Is there a place for e-learning in clinical skills? A survey of undergraduate medical students' experiences and attitudes

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Is there a place for e-learning in clinical skills? A survey of undergraduate medical students' experiences and attitudes

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Abstract

Background: e-learning is established in many medical schools. However the effectiveness of e-learning has been difficult to quantify and there have been concerns that such educational activities may be driven more by novelty, than pedagogical evidence. Where some domains may lend themselves well to e-learning, clinical skills has been considered a challenging area for online learning.

Aims: The aims of this study are to assess undergraduate medical students? perceived level of IT ability and accessibility, and attitudes towards e-learning in basic clinical skills education, compared to other teaching methods.

Methods: A self-administered questionnaire was developed to capture undergraduate medical students: (i) demographic details (ii) perceived level of IT ability and accessibility (iii) experiences and attitudes towards e-learning and clinical skills training. Responses were linked to student?s performance in a clinical skills OSCE.

Results: The majority of students reported good access to computers and the internet, both on and off campus and appear confident using IT. Overall students felt that e-learning had a positive impact on their learning of clinical skills and was comparable to other traditional forms of clinical skills teaching. Students who displayed deep learning traits when using e-learning, performed better in clinical skills OSCEs.

Conclusion: Undergraduate medical students value the use of e-learning in clinical skills education, however they vary in their utilization of such learning environments. Students rate e-learning just as highly as other traditional methods of clinical skills teaching and acknowledge its integration in a blended approach. Developers of clinical skills curricula need to ensure e-learning environments utilize media that encourage deeper approaches to learning.

Introduction

Over the last decade there has been considerable advancement in the use of technology in both medical education and the delivery of healthcare. With the potential of providing an efficient and economical learning environment, over a geographically dispersed campus, universities have placed considerable investment in the development of e-learning to help deliver undergraduate curricula (National Workforce Group 2006). E-learning has gained popularity in undergraduate medical education and is now well established in many medical schools (Greenhalgh 2001; Rajendran 2001; Cook 2005). The General Medical Council advocate the use new technologies to deliver teaching (General Medical Council 2003). Such technology-mediated learning has the potential to provide the learner with an educational environment whenever and wherever they desire (Broadbent 2002). Despite the widespread introduction of such learning technologies in medical education, their effectiveness on learning has been difficult to quantify (National Workforce Group 2006; Cook 2007). On a national level there is an apparent lack of a cohesive approach to e-learning in health care education

Practice points

- Medical students value the use of e-learning in their learning of basic clinical skills.
- Students appear to have the necessary skills and opportunities to access e-learning environments.
- Students vary in their use of e-learning.
- Developers of clinical skills curricula need to ensure e-learning environments utilize mediums that encourage deeper approaches to learning.

(National Workforce Group 2006). In a survey of UK medical schools there appears to be a variable uptake in the use of some e-learning mediums (Cook 2005). Concerns have also been highlighted that such educational activities may be driven more by novelty, than pedagogical evidence (Bates 1995; Cook 2007).

In order for learners to engage with e-learning, they require accessibility of relevant technologies and the appropriate IT skills. However a lack of such skills and inadequate

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technology provision have been identified as potential barriers to e-learning both for health care professionals and students (Childs et al. 2005; Cook 2007). To this end educationalists have been encouraged to evaluate the impact of e-learning in the medical setting and to develop an evidence base that can inform and shape future developments (Cook 2005; National Workforce Group 2006). The teaching and learning of clinical skills has been highlighted by the Association of American Medical Colleges (1998) and the General Medical Council (2003) as a key area for undergraduate medical education. It is necessary for students to have the opportunity to develop and improve their clinical skills in appropriate teaching environments (General Medical Council 2003). Where some domains may lend themselves well to e-learning, clinical skills has been considered a challenging area for online learning (Knutson et al. 2006).

The aims of this study are to assess undergraduate medical students' (i) perceived levels of IT ability, accessibility and availability during a clinical skills training module, (ii) experiences and attitudes towards e-learning and their development of clinical skills, (iii) attitudes towards e-learning in clinical skills education compared to other teaching methods and (iv) attitudes and experiences in the use of e-learning in clinical skills and their relationship with performance, if any, in a clinical skills Objective Structured Clinical Examination (OSCE).

Methods

Setting and participants

The study was conducted in the School of Medicine and Dentistry, at Queen's University Belfast (QUB). The undergraduate medical programme follows a five year integrated spiraling curriculum model. Second year medical students were invited to participate. Students attended a twelve week Introductory Clinical Skills Programme (ICSP) in their second year of studies, which was delivered in parallel with an integrated systems based course. Students received training in history taking, physical examination and performing basic clinical procedures. A blended learning approach was employed. Initially students practiced on simulated patients, mannequins and peers in a clinical skills laboratory. Following this they attended community and hospital based attachments to practice these skills on real patients. Students also had access to an e-learning environment in clinical skills, together with other on-line resources. They had access to online clinical skills videos, descriptive text with images, patient cases, moderated discussion forums, online assessment and online procedural/clinical skill check lists. On completion of this module students sit a ten station OSCE. The OSCE assessment comprised of history taking, physical examination and basic procedural stations.

Questionnaire design and deployment

A self-administered questionnaire was developed following a review of the literature and a focus group of medical educationalists, clinical teachers and medical students. It aimed to capture:

- respondents' demographic details.
- perceived level of IT accessibility, availability, ability, training and usage.
- experiences and attitudes towards e-learning and clinical skill training.
- attitudes towards e-learning compared to other methods of clinical skills teaching.

The questionnaire was reviewed by the authors for face validity and piloted on a sample of medical students and revised accordingly. Participants' responses were rated on a 5-point Likert scale ranging from $1 =$ Strongly disagree to $5 =$ Strongly agree.

On the completion of their ICSP module, during the academic year of 2006–7, students were consented and the questionnaire was distributed to the whole year group ($n = 304$). With students' permission, their total OSCE score was also recorded and linked to their responses.

Statistical analysis

Data from the questionnaire and OSCE scores were tabulated and analysed using SPSS 15.0 statistical software. Simple frequencies and descriptive statistics were used to analysis responses to the questionnaire. t-tests and multiple regression analysis techniques were used to investigate associations and relationships between variables.

Results

Two hundred and sixty nine completed questionnaires were returned giving a response rate of 88.5% (269).

Respondents' characteristics

The mean age of respondents was 20 years of age. Respondents' characteristics were comparable, in terms of *gender*, ratio of undergraduate:graduate entrants and whether they were UK nationals or from overseas–to the total undergraduate medical student population at QUB (see Table 1).

Table 1. Characteristics of survey respondents ($n = 269$) and comparison to total undergraduate medical student population ($n = 1121$) at Queen's University Belfast.

Characteristic	Valid% (n)	
	Survey respondents	Total medical student population at QUB*
Gender: Male	44.2 (119)	42.6 (477)
Undergraduate entry	91.8 (247)	93.0 (1042)
Overseas students[+]	4.8 (13)	5.8 (65)

Notes: *Data obtained from registration records of all five undergraduate years at School of Medicine and Dentistry, Queen's University Belfast (Academic year 2006–7). [+]Students from non UK or Southern Ireland countries classified as overseas students.

During term time, 76.6% (206) of students reported living in rental/university accommodation, with 23.4% (63) students living at home.

IT usage, accessibility, availability and connectivity

The vast majority of students (86.2%) either strongly agreed or agreed that they had good access to a computer while on the university campus (see Table 2). Two hundred and forty (89.2%) respondents reported having their own computer, of which 60.0% (144) owned a laptop and 40.0% (96) a desk top personal computer. Of the 10.8% (29) of students who didn't own a computer, 100% (29) of them were considering purchasing a computer, the main incentive cited was to aid their studies (62.1%). Of the 240 students who reported having a computer in their own accommodation, 99.6% (239) reported having internet connectivity. Of those students who reported having internet access, 92.1% (220) had broadband/high speed access and 7.9% (19) had dial-up. Only a small minority of students (3.3%) reported owning a personal digital assistant (PDA) but the majority of students had an MP3 player and/or a multimedia mobile phone (72.1%).

Students were asked to report their average amount of time per week spent online both for studying and for leisure purposes (see Figure 1). On average, students reported to have spent 3.9 hours per week online studying and 3.6 hours online for leisure activities. Though there was a small difference, the excess time spent online studying was not statistically significant (mean of excess hours spent online studying −0.13; sd 2.80, std error mean 0.17).

Perceived IT ability and training

Students were asked to report their overall level of using a computer and for individual IT applications (see Table 3). On the whole students reported confidence in their overall use of computers and for individual applications such as the internet, e-mail and media software. All students (100.0%) claimed that they received IT training both at University and in their secondary level education. However, the majority of students (70.6%) felt that the training they received in their secondary level education, was more relevant to them.

Experiences and attitudes towards e-learning and clinical skills learning

Students were asked about their experiences and attitudes towards e-learning in clinical skills. Table 3 summarizes their responses. Overall students felt that e-learning had a positive impact on their learning of clinical skills. The majority of students strongly agreed or agreed that e-learning encouraged them to attend clinical attachments (81.4%) and to go and practise their clinical skills on real patients (89.6%). The majority of students also felt that e-learning helped to standardize teaching (86.7%) and was particularly useful in terms of revision and exam preparation (95.9%). Just under a third of students (30.1%) strongly agreed or agreed that they reviewed e-learning material prior to their teaching sessions. It was interesting to note that the majority of students strongly agreed or agreed (84.0%) that e-learning encouraged them not to purchase recommended textbooks.

Students were asked to rate various e-learning mediums in terms of their usefulness for clinical skills learning (see Table 3). Overall online videos, images and online clinical

Table 2. Student responses to perceived level of IT usage, accessibility, availability and connectivity.

| Question	Responses% (n)
Reported satisfactory access to a computer on campus	
• Strongly agree	33.8 (91)
• Agree	52.4 (141)
• Neutral	7.1 (19)
• Disagree	6.7 (18)
• Strongly disagree	0.0 (0)
Access to computer in living accommodation?	
• Yes	89.2 (240)
• No	10.8 (29)
What type of computer do you own?	
• Desk top personal computer	40.0 (96)
• Lap top	60.0 (144)
If you don't own a computer are you considering buying one?	
• Yes	100 (29)
• No	0.0 (0)
If you don't own a computer and are considering buying one – what is your main incentive for doing this?	
• Leisure	13.8 (4)
• Studying	62.1 (18)
• Leisure and studying	24.1 (7)
If you own a computer – what type of internet access do you have in your living accommodation?	
• Dial up	7.9 (19)
• Broadband	91.7 (220)
• None	0.4 (1)
Do you own a personnel digital assistant (PDA)?	
• Yes	3.3 (9)
• No	96.7 (260)
Do you own an MP3 player and/or a multimedia mobile phone?	
• Yes	72.1 (194)
• No	27.9 (75)
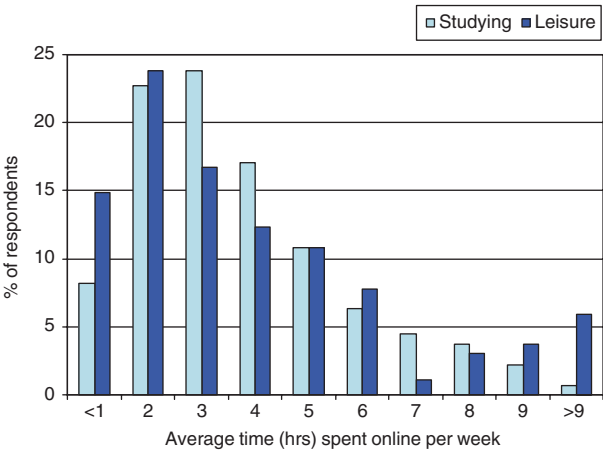
Figure 1. Respondents reported average time spent online (per week) for studying and for leisure purposes.

skill check lists appeared to be the most popular mediums among respondents. Moderated hyperlinks appearred not to be as popular with students in their learning of clinical skills.

Attitudes towards e-learning compared to other clinical skills teaching methods

Students were asked to report on their perceived level of usefulness of different methods of clinical skills teaching (see Table 3). Overall students felt that e-learning was comparable to other traditional methods of clinical skills teaching, such as clinical attachments, practice on simulated patients and mannequins. However, it was interesting to note only a minority of students (28.4%) either strongly agreed or agreed that textbooks were a useful medium in their learning of clinical skills.

Relationship between attitudes and experiences in the use of e-learning in clinical skills and performance in a clinical skills OSCE

Students' responses were compared to their performance in a clinical skills OSCE (Cronbach's α 0.8) (see Figure 2). A number of significant associations were observed (see Table 4). Those students who reported to have spent more time on-line studying rather than for leisure purposes were significant associated ($p < 0.01$) with a better performance in a clinical skills OSCE (see Figure 3a). Factor analysis demonstrated that students who reported (1) that they tended to reviewed e-learning material prior to learning, (2) Felt that e-learning encouraged them to see real patients and (3) found online videos of particular use–appeared to act as one domain. A Cronbachs α of 0.7 justified the internal consistency of this domain. This domain of attributes were significantly associated with a better performance in a clinical skills OSCE ($p < 0.01$)

Table 3. Students' responses to questionnaire regarding their experiences and attitudes towards the use of e-learning and their learning of clinical skills.

	% (n)					Mean categorical value
	1 Strongly disagree% (n)	2 Disagree% (n)	3 Neutral% (n)	4 Agree% (n)	5 Strongly agree% (n)	
Perceived IT ability						
• Overall I am confident using a computer	0.0 (0)	1.9 (5)	7.4 (20)	43.1 (116)	47.6 (128)	4.4
• I have good keyboard skills	0.0 (0)	3 (8)	13 (35)	41.6 (112)	42.4 (114)	4.2
• I am confident word processing	0.0 (0)	1.1 (3)	4.1 (11)	39.8 (107)	55.0 (148)	4.5
• I am confident using Power Point	0.4 (1)	4.5 (12)	11.5 (31)	42.0 (113)	41.6 (112)	4.2
• I am confident using e-mail	0.0 (0)	0.4 (1)	4.2 (11)	41.0 (110)	54.5 (146)	4.5
• I am confident browsing the internet	0.0 (0)	0.4 (1)	2.2 (6)	37.9 (102)	59.5 (160)	4.6
• I am confident using media software	0.0 (0)	6.7 (18)	17.8 (48)	36.1 (97)	39.4 (106)	4.1
Attitudes towards and experiences of e-learning and learning of clinical skills						
• Overall e-learning is useful in my learning of clinical skills	0.0 (0)	0.7 (2)	8.6 (23)	57.8 (155)	32.8 (88)	4.2
• I feel that e-learning encourages me to examine real patients	0.0 (0)	0.7 (2)	9.7 (26)	55.0 (148)	34.6 (93)	4.2
• I review e-learning material prior to my teaching sessions	7.1 (19)	27.9 (75)	34.9 (94)	34.9 (94)	8.2 (22)	3.0
• e-learning encourages me to attend clinical attachments	0.0 (0)	1.1 (3)	17.5 (47)	58.0 (156)	23.4 (63)	4.0
• I find e-learning useful for my assessment preparation in clinical skills	0.0 (0)	1.1 (3)	3.0 (8)	24.2 (65)	71.7 (193)	4.7
• e-learning improves standardization of teaching	0.0 (0)	1.9 (5)	11.5 (31)	45.4 (122)	41.3 (111)	4.3
• e-learning encourages me to purchase textbooks	8.9 (24)	35.7 (96)	39.4 (106)	14.1 (38)	1.9 (5)	2.6
Perceived usefulness of different e-learning media						
I find the following media useful in my learning of clinical skills:						
• Descriptive text	0.0 (0)	1.5 (4)	11.9 (32)	58.7 (158)	27.9 (75)	4.1
• Images	0.0 (0)	0.7 (2)	6.7 (18)	40.9 (110)	51.7 (139)	4.4
• Discussion boards	0.7 (2)	6.7 (18)	48.3 (130)	34.6 (93)	9.7 (26)	4.1
• Demonstration videos	0.0 (0)	0.7 (2)	5.2 (14)	37.5 (101)	56.5 (152)	4.5
• Online assessment	0.4 (1)	1.9 (5)	22.3 (60)	45.7 (123)	29.7 (80)	4.0
• Clinical skill check lists	0.4 (1)	0.7 (2)	10.4 (28)	41.6 (112)	46.8 (126)	4.3
• Moderated hyperlinks	1.1 (3)	4.8 (13)	42.8 (115)	42.4 (114)	8.9 (24)	3.5
Perceived usefulness of different methods of learning clinical skills						
I find the following useful in my learning of clinical skills:						
• e-learning	0.0 (0)	0.4 (1)	3.3 (9)	54.6 (147)	41.6 (112)	4.4
• Use of simulated patients	0.0 (0)	0.0 (0)	2.2 (6)	33.1 (89)	64.7 (174)	4.6
• Hospital attachments	0.4 (1)	2.2 (6)	13.4 (36)	30.1 (81)	53.9 (145)	4.4
• Mannequins and simulated models	0.0 (0)	3.7 (10)	12.6 (34)	55.0 (148)	28.6 (77)	4.1
• Community attachments	0.4 (1)	3.3 (9)	7.1 (19)	38.3 (103)	50.9 (137)	4.4
• Clinical skills laboratory	0.0 (0)	0.0 (0)	2.2 (6)	38.3 (103)	50.5 (160)	4.6
• Text books	2.6 (7)	15.6 (42)	53.5 (144)	21.6 (58)	6.7 (18)	3.1

(see Figure 3b). Those students who reported finding on-line check lists more useful than other e-learning mediums, performed significantly worse ($p < 0.01$) in their OSCE (see Figure 3c). No other responses were found to be significantly associated with performance in a clinical skills OSCE.

Discussion

Our results suggest that undergraduate medical students value the use of e-learning in their clinical skills studies, however students vary in their approach to and utilization of such learning environments. It appears that students rate e-learning just as highly as other traditional methods of clinical skills teaching and acknowledge its integration in a blended approach to teaching.

Modern undergraduate medical education aims to provide an environment that promotes deep learning. Through e-learning, students have the chance to experience an increased number of new learning mediums. However there have been concerns that e-learning may not consistently facilitate effective learning (Bates 1995; Cook 2005; National Workforce Group 2006; Cook 2007). Evidence would suggest

that students learn more effectively, when a deep rather than a superficial approach is taken (Newble & Entwhistle 1986; Newble & Hejka 1991; Rhem 1995; McManus et al. 1998). Our observations would also suggest that those students who display traits associated with deeper learning of clinical skills, when using e-learning, performed better in clinical skills OSCEs; namely those students who reported spending more time using e-learning, engaging in e-learning prior to teaching and who are encouraged by it to examine real patients. Furthermore, for effective learning to take place, learners need the opportunity to discuss and reflect on what they have learnt. Students rated both on-line assessments and on-line discussion boards highly, the latter offer learners the opportunities to interact with their peers and teachers, and to reflect on what they have learnt. When students adopted a more superficial approach to learning, effective learning seldom takes place (Rhem 1995; McManus et al. 1998). We found that those students who favoured a more superficial approach to learning, by using on-line check lists, did not perform as well in OSCEs. Deep and superficial traits are regarded as not
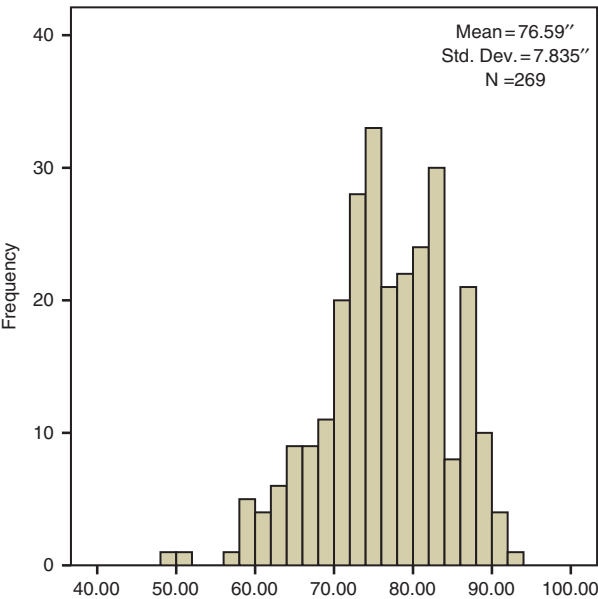
Figure 2. Distribution of student's scores in a clinical skills OSCE that was used to compared responses to questionnaire.
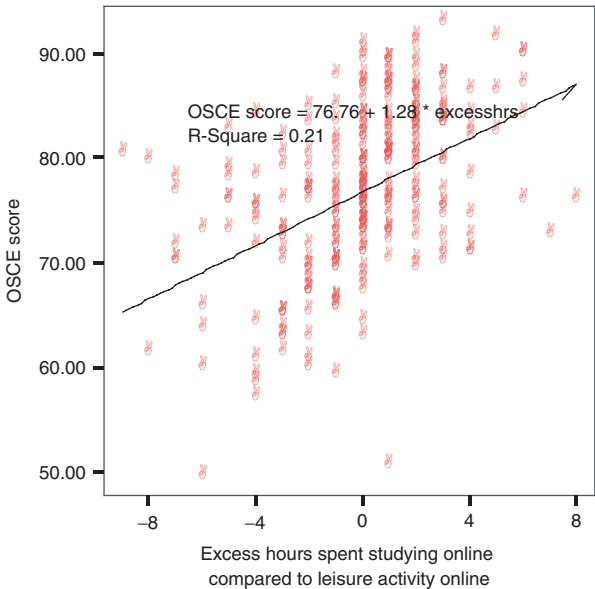
Figure 3a. Scatterplot of relationship between students reported excess hours spent studying online compared to time spent online for leisure activities, and performance in a clinical skills OSCE.

Table 4. Observed relationships between students' responses about e-learning in clinical skills and performance in a clinical skills OSCE.

| Variable	Mean 95% CI	t	Sig	95% Confidence interval for B	
				Lower bound	Upper bound
Difference in hours spent 'online studying' compared to hours spent online for 'leisure purposes'	0.63	4.45	<0.01	0.35	0.91
I review e-learning material prior to my teaching sessions	0.23	8.77	<0.01	0.18	0.28
I feel that e-learning encourages me to examine real patients					
I find online demonstration videos useful in my learning of clinical skills					
I find online check lists useful in my learning of clinical skills	−3.10	−6.14	<0.01	−4.10	−2.11
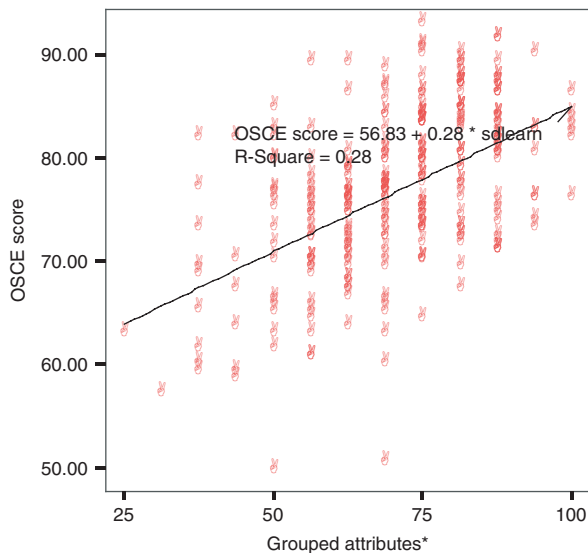
Figure 3b. Scatterplot of relationship between grouped student attributes* and performance in a clinical skills OSCE. (1. Reviewed teaching material prior to teaching. 2. Felt that e-learning encourage them to examine real patients. 3. Found online clinical videos of particular use in learning of clinical skills) and performance in a clinical skills OSCE * Grouped attributes of (1) *Reviewed teaching material prior to teaching,* (2) *Felt that e-learning encourage them to examine real patients* and (3) *found online clinical videos of particular use.*

Figure 3c. Scatterplot of relationship between those students who found online checklists of particular use and performance in a clinical skills OSCE.

being stable traits, and have been shown to be influenced by curriculum design, delivery and assessment (Rhem 1995; Spencer & Jordan 1999). Therefore developers of e-learning environments need to understand how people learn in order to design methods that interact with students and encourage deeper approaches to learning. Clinical skills such as physical examination and procedural skills are visually intensive subjects. Results presented here would indicate that students highly rated on-line videos and images. Students who valued these mediums the most performed better in clinical skills OSCEs.

The clinical encounter is at the heart of clinical skills learning. Ultimately students need to transfer their skills from the simulated environment to the patient's bedside. However one concern regarding e-learning is the potential isolation of the learner (McKendree 2006). As with other studies, our results would suggest that learners not only want to engage with e-learning but also with other modalities of teaching in a blended approach (Ravenscroft et al. 1998) A systematic review identified barriers in the effective utilization of e-learning (Childs et al. 2005). They highlighted that delivery of a blended course, with access to e-learning, may provide one solution for a more effective learning experience. Our findings would also suggest that students who valued e-learning were promoted by its use to attend clinical attachments and examine real patients. Furthermore our data also indicated that clinical skills textbooks are not as popular as e-learning. An obvious advantage of e-learning is that it has the potential to interact with the learner and can be easily updated without needing to wait for
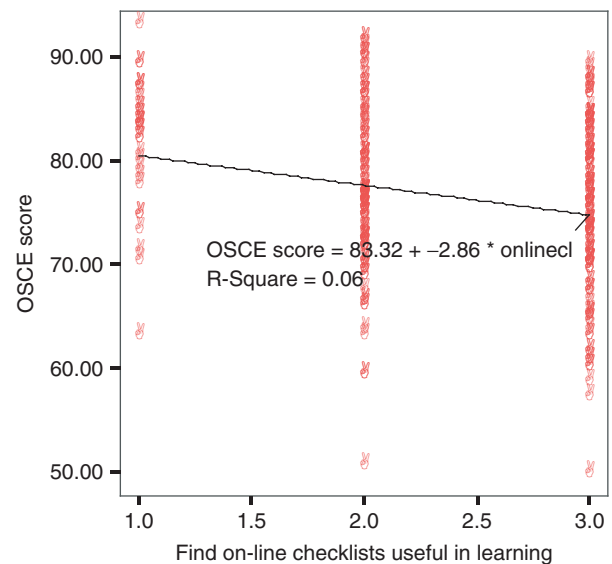
the next publication. Conversely text books have the potential for variable content and do not provide an interactive environment for the learner (Stuyt et al. 2003).

As highlighted by the General Medical Council (2003), a prerequisite for the engagement of the learner in e-learning is that they should have access to the appropriate technologies and acquire the necessary IT skills. Where other studies have reported a lack of IT ability and access as potential barriers to e-learning, it is our experience that medical students are confident in using IT technologies and have adequate access to computers both on and off campus (Greenhalgh 2001; Childs et al. 2005; Cook 2007). Our data would also suggest that junior medical students value considerably their IT training gained in secondary level education, prior to entering medical school.

Limitations of our study include the validity of our questionnaire. Our questionnaire was designed and piloted by medical educationalists, clinical teachers and students, and then reviewed by faculty for face validity. However, it is a new questionnaire and has not been validated by prior research. While we achieved an excellent response rate, our sample only represented a cohort of junior medical students. Our results may not be generalisable due to variation in medical schools' curricula and student demographics. Previous studies have aired concerns about the difficulties related to internet access. The majority of students in this study reported high levels of fast speed internet access, which may not be generalisable to other regions. Northern Ireland was the first region in Europe to have total broadband availability, which may be a contributory factor to such high levels of connectivity (Department of Enterprise, Trade and Investment 2006). Quality outcome measures in medical education are notoriously difficult to quantify and performance in an OSCE may not reflect true levels of clinical performance. Furthermore, different institutions may use different e-learning packages, both in terms of layout and content.

In conclusion, we believe that the findings from this study place another piece in the complex jigsaw of evidential based e-learning. Further research is required to explore how pedagogical design can affect the effectiveness of e-learning in clinical skills. In our experience, medical students value the role of e-learning in clinical skills education and appear to have the necessary skills and opportunities to access such learning environments. e-learning appears to be a useful tool in the learning of clinical skills, how learners approach and use such learning environments varies. Developers of clinical skills curricula need to ensure they design e-learning environments that utilize mediums which are learner centred and encourage deeper approaches to learning.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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