unclear. The use of E-learning has been adopted globally in both undergraduate and postgraduate education. Its adoption in DVT could mitigate some of the loss of opportunity for VDPs during their training due to COVID-19.

There are no published studies investigating the effectiveness of e-learning in Dental Vocational Training (DVT). Dental graduates work in a mentored environment under the guidance of an experienced trainer [11]. These Vocation Dental Practitioners (VDPs - previously known as Dental Vocational Trainees (DVTs or VTs)) are a unique

type of learner, in that they have the traits of both undergraduate students and graduate professionals. Therefore, the aim of this study was to explore how e-learning is perceived amongst both VDPs and their trainers.

## Methodology

Study volunteers consisted of both trainees and trainers within the Scottish DVT programme. Participants were contacted via the Head of Scotland's DVT program following ethical approval (University of Glasgow, College of Medical Veterinary and Life Sciences, Research Ethics Application number 200170112). A mixed methodology approach was taken. An e-learning package was developed on the restoration of the endodontically treated tooth – specifically the provision of post-retained restorations (Figures 1 and 2). A questionnaire designed to measure the suitability of this educational intervention was attached to the package. The intention of including the package was to not only understand the make-up of a package that would best suit the needs of the VDP, but also to set the scene for exploration of e-learning more generally amongst the study population. It would set a standard for packages that may be delivered to VDPs. After analysis of the questionnaire data, focus groups were established to explore the implementation of e-learning in DVT.

### Questionnaire design

The questionnaire was adapted from a study of dental undergraduates [12]. Fundamentally, the outcome to be measured in this approach was the user's attitude, thus, the questionnaire involved 17 statements to evaluate the package's accessibility, educational content and user satisfaction (Table 1). Responses were gathered using a five-point Likert scale ranging from strongly agree to strongly disagree.

### Focus groups

Focus Group sessions were conducted to explore perceptions of e-learning in DVT. Two Focus Groups: one of VDPs and one of trainers were established to collect responses to advantages, disadvantages, needs, and barriers of implementing e-learning in DVT. Focus Group

discussion was facilitated using a semi-structured interview guide. The guide addressed user's previous and current experiences of e-learning; delivery and support; benefits and barriers in implementing e-learning in DVT (Table 2). Prior to conducting these sessions, all participants were reminded of their right to withdraw at any time, permission to tape record the interview was sought and participants completed a written consent form. The recordings were independently transcribed and the transcripts were reviewed and coded to identify patterns and themes in the data through a strategy known as a "general inductive approach" [13].

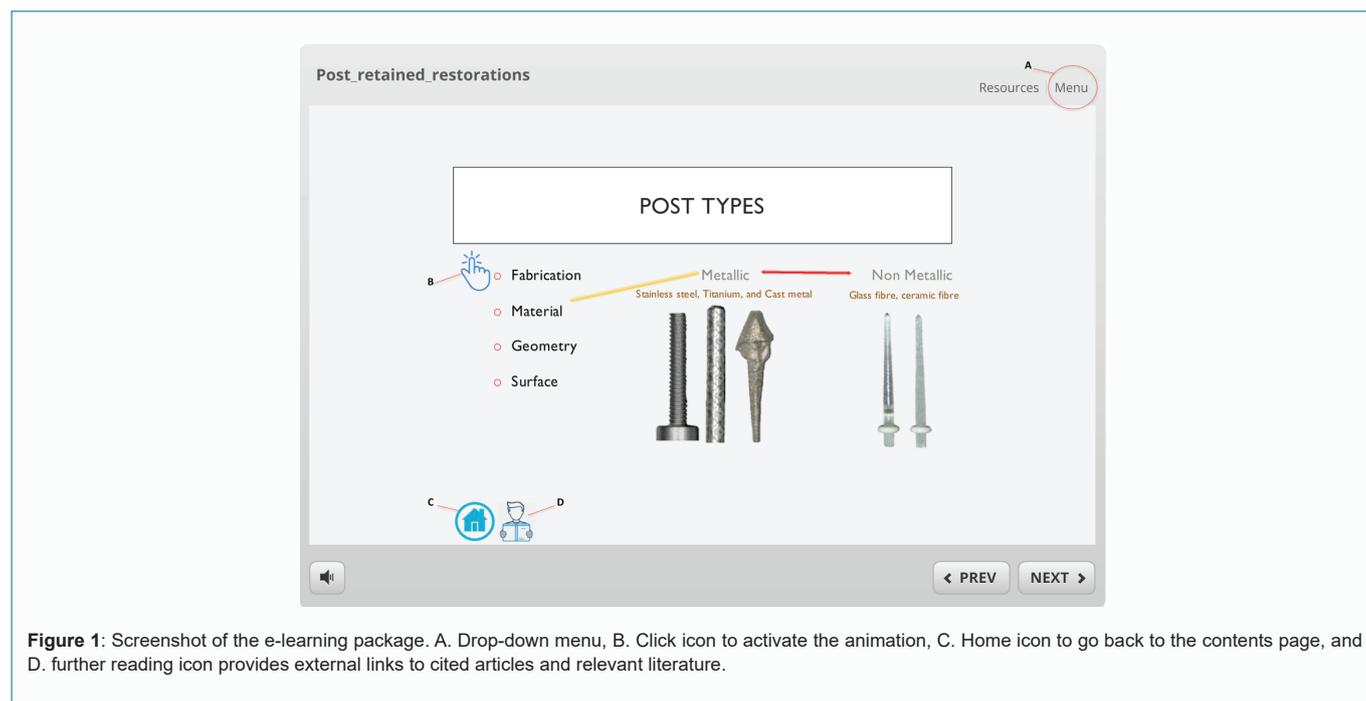
## Results

### Questionnaire

Twenty-seven participants completed the feedback questionnaire enclosed within the package, 90% (n=24) were VDPs and 10% (n=3) were trainers. The sample size impedes any statistical analysis to be carried out between VDPs' and trainers' responses. In response to the questionnaire evaluating participants' experience, almost all responses to the e-learning package were positive (Figure 3). For statements evaluating usability and accessibility of the package (Figure 3A): almost all users found that the electronic tutorial was simple and accessible, except for one user (4%) who found difficulties accessing the package through his/her preferred device. Responses for statements evaluating the educational content quality of the electronic tutorial were almost all positive (Figure 3B). However, 37% (n=10) were uncertain that the provided information fitted their needs. Also, 44% (n=12) did not feel that the package provided sufficient information on the topic. Nevertheless, the majority (93% n=25) agreed that the e-learning tutorial made it easier to understand the topic. Lastly, responses intended to gather users' satisfaction and acceptability indicate similar positive results, though, 52% (n=14) did not feel motivated to use this package and 66% (n=18) felt that the package did not stimulate them to look for additional information on the topic (Figure 3C).

### Focus groups

Two focus groups were hosted, the first had nine volunteer



**Figure 1:** Screenshot of the e-learning package. A. Drop-down menu, B. Click icon to activate the animation, C. Home icon to go back to the contents page, and D. further reading icon provides external links to cited articles and relevant literature.

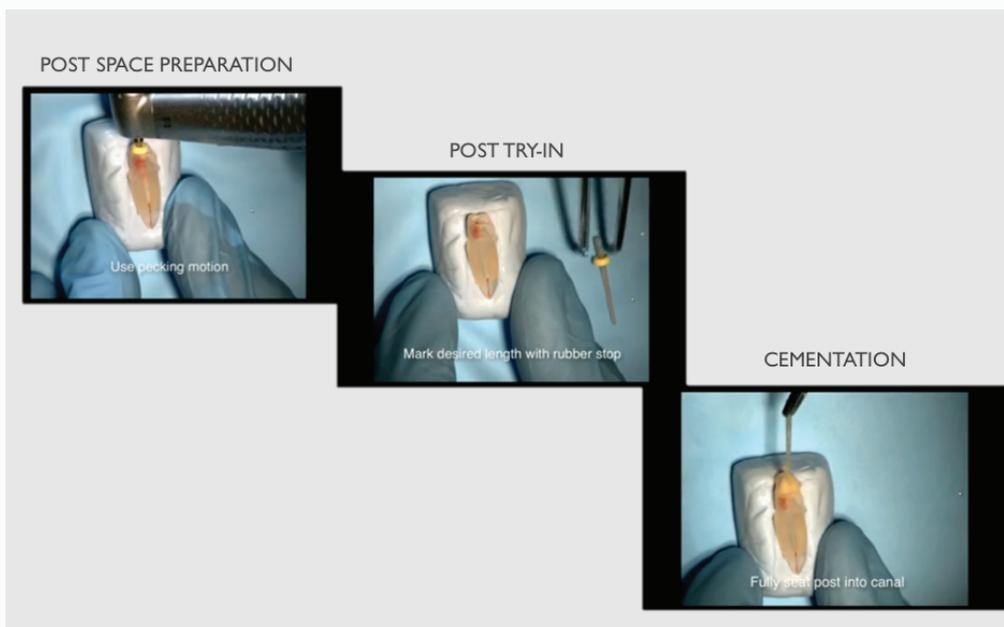


Figure 2: Screenshot of video demonstrations included in the e-learning package. Videos can be downloaded, paused, and viewed in full screen mode.

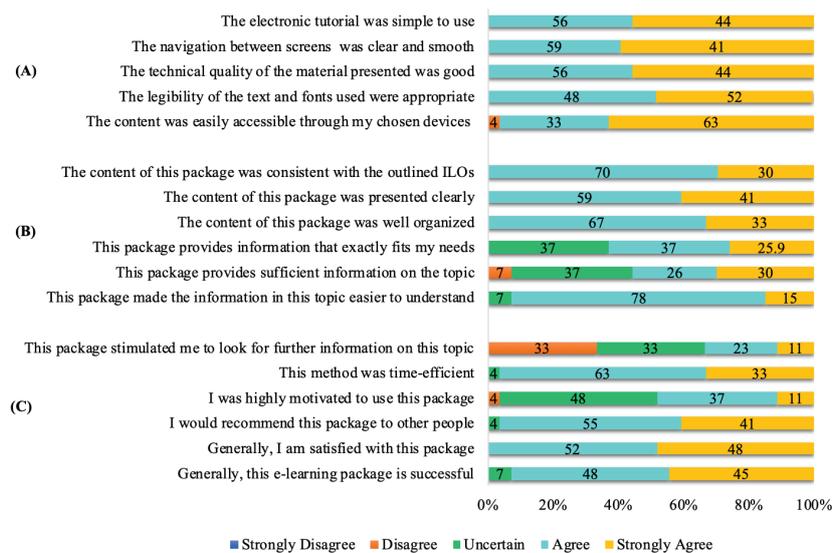


Figure 3: Questionnaire results: percentage of user agreement/disagreement with statements. (A) Represents accessibility and design of the package, (B) represents quality of the educational content, and (C) represents users' satisfaction and acceptability.

VDPs and the other had four trainers. The analysis of these groups' transcriptions provided several themes. The following four themes have emerged from the VDP group, while the subsequent three emerged from the trainer group. To maintain anonymity each contributing member of the focus group has been given a pseudonym.

**Supplementing self-paced learning:** the following quotes highlight the view that e-learning is seen as a supplement to traditional learning methods, in which the individualised self-paced nature of e-learning is valued:

"I think the e-learning things are useful as an add-on, not necessarily as the main way of learning something...I don't know whether it necessarily is always good in the first instance to teach you

something but it's good to look back, to refresh your memory..." Grace

"You can access it whenever you want. A lot of them you dip in and out, so you can pause it whereas conventional learning is usually going to be in a lecture-type..." James

**Content quality assurance:** educational content quality, design, and source were factors of importance according to VDPs and were viewed as crucial elements that played a role in the acceptance of an e-learning approach:

"I think it very much depends on the quality of the package, I think some of them were very good, some of them were harder to use, maybe just not as well developed so then they are less useful" Grace

**Table 1:** Questionnaire evaluating the package’s accessibility, educational content, and user satisfaction.

Statements	
<b>A. Accessibility</b>	
1.	The electronic tutorial was simple to use
2.	The navigation through screens was clear and smooth
3.	The technical quality of the material presented (i.e. audio, video, and animations) were clear
4.	The legibility of the text and fonts used were appropriate
5.	The content of this e-learning package was easily accessible through my chosen device (i.e. Windows, iOS, iPads and tablets)
<b>B. Educational contents:</b>	the content of the e-learning package...
6.	was consistent with the outlined intended learning objectives
7.	was presented clearly
8.	was well organized
9.	provides sufficient information on the topic
10.	provides information that fits my needs
11.	made the information in this topic easier to understand.
<b>C. Users’ satisfaction</b>	
12.	This e-learning package stimulated me to look for further information on this topic
13.	This method was time-efficient
14.	I was highly motivated to use this e-learning package
15.	I would recommend this e-learning package to other people
16.	Generally, I am satisfied with this e-learning package
17.	Generally, this e-learning package is successful

**Table 2:** discussion Guide used in focus groups. \*Phrases were changed ever so slightly between VTs and Trainers.

Statements	
<b>Experience with e-learning</b>	
	From your own prospective, what does e-learning mean?
	What is your experience with e-learning courses/Modules or Apps?
	What have you heard from others regarding online e-learning courses?
<b>Content and delivery</b>	
	In your opinion, is there a role for e-learning in vocational training?
	How should e-learning modules be best integrated in your training?*
	Would you prefer this method in all or in particular parts of your training? And why?*
	Would you prefer learning form an e-learning module on your own?*
<b>E-Learning Facilitators</b>	
	Describe what features would interest you or motivate you in an e-learning package?
	What are the things that you would consider in choosing an e-learning program?
<b>Student support</b>	
	Would you feel well supported with e-learning on its own?*
	Do you think that online e-learning courses could help you prepare for your clinic?*
<b>Benefits of e-learning</b>	
	From your own prospective, what do you think is good or beneficial about e-learning?
	Generally speaking, what would be the major advantage/s in courses that use online e-learning packages?
<b>Barriers to e-learning</b>	
	What do you think is negative or useless about online e-learning programs?
	Generally speaking, what would be the challenges associated with e-learning as a tool for dental vocational training?
	From your own prospective, what are the downfalls of e-learning compared to traditional methods of training?

“Your first couples of slides or areas have to be good and they have to look like they’re going to be good. If there’s too much writing in the first couple of pages I’m like ‘I’m done’” Sophie

“I suppose where it’s come from if you know the organization it’s come from or some of the people that developed it, maybe they’ve lectured you or something then I think you’d be more likely to use it” Olivia

**Barriers to implementing e-learning in DVT:** the ability of e-learning approaches in developing clinical skills is seen as one of the important limitations in such methods. In addition, factors ranging from learner’s learning style to teacher’s teaching approach, were highlighted in the following quotes that could stand as a potential barrier in developing or implementing e-learning in DVT:

“I suppose a lot of people struggle with taking teeth out, there is only so much of that you can teach on an e-learning package rather than actually just doing it” Alex

“We’ve got very instantly accessible people whose job it is to help

us, so it’s going to be a lot quicker for me to run next door and say ‘what do I do’ rather than log on something” Ashley

“There’s so many different characters in our year and different learning styles that I don’t think it would help the whole VT year but that’s because everyone learns differently” Sarah

“A barrier is getting the people above us to use it and they are of a generation that aren’t as au fait with computers and with learning on a computer, they are the kind of generation that sat in lecture theatres all day every day so they might find it a bit strange that this should get added in to the curriculum as well” Olivia

**Desired e-learning approach:** engaging the end-user, the educational content, and technical design were highlighted as factors to be considered upon implementing an e-learning approach in DVT:

“You would need the topic that you were making the e-learning about to be from VT’s if you are aiming it at the VT’s...” James

“I still struggle with posts and crowns and things so having a

visualization of that would probably help me, or even basing it on real life dentistry.... and just make it more realistic rather than all hospital-based dentistry where you get the best of the best as you don't always have that." Ashley

"it's the stuff that's outside of clinical dentistry and around regulations and general practice and GDC ... that is what we are finding hard in our first years" Alex

"Not too much text in one go. It needs to be broken up and preferably broken up by if you can have animated things or videos" Sophie

"Makes you concentrate a bit more maybe if you know there's going to be a quiz at the end" Emily

"A good navigation system so you can jump from page to page and go back and so you can find things rather than go all the way though clicking 'next, next, next'" Ashley

The following three themes have emerged from Trainers' transcription results:

1. Pre-conceived attitudes towards e-learning: trainers underline the valued potential of e-learning; however, they have reservations toward this approach in their training:

"Generally, it's a good way to get CPD, to get verifiable CPD in some things and it's good to kind of broaden your horizons and knowledge on a broad range of things" John

"Conventional way of learning would allow me, probably, to be in a group of my peers who I can discuss things with as well whereas e-learning seems to be a very solitary past time" Mark

"It strikes me as a list of tasks to click your way through now maybe that's the bulk of the e-learning packages that I've been subjected to, but I don't find them particularly...a particularly nice way to learn." Paul

"I always think its second best to there being a person there. It's an easy way to provide training for a large number of people but I never think it's quite as good as having someone there to teach you. I'm quite kind of old fashioned about that kind of thing, I think." Ben

2. Challenges in adopting e-learning in DVT: motivation and technical ability where highlighted from a trainer perspective as barriers to employing e-learning in their teaching alongside the nature of the training program and how it runs on a one-one relationship:

"I've found it difficult to implement in my practice with my staff. .... It's difficult to keep them motivated to keep logging on to it." Mark

"To get the VT's to be logging on in their downtime to learn about extra things, I just don't think it's going to happen" Ben

"I wouldn't see myself as leading an e-learning package... I don't have the skills involved to produce videos or do any of that sort of thing but it's not something that I am all that interested in learning to do either to be perfectly honest with you." Paul

"I think most of the training is done by the trainer with the trainee there. It's a one-to-one teaching environment then which I don't think you can get better than that. I think, again, if they're going to an e-learning course to look at it such that you can then sit down and go through it in more detail with your trainee, but as a single resource I don't think it's in any way superior to having a trainer there." Paul

"Dentistry is based around people and around practical skills neither of which I think don't work particularly well on a screen." John

3. Trainers suggestions for e-learning: the following quotes highlight trainers' suggestions to be considered if e-learning were to be developed in DVT. They highlight the importance of quality control; educational content; and timing.

"I've seen some things online that I don't agree with in terms of the dentistry that's being performed, it's a grey area for me. I think because there is kind of a consent issue and a kind of an information sharing thing that doesn't really sit well with me and who are these people that are doing something?" Mark

"I've done ones on the BDA website before, you can get CPD there so at least you know it's accredited, it's coming from the BDA, a trusted source and it's verifiable...you're getting taught the right thing" Ben

"It would probably be beneficial to have some cases and some material there just to help the trainees and trainers out. It could be used as an add on for tutorials relevant to the common tutorial topics." John

"I found one that I did recently and it was learning that was based on the initial actual training day that I was on a few months prior to that, so the motivation was there to complete it because it was following something that was relevant to me." Paul

"e-learning should be primed to go out after VT to maintain their level of learning and I think that's where e-learning thing should be coming in. They should have access to e-learning like, after VT, so they can continue their CPD and start on a good footing" Mark

## Discussion

The study set out to explore VDPs' perceptions and experiences of e-learning as a resource in DVT. It was acknowledged from the outset of the study that findings would provide an insight into VDPs' and trainers' attitude towards e-learning as a supplementary method of instruction during the DVT year. The current study has even greater significance as a result of the COVID-19 pandemic. As outlined there has been unprecedented disruption to the delivery of DVT and it is apparent this disruption may be ongoing for some time. It is essential that alternative formats are adopted in DVT to minimise the impact on the training experience and outcomes. The insight gained will be instrumental in delivery of appropriate material.

The study presents a mixed-methods evaluation of participant's attitude towards e-learning by gauging their perception towards a specific online package and further exploring their attitude towards e-learning in general. The small number of participants represents a major limitation of this study, despite the large number of the cohort and the assistance of the DVT organising team. The poor response could be due to the method of recruitment, which was done via email. In addition, the timing of this study coincided with the end of the training cycle, a time at which most VDPs are in the process of seeking new positions.

As highlighted previously, the aim of evaluating the package was to not only understand the make-up of a package that would best suit the needs of the VDP, but also to set the scene for exploration of e-learning more generally amongst the study population. In achieving the first aim, the use of an evaluation instrument for user's experience towards e-learning, established that most participants viewed the online package positively. More specifically, users' evaluation of three

elements; technical design and accessibility, quality of the educational content, and acceptance were collected.

Overall, responses were positive with respect to the accessibility and usability of the package. With regards to content, educational quality and acceptability, half of the participants felt unsure if this method was sufficient to cover the topic. Despite the fact that a clinical-based topic was selected, the needs of VDPs may not be so much centred around knowledge, but rather application of knowledge. It is the perception that newly qualified dentists struggle to apply what they have learned in dental school to real-life practice [14]. This was confirmed in comments suggesting case-based scenarios or patient demonstrations as the preferred method of learning for the VDP. This is in accordance with growing research suggesting this type of learning (i.e., work-based learning or experience-based learning) as an effective gateway to clinical professions [15]. It is clear that in its current form the e-learning package evaluated may struggle to align with these needs. It may have been more appropriate to have video content of a patient encounter rather than a simulated post preparation and placement. Such a strategy may improve the perceived relevance to the VDP. The use of evaluations of e-learning packages is important. There is a plethora of e-learning interventions and establishing the technical elements that best suit the learner is important. The current evaluation has explored a single intervention in isolation. In accordance with Cook's [16] views, future research should be focused on comparing multiple e-learning interventions to each other. This would aid in determining the most appropriate e-learning tools/content for integration into VDP training.

The rationale behind the use of focus groups was to encourage interaction between participants that fosters a rich context capturing wider spectrum of views [17]. Feedback obtained from these discussions showed that VDPs are satisfied with their theoretical level of knowledge, and any e-learning intervention will be viewed as a supplement to their training. This was asserted, as a number of participants expressed their concerns whether e-learning will help them acquire experience in clinical skills. The VDPs recognised the added value of e-learning in allowing for individualised self-paced learning, but that clinical experience should be sought from their designated trainer. This was further expressed in the trainers' comments highlighting their role in providing one-to-one teaching as the main goal of DVT, and to tailor the training to the needs of their VDPs. Importantly, it was suggested that should e-learning packages be developed it would be important to approach VDPs first to obtain their opinions on what would be required. Both trainers and VDPs stressed the importance of the educational content to be led by VDPs and specific to their needs. This further translates into having topics that help them transfer into real-life practice environments. Their suggestions were e-learning packages on administrative topics or specific clinical topics that utilises experience-based learning strategies. In addition, technical design was also highlighted as a factor contributing to engagement and acceptability of an e-learning intervention. The suggestions included having a specific short interactive e-learning package with more multimedia and a navigation system.

One of the key findings of this study was that VDPs value the input of their trainers and advisors, and regardless of their positive views of e-learning, they were not keen to relinquish this face-to-face contact. Both view that the essence of DVT is established through the VDP-trainer relationship, and the ultimate goal of

producing a competent practitioner is through transfer of experience. Nevertheless, they welcome e-learning as a supplementary resource giving that it is supported by their program lead and advisors. This quality assurance of the delivered content was one of the main factors expressed in adapting an e-learning program. In addition, VDPs opinions showed that they will be more likely to accept and use an e-learning package upon the recommendation of people they trust such as peers or trainers. This could represent a barrier as trainers are reluctant to adopt e-learning methodologies in their training. They see that the hands-on training they provide is sufficient for their VDPs, and any more would be an overload to the already VDPs' demanding training program. Also, while trainers see the potential of e-learning applications, they personally are not fond of this method. This can be due to a number of factors, which according to their comments, may be due to a lack of technical literacy or that they are too set in their own ways to adopt a new teaching approach. This is not surprising, as literature points that both lack of technical skills and, more importantly, difficulty in recognising the pedagogical potential of e-learning are a major impairment in trainers/trainers adopting this approach [18].

Further research is warranted to investigate the effectiveness of e-learning in DVT. Quantitative studies may be useful, perhaps in calculating knowledge according to Kirkpatrick's model [19], however, well-conducted qualitative studies can provide more in-depth analysis specific to the subjects of such intervention. However, to truly assert this and evaluate a cohort's reaction to an educational intervention, qualitative research is suggested as a beneficial method to gain further insight of various perspectives [20]. This in theory, will allow stakeholders and the organising team of the DVT program to judge effectiveness and relevance of such interventions in their own setting.

Although the current study predates the COVID-19 pandemic, it has identified a set of guiding principles that can be applied in the development of E-learning packages to be implemented in DVT as a result of COVID-19. Multiple groups are currently in the process of creating material and the availability of the findings of this study will be instrumental in ensuring appropriateness of these packages. Furthermore, the presented study could serve as gateway for more organized research to investigate whether there is a place for e-learning in DVT and whether such an intervention could improve the training experience of the trainees. The integration of E-learning into DVT during the COVID-19 pandemic may serve as an opportunity to further explore these questions.

## Conclusions

Despite the lower numbers of volunteer participants, the findings of this study present a first insight into how e-learning is perceived in DVT. It appears that trainees and trainers are aware of the potential of e-learning. However, they do not feel that this approach suits the needs of the VDP or supplants the benefits of the trainee-trainer relationship and the teaching that occurs, especially in the transition to clinical practice from an undergraduate clinical environment. E-learning is perceived as an additional learning tool in DVT and that it provides no match for the availability of an experienced trainer. The main aim of DVT is for trainers to support their VTs' specific needs through a tailored training scheme. Nevertheless, an e-learning approach could still be welcomed if it is customised to VDPs needs and is it acts as a supplement to their training. Insight gained from this study may inform the design and delivery of E-learning packages

during the current/ongoing COVID-19 pandemic to ensure maximal benefits to VDPs.

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