

Learning clinical procedures through Internet visual resources: A qualitative study amongst undergraduate students

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Keywords

clinical skills; Internet; qualitative research; focus groups; dental education; medical education.

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Accepted: 19 February 2014

doi: 10.1111/eje.12099

Abstract

Objective: Acquiring competency in performing clinical procedures is central to professional education of healthcare providers. Internet visual resources (IVR), defined as visual materials openly accessible on public websites, provides a new channel to learn clinical procedures. This qualitative study aimed to profile the experience and opinions of undergraduate students (in dentistry, medicine and nursing) in learning clinical procedures through IVR.

Methods: From clinical degree programmes (Bachelor of Dental Surgery, Bachelor of Medicine, Bachelor of Surgery, and Bachelor of Nursing) of University of Hong Kong, 31 students were recruited to join six focus group discussions, which were transcribed and subjected to thematic analysis using inductive method, in which themes emerge from data.

Findings: Students actively looked for IVRs through various means and used them for pre-clinical preparation, post-clinical revision, learning simple and advanced procedures, exploring alternative and updated techniques, and benchmarking against international peers. IVRs were valued for their visual stimulation, inclusion of a wide variety of real-life cases, convenience in access, user-friendliness and time-saving features. Students tended to share and discuss IVRs with their peers rather than with tutors, even when contents deviated from school teaching or faculty's e-learning materials. When doubts persisted, they chose to follow faculty guidelines for examination purpose. Students were frustrated sometimes by difficulties in judging the scientific quality, lack of immediate interactive discussions and loosely structured presentations in some IVRs. Teachers' attitudes towards IVR appeared to vary greatly.

Conclusion: Despite the wide spectrum of experience and opinions, IVR was generally viewed by undergraduates from across clinical faculties as enhancing their clinical confidence and self-perceived competency, enriching their learning experience and serving as an important supplement to formal learning in the planned curriculum.

Introduction

Since the commercial Internet service began to emerge in early 1990s, there has been an exponential growth in Internet users (1). The number of Internet users in 2011 was estimated to be 2.7 billion, representing 39% of the world population (2). In developed countries, the percentage was as high as 77%. Internet has been instrumental in transforming the way we interact with the world and provided unparalleled opportunities for collaborative learning.

Internet was introduced for medical education purposes shortly after its advent (3). The complexity and breath of medical education content makes the usage of Internet sources a reasonable proposition. Web-based learning was found to enhance medical education in several ways, such as improving learners' satisfaction and learning outcomes (4–6), leading to significant cost savings (7), and helping meet the challenge of the global decrease in academic teachers (8).

Acquiring competence in performing respective clinical procedures is fundamental for the professional training of

healthcare providers. Students mainly acquired their clinical competency by observing and practising on mannequins and patients during instructor-led pre-clinical and clinical sessions. In addition, the incorporation of various visual aids, such as videotape, slides, posters and models, was found to be very useful in enhancing clinical learning (9–11). Such visual aids had already been widely used in the pre-Internet era. With the advent and proliferation of Internet, current generation of students are provided enormous opportunities to learn from the vast volume of online electronic visual materials, be it videos, animations, illustrations or photos showing the flow of the clinical procedures (12, 13). An international survey amongst health educational stakeholders in dentistry showed that various types of online learning tools, such as virtual reality with haptic devices, virtual learning environments, telecommunications and Rich Media, were widely used in institutions (14).

Students' modes of web-based learning are not limited to e-learning resources provided by their faculties (often not openly accessible to all) or prescribed by the teaching staff, but also include spontaneous information seeking through Internet, a learning style that is common and highly encouraged under the concept of self-directed learning (4, 12, 15). Whilst the former has been extensively investigated (4, 5), the impact of the latter on medical education is understood to a much lesser extent. As openly accessible Internet visual resources (IVRs) are voluminous, uncontrolled and often uncensored, they may foster or hamper students' acquisition of clinical competency in one way or another. It remains largely unknown how these resources shape students' learning experience and affect their learning outcomes.

This study aimed to profile the experience and opinions of undergraduate students in learning clinical procedures through IVR. IVR was defined as visual materials (e.g. videos, animations, graphic illustrations and photos) that were openly accessible on public websites. Pure text materials were not included. The e-learning materials provided by students' own faculties were not in the scope of this study. This was a qualitative research using focus groups for data collection. This method is exploratory and is particularly useful for a topic that has been hardly investigated (16). Focus groups allow researchers to capture a wide spectrum of views in rich context using informants' own words and gain in-depth understanding on the study topic.

Methods

Participants

This study targeted undergraduate students enrolled in three clinical programmes (dentistry, medicine and nursing) in the University of Hong Kong, which is the sole institution in Hong Kong dedicated to training dentists and is one of the main institutes providing degree programmes in medicine and nursing. Following the education reform in 2012, undergraduate programmes in Hong Kong's universities have been extended by a year. Students enrolled before that are under the 5-year Bachelor of Dental Surgery (BDS), 5-year Bachelor of Medicine and Bachelor of Surgery (MBBS) and 4-year Bachelor of Nursing (BNurs) programmes. The curricula in these three clinical

programmes are integrated, student-centred and inquiry-based to promote students' critical thinking skills and application of acquired knowledge (17–19). Early clinical contact is arranged in the first or second year. Clinical sessions gradually take up an increased proportion of their classes until their final year of studies, when attachments to different departments in various hospitals are organised.

The protocol of this study was reviewed by the Institutional Review Board of the University of Hong Kong. An ethical approval was obtained (Reference Number: UW13-020). For each degree programme, a junior year (BDS III, MBBS III and BNurs II) and a senior year (BDS V, MBBS V, BNurs IV) were selected and a focus group was formed. To be included in a focus group, a student should be proficient in Cantonese, the mother tongue of the overwhelming majority of students. Focus group participants were recruited by contacting class representatives or student bodies, who circulated our invitation to students and purposefully selected students with diverse backgrounds (i.e. gender, type of secondary school attended, acquisition of first degree, etc.) to join our study. Informed written consent was obtained from each participant. Each focus group participant received a coffee shop coupon valued HK\$50 (equivalent to EUR4.94).

Focus groups

Four to six students from each selected year level of each degree programme were invited to participate in a focus group. There were a total of 31 participants in six focus groups. This included six BDS III students, five MBBS III students, four BNurs II students, five BDS V students, five MBBS V students and six BNurs IV students. Each focus group was facilitated by a moderator and an assistant moderator who were trained on principles and methods for moderating a focus group. A focus group guide was prepared and followed. A mock focus group was organised for moderators to practise their facilitation skills and receive feedback. At the end of the mock session, moderators showed competence in facilitating a focus group, as shown in their skills of building rapport, remaining neutral and involved, active listening and probing and advancing the discussion. The focus groups were conducted in Cantonese. A researcher experienced in focus group facilitation was present in the first two focus group meetings. His feedback to the moderators was positive in general and some suggestions were made for fine-tuning the structure of the discussion.

The aim of the focus groups was explained to participants. The moderator adopted a neutral stance and emphasised to participants that there was no correct or wrong answers but only opinions and the purpose of the focus group was only to understand students' experiences and views. Students were also reassured that all opinions collected would be kept confidential and anonymous. During discussions, moderators encouraged all participants to share their experiences and express their views freely and ensured the discussion was not dominated by any particular member. Attempts were made by the moderators to maintain a positive group dynamic. Open-ended questions were asked to encourage elaboration and probe into details. Representative examples of such questions were 'What are the impacts of these online visual materials on your learning?'

'Would you like to share with us more what you experienced that time?' and 'What make you feel unsure about the trustworthiness of the online video?' To keep the discussions on course, participants were guided back towards relevant ideas if the discussion was sidetracked. The discussions were audio recorded with consent of the participants.

Transcription and thematic analysis

The six focus group discussions were transcribed *verbatim* and analysed by three of the authors (LMW, DYSC, XJL) through two rounds of line-by-line thematic coding. An inductive method was adopted (themes emerging from data), and the grounded theory approach was followed (20). The key elements that were relevant to the area of inquiry were identified and labelled by using either the informant's words (*in vivo* codes) or the concepts of our disciplines (*in vitro* codes). This process of open coding led to a clustering of substantive codes that had similar content into subthemes, which were subsequently grouped and organised under several main themes.

The group members strived to avoid being governed by their own pre-structured understanding and to maintain a self-reflecting attitude to ways in which the coding process could be influenced. To ensure reflexivity, competing explanations and alternative interpretations were taken into consideration throughout the analysis. Disagreement amongst group members existed in 5% of the codes and discussions took place until a consensus was reached. The key elements of each thematic category were described and illustrated by original quotes, *verbatim* excerpts, or illustrative examples drawn directly from the transcripts.

Findings

Five main themes were derived from the focus group discussions on students' learning experience with IVR, opinions towards IVR and their suggestions on using IVR.

Access to IVR

It was shared by students that their main method of searching was by typing the 'keywords' of the procedure into their favourite search engines or referring to relevant links to other videos uploaded by the same provider. 'I will actively search what I want by typing in keywords and see what comes up' (BDS III; Participant #2). 'When I see a good video, I will look for other videos under the same provider's name to see if he/she has other good videos' (BDS III; Participant #1).

YouTube was quoted as a main source of IVR. A few dental students said they could find IVR at 'blogs' of other dentists. Besides that, 'manufacturer's manuals' was one of the sources for learning clinical procedures, because they somewhat displayed the appropriate approach for carrying out the procedures with detailed illustrations and instructions. Some students were able to find IVR posted by other universities. Other sources included commercial advertisements, journals and continuing education websites.

Students selected videos based on the time of publication, the authority, their first impression and the length of the video.

Recently uploaded IVR showing updated practices was favoured. Students also considered the background of the author. A student mentioned that he was 'more confident in resources provided by universities' (MBBS III; participant #3). A nursing student chose videos 'by checking how many minutes it lasts' (BNurs IV; Participant #1).

Learning experience with IVR

A main format of IVR was videos containing clinical demonstration involving real patients. Other formats included 'animations' and 'step-by-step procedures' with clear photos and descriptions. The frequency of usage varied widely. Senior students seemed to use IVR less often as they 'can learn through regular practices on real patients' and 'would already be very familiar with it' (MBBS V; Participant #5).

Students tended to turn to IVR prior to performing a clinical procedure. One student shared that IVR mentally prepared her to carry out the procedure. 'It (IVR) allows me to mentally practise how to position the syringe and visualise what I will later perform in the clinic' (BDS III; Participant #1). Another student mentioned that watching these videos gave him a boost of confidence, 'For procedures that I have not performed before, or equipments I have not used before, I feel more confident in clinic after watching video demonstrations' (BDS III; Participant #4). Students also used IVR to refresh their memory about a procedure that was performed some time ago.

Some students mentioned that IVR was useful in learning certain simple clinical procedures that were meant to be self-learned and in learning advanced procedures that were not required at undergraduate level, as they believed this would benefit them after graduation. 'I mainly watch videos on procedures which are not taught in the simulation laboratory or clinic. For example, how to place a retraction cord and ortho-band' (BDS III; Participant #1). 'For those procedures I rarely do or have rare chances to see, like implant and sinus lift, I would like to watch these videos' (BDS V; Participant #2). IVR also served as a useful source for learning the diagnosis and management of rare diseases, which students may not have chance to see in real patients: 'The hospital is not able to support the bedside teaching of every medical condition, especially some rare diseases, and thus, these online resources provide a convenient mode of learning' (MBBS III; Participant #3). Some students used IVR for benchmarking against international peers by 'comparing the modes of learning between our and other universities' (MBBS V; Participant #3). Other reasons of using IVR include being inspired by clinical skills demonstrated by tutors and to learn up-to-date methods of performing some procedures.

Students' learning through IVR included some preventive procedures: 'It (IVR) clearly showed how to apply fluoride (an agent to prevent tooth decay), so that I could get it quickly and be reminded about some main points.' (BDS III; Participant #6). However, concerns were shared about using IVR for learning health counselling due to the cultural differences across countries: 'For learning counselling and interaction with patients, many videos were from overseas and may not be so useful because there are cultural differences' (MBBS V; Participant #2).

A major problem encountered by students during their usage of IVR was the discrepancy of contents from what was taught in class. Apart from discussing with classmates, some students mentioned that they would ask their teachers or clinical tutors to clarify the difference. Whilst a student had his hesitation to 'challenge the teachers' (MBBS V; Participant #3), some students shared that teachers were usually willing to explain to students if there were different ways of carrying out a certain procedure and why such differences existed (MBBS V; Participant #4). Some other students preferred to assess the content with their own knowledge: 'If he (the demonstrator in the video) can achieve a desirable result, I will respect him' (BDS III; Participant #5). Students tended to follow the school's guidelines for exam purposes. 'For exams, of course I'll follow the faculty's guide' (BNurs IV; Participant #6).

Another difficulty students encountered was uncertainty regarding the reliability of the sources and the contents. Several solutions were mentioned, including critically assessing the content based on principles learnt in school, confirming with tutors, referring to textbooks, and trusting videos that were released by sources with authority, such as some universities. One dental student mentioned that he would 'try out the clinical procedure, if the tutor allows' (BDS III; Participant #2). Some students would follow tutors' instruction and disregard IVR, whilst some suggested that they would 'look at the online comments' to determine the reliability of the resource (MBBS III; Participant #3).

Benefits and drawbacks of IVR compared with other learning resources

The main advantages of IVR included the visual impact and inclusion of real patient cases. Videos were considered more attractive than text materials as 'they contain demonstrations on a real patient, which is far more practical' (BDS V; Participant #4). Some students regarded IVR as a more interesting, less tiring and more efficient way of learning in comparison with reading texts:

'Text is too difficult to understand. Sometimes when I'm tired, I don't have the patience and energy to read. I feel that video images are more attractive' (BDS V; Participant #5).

'I will skip the text because it consumes lots of time. For example, learning a crown preparation procedure takes 20 pages in books, but watching a video only takes 2–3 mins' (BDS V; Participant #3).

Students were also able to re-access the videos any time at their convenience for revision purposes:

'Sometimes, I would watch it again before exam to be sure that I did not forget how to carry out some procedures' (MBBS III; Participant #5).

'It's very convenient because I can watch them even when I take public transport' (BDS V; Participant #2).

Nonetheless, students' views on IVR were not all positive. Students felt that the contents of IVR were of varied quality: 'Every video is different. Some are too simple, whilst some only show the first part of the procedure...and some don't mention key points that should be noted, but some are quite complete' (BNurs II; Participant #2). Some videos were

regarded as 'too long and not straight to the point' (BDS V; Participant #3).

Another limitations was that certain demonstrations in IVR were 'too idealistic and would not be encountered in real-life situations' (BNurs IV; Participant #4). Although students may refer to the online comments and discussions, a student was dissatisfied with the limited interaction whilst using IVR because he could not ask questions and get immediate and direct answers, whilst he would be able to do so during demonstrations by tutors (BDS III; Participant #6). Moreover, students pointed out that patient management skills were not taught in some IVR. 'The video does not teach you how to comfort or position the patient during alginate impression taking' (BDS III; Participant #5). Students also stated that the content of the videos may not be compatible with what was taught in their course as there were cultural differences: 'I think it's very difficult to apply the things learnt from the overseas videos' (BNurs II; Participant #2).

Role of IVR in clinical education

IVR was mainly regarded by students 'as a supplementary learning source, to reinforce the main stream clinical learning' (BDS III; Participant #5). Some students, however, felt that IVR would become increasingly popular and perhaps even become the major method of learning in the future. 'We have some lectures in which our clinical tutors play videos for teaching purposes. I think this way of teaching will gradually be accepted by the general population' (BDS III; Participant #3). A student worried that he is 'over-dependent on IVR' and sometime overlooked what he was taught at class (MBBS V; Participant #4).

Sharing IVRs with peers and teachers

Students had some concerns regarding sharing IVRs with their peers, because they believed that the sources might not be of authoritative order. 'Even when I shared IVRs with others, they would not bother because they did not trust the content of my source' (BDS III; Participant #5). Another student felt it was strange to recommend IVR to others. 'If people are discussing about the topic, then it is okay to share. Otherwise, it is very strange to ask people to watch the clinical videos. After all, people prefer someone to recommend them a good movie to watch in the cinema rather than online video for academic purposes' (BDS V; Participant #2). In circumstances when students shared, a common mode for sharing was via 'Facebook' where students of a cohort formed a 'group' to communicate amongst themselves or 'WhatsApp' through which students were closely connected using their mobile devices.

Students found that their tutors' and lecturers' opinions towards IVR varied. Some encouraged students to fully utilise IVR, even to the extent of using them in lectures. 'A lot of doctors encourage us to watch more of such videos on our own. In fact, some even play videos or search for animations during lectures' (BNurs II; Participant #1). On the other hand, some lecturers believed that attending laboratory sessions was sufficient and were indifferent towards the usage of IVR. 'They feel that we have done sufficient preparation by attending lab

sessions. As long as we can keep up with class lectures, they are okay with it' (BNurs II; Participant #1). Some teachers have some concerns about the source of materials: 'My teacher feels that, as a medical student, I should at least choose some reliable website such as medscape, rather than searching through public search engines.' (MBBS V; Participant #4).

Suggestions on incorporating IVRs into formal teaching

Students welcome the idea of their home faculties referring to IVR to produce videos on various clinical procedures. This ensures the trustworthiness of the content, and thus, students would be able to save time spent on searching for a provider that was up to standards. 'If the faculty provides videos, I would prefer videos with demonstrations on real patients' (BNurs IV; Participant #1). A fifth-year medical student suggested 'visual resources with higher resolution to be released by the faculty' and thought that 'this would aid in students' learning' (MBBS V; Participant #4).

Discussion

Whilst e-Learning has brought revolutionary changes to education of all levels worldwide, clinical students' exploration of e-resources is far beyond materials provided by their own faculties or those prescribed or recommended by their teachers. Their spontaneous search of resources in the unrestricted environment offered by Internet forms an important part of their self-directed learning. Investigation into this area could potentially shed light into the learning pattern of the current e-generation of students.

Our qualitative investigation into students' self-study practices showed that students not only used IVRs for understanding and reinforcing key clinical skills taught in the curriculum, but also resorted to it for learning simple procedures that were supposed to be self-learned or advanced procedures that were not introduced in detail at undergraduate level. IVRs were also used for benchmarking against international peers. This helps to break the isolation of learners, promote collaborative learning and form an online learning community. Such collaborative knowledge acquisition was also advocated in the dental educational initiative known as International Peer Review Project, which was funded by the U21 Health Sciences Group (21).

Our findings revealed both sides of the coin – students' approving views and their concerns on IVR. The advantages of IVR are in both learning enhancement and learning delivery. IVR is considered as a valuable addition that enhances students' self-perceived clinical competency, boosts their confidence in clinical practice and enriches their learning experience. IVR has opened a vast library of clinical materials to students. The availability of a full range of patient cases accommodates students' diverse learning needs and helps them meet the challenges in patient care. In learning delivery, IVR owns some unique features unmatched by other learning resources, such as universal accessibility, ease in updating content and hyperlink functions that permit cross-referencing to other resources. Students' self-exploration of IVR catalyses the shift towards a learner centred model that puts learners in control of their own learning and is in line with the

constructivist learning theory, where learners search and create their own knowledge bases (4, 6, 22).

Amidst many positive comments on IVR, students also raised some concerns, especially the difficulty in judging the scientific quality of IVRs. Some recent studies reviewing learning materials in Internet platforms, such as YouTube, also pointed out varied quality and the existence of questionable or misleading contents (23, 24). This calls for a need for the transforming role of educators from one of dispensing knowledge to one of guidance and support (6, 25). In addition, although e-learning is recognised for its advantage in forming interactive learning community, the communication is often asynchronous thus hinders fast exchange of question and direct and immediate feedback. On the other hand, the polarised attitudes of teachers towards IVR might have deterred some students from sharing and discussing IVR with teachers and clarifying over some controversial contents.

Cantonese was chosen as the language for focus group discussions, because it was the mother tongue of most university students in Hong Kong. Even for non-local students, because they need to communicate with patients, most of them were able to speak Cantonese. There was, however, a small number of non-Cantonese speaking students who were excluded from the focus groups, and their views were not profiled in this study. Although confidentiality, anonymity and neutrality were ensured, there may be a chance that some students tended to give some socially desirable answers in a focus group. However, as the topics discussed were not considered as sensitive, giving socially desirable answers might be relatively unlikely in this study. The highly diverse views and experiences students shared in the focus groups supported the participants' openness and willingness in sharing their thoughts. Transcripts of the focus group discussions were analysed using inductive method (i.e. themes emerging from data), to avoid the pitfalls of our own assumptions and ensured that the views were derived and interpreted from the participants' perspective.

Clinical faculties in the University of Hong Kong adopted student-centred, self-directed and inquiry-based learning system. Our findings may not be extrapolatable to some universities, especially those using traditional didactic teaching method. This study focused on profiling students' experience and opinions. Teachers' and administrators' perspectives on learning clinical procedures through IVR remain another interesting area to be explored in further studies.

Conclusions

Despite the wide spectrum of experience and opinions, IVR was generally viewed by undergraduates from across clinical faculties as enhancing their clinical confidence and self-perceived competency, enriching their learning experience and serving as an important supplement to formal learning in the planned curriculum.

Acknowledgements

We would like to thank students from three degree programmes (Dentistry, Medicine, and Nursing) for their participation. We are grateful to Dr Susan Bridge and Mr Samuel

Wang for their valuable feedback on our manuscript and focus group discussions, respectively.

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