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WEB PAPER

The role of blended learning in the clinical education of healthcare students: A systematic review

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Abstract

Background: Developing practice knowledge in healthcare is a complex process that is difficult to teach. Clinical education exposes students to authentic learning situations, but students also need epistemological access to tacit knowledge and clinical reasoning skills in order to interpret clinical problems. Blended learning offers opportunities for the complexity of learning by integrating face-to-face and online interaction. However, little is known about its use in clinical education.

Aim: To determine the impact of blended learning in the clinical education of healthcare students.

Methods: Articles published between 2000 and 2010 were retrieved from online and print sources, and included multiple search methodologies. Search terms were derived following a preliminary review of relevant literature.

Results: A total of 71 articles were retrieved and 57 were removed after two rounds of analysis. Further methodological appraisals excluded another seven, leaving seven for the review. All studies reviewed evaluated the use of a blended learning intervention in a clinical context, although each intervention was different. Three studies included a control group, and two were qualitative in nature. Blended learning was shown to help bridge the gap between theory and practice and to improve a range of selected clinical competencies among students.

Conclusion: Few high-quality studies were found to evaluate the role of blended learning in clinical education, and those that were found provide only rudimentary evidence that integrating technology-enhanced teaching with traditional approaches have potential to improve clinical competencies among health students. Further well-designed research into the use of blended learning in clinical education is therefore needed before we rush to adopt it.

Introduction

Clinical education is an important component of any healthcare curriculum, with exposure to patients in clinical settings creating an environment for clinical practice that cannot be replicated in a classroom (Baldry-Currens & Bithel 2000). However, clinical practice is also challenging as the healthcare practitioner must review and re-prioritise poorly defined clinical problems in an enterprise of active interpretation during the management of the patient. In addition, this tacit understanding of practice knowledge is often contextualised within the language and norms of the profession and can therefore be obscured to the undergraduate student (Higgs et al. 2004). Another challenge in the domain of clinical education is the difficulty in providing student support that facilitates the development of clinical reasoning skills (Tan et al. 2010). It has been suggested that clinical practice can be developed through sharing knowledge and experiences within a collegial environment. This enables external knowledge to be internalised, develops problem-solving strategies and promotes critical reflective thinking by challenging unshared biases and presuppositions (Jaques 1991; Mason 1998; Hanco 1999, cited in Welch & Dawson 2006, p. 231).

Practice points

- Clinical education is complex and requires a multi-faceted approach to address the many needs of students.
- Blended learning may have some potential to enhance the development of a range of clinical competencies among healthcare students.
- There is a need for well-designed, well-described studies into the use of blended learning in clinical education, especially in developing countries.

Today's healthcare graduates must not only possess the technical skills necessary to practice but must also be proficient in other competencies that impact on their professional practice. This includes an awareness of their own attitudes, values and responses to health and illness. In addition, they must also be able to educate others effectively, critically evaluate their own professional practice and have good communication skills. Other competencies include clinical reasoning and an ability to articulate the rationale behind patient management (Higgs et al. 1991). If the development of these competencies is to be effective, clinical

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education needs to facilitate ongoing reflective practice which could be used by students who become health professionals for their ongoing lifelong learning. In addition, educators should seek to establish 'mutually beneficial' relationships with students, and place a greater emphasis on the relationship between theory and practice (Strohschein et al. 2002).

Although the importance of clinical education is widely acknowledged as being important, there is a lack of evidence for evaluating its process, as well as about the effects of new models or approaches. Many models of clinical education currently exist, including mentoring, collaborative, shared responsibility, combined collaborative and peer tutoring.¹ Currently, no model of clinical education is superior to any other and studies that did recommend one approach to another were not methodologically strong (Lekkas et al. 2007). In order to better understand the process and outcomes of clinical education, there is a need for research that evaluates the relationships between educators and students, the variability of the process and the role of reflection within the clinical setting (Strohschein et al. 2002). Any approach to teaching clinical practice must therefore take into account its complex and varied needs. A blended approach to clinical education may have the affordances to address some of this complexity and variation.

Blended learning refers to the systematic integration of online and face-to-face engagement to support and enhance meaningful interaction between students, teachers and resources (Garrison & Kanuka 2004). Using principles of adult education, blended learning allows for greater flexibility and responsiveness in the teaching and learning process (Lewin et al. 2009). In addition, the integration of online instruction has been shown to overcome the limitations of time and space, support instructional methods that are hard to achieve using textbooks and reach a larger number of students without increasing resource requirements (Gray & Tobin 2010). The integration of technology into pedagogy has the potential to facilitate flexible, learner-centred teaching, encourage interaction among students and staff and enable them to collaborate and communicate asynchronously (Ellaway & Masters 2008).

It is important to note, however, that blended learning is highly context-dependent and that the generalisation of concepts across disciplines is challenging (Harris et al. 2009). Thus, a successful implementation of blended learning in one domain does not necessarily mean that it will have value within another domain. Although blended learning makes use of computers and the internet, it should be remembered that the focus should not be on the technology. Rather, the educator must first determine the best way to teach a particular topic and then determine how technology might enhance the teaching (Laurillard 1993). Furthermore, while an innovative approach to clinical teaching may be effective, it also requires a cultural change in teaching practice, which has implications for its effective implementation (Gray & Tobin 2010). The aim of this systematic review was therefore to determine whether a blended approach to teaching and learning in clinical education has the potential to enhance the clinical competencies of healthcare students.

Review question

A specific, targeted review question was formulated identifying the population, intervention and outcomes that the review would evaluate (Khan et al. 2001). The population included allied health, medical or nursing students and the intervention was the implementation of a blended learning strategy in clinical education. The outcome measure was any change in the components of clinical education that had been identified in the preliminary literature review. These included reflective practice, lifelong learning, mutually beneficial relationships, enhancement of the clinical experience, application of theory to practice, teamwork, self-appraisal skills or a re-framing of existing knowledge with a subsequent impact on practice.

Review question: What is the impact of a blended learning approach on healthcare students' clinical competencies as part of clinical education?

Method

Inclusion criteria

The search parameters included full-text articles published in English between 2000 and 2010 and incorporated studies that both supported and did not support the use of blended learning, in order to reduce publication bias. It included cohort and case studies which used quantitative, qualitative and mixed methods. Search terms were chosen after a preliminary review of relevant literature yielded commonly used words and phrases, which were finalised after consultation with an experienced researcher and clinical educator (Table 1).

The search was conducted in three parts. Initially, publications were retrieved from selected electronic databases (Academic Search Premier, CINAHL and MEDLINE), print journals (via JSTOR) and published conference proceedings. When available, the 'related research' option within each database was consulted. The next search made use of Google, Google Scholar and Mendeley, a socially constructed research database, in order to identify relevant articles that existed outside of the previously identified databases. The last stage included scrutiny of the reference lists of the collected articles in order to identify additional studies that fit the inclusion criteria. When the titles of the articles were not sufficiently descriptive to make a decision, the abstracts were consulted.

The preliminary review indicated that many studies were conducted on cohorts of students via surveys that used quantitative, qualitative and mixed methods, as well as individual case studies. Once all articles have been collected,

Table 1. Key search terms and related synonyms.

Educational field	Approach to teaching and learning
Clinical education	Blended learning
Medical education	Computer-aided instruction
Nursing education	Computer-aided learning
Health education	Integrated learning
	Hybrid learning
	Multi-method learning

the first author conducted an initial screening to ensure that only relevant studies were included in the critical appraisal. Then, a second screening was conducted with the second author with the same objective. The methodological quality of studies was determined independently by the two reviewers using quantitative, qualitative and mixed method critical appraisal tools to exclude poor quality studies. Finally, a self-developed data extraction form was used to extract the data from the studies, using criteria that were determined prior to the data extraction.

Data were analysed using a narrative format according to pre-determined themes that had emerged from the preliminary literature review. The themes included the design of the study, presence of a control group, description of the sample and intervention and the clinical competencies and results.

Results

A total of 71 articles were retrieved during the keyword search. The first round of screening by the first author excluded 47 studies on the basis of not meeting the inclusion criteria and student learning outcomes identified in the preliminary literature search. Another round of screening with the second author excluded an additional 10 studies on the same basis. Thus, 57 articles were excluded during two rounds of analysis, the reasons for which are presented in Table 2.

This left a total of 14 studies that were eligible for the critical appraisal of methodological quality by the author and second reviewer, of which seven were excluded. These are presented in Table 3.

Table 4 presents the final seven studies that were selected for the review, following the critical appraisal.

Of the seven studies described in Table 4, only two contained details of the ethical considerations of this study.

Table 2. Reasons for excluding retrieved studies during the initial analysis ($n = 57$).

No.	Reason for exclusion
24	Blended learning was used in healthcare education, but not in a clinical setting
26	Intervention was described as blended learning or an appropriate synonym, but was not a true blend, i.e. the intervention was not integrated with clinical activities
7	Study discussed or mentioned blended learning but was evaluating something else

Table 3. Reasons for excluding studies based on methodological quality ($n = 7$).

No.	Reason for exclusion
3	Outcome measures not identified, poorly described or not valid/reliable
1	Limited literature review and/or background
3	Sample poorly described
4	Study design, intervention or methodology was not clear
1	Conclusions not supported by results

Note: Certain studies were excluded for multiple reasons, which is why the total is higher than 7.

Discussion

Sample

The samples consisted of healthcare students across a range of disciplines, including physiotherapy, medicine, nursing, social work, occupational therapy, pharmacy and paramedics. Thus, the results of these studies indicate that blended learning has been explored across many disciplines in healthcare, which may have implications for healthcare educators looking to integrate technology into their teaching practices. Sample sizes were small throughout, ranging from 51 to 88 participants, making generalisation of results across different domains challenging, if not impossible. While these numbers are low, it would be difficult to increase the samples by any substantial figure, since most of the interventions were implemented among single classes of students within single institutions.

Location

The studies were conducted in the UK (2), the USA (2), Canada (1), Australia (1) and South Korea (1). Students in these developed nations could generally be expected to have access to the necessary technical infrastructure that makes blended learning a feasible option. However, as was highlighted earlier, blended learning is highly context dependent (Harris et al. 2010), making it difficult to generalise results between populations and geographical location. The lack of evidence of a blended approach to clinical education in developing countries may be an indicator of some of the challenges associated with technological innovation in areas with poor infrastructure. Indeed, epistemological and physical access to technology has been highlighted as a major challenge in the implementation of technology-enhanced teaching and learning practice in developing countries (Czerniewicz & Brown 2005).

Study design and evaluation of interventions

A range of study designs were used, with and without control groups, indicating a variety of methods to determine the efficacy of the blended learning approach. These included quantitative, qualitative and mixed research methods that sought to identify which of the clinical competencies had been met. Again, the variety of methods used indicates the prominence of context in determining how interventions were implemented and evaluated. While three of the studies in this review included comparative evaluation with a control group, it has been suggested that evaluating the effectiveness of blended learning must go beyond a mere comparison with traditional approaches. Instead, research into blended learning should focus rather on exploring different blends of effective approaches, tools and technologies (Ayaia 2009). In this sense, current studies may be emphasising the wrong aspects of blended learning. Instead of using computers in a more traditional approach, educators may need to shift their focus towards redesigning curricula to take advantage of technology-enhanced teaching and learning. The diversity in

Table 4. Data extraction from selected articles ($n = 7$).

Study	Control	Sample and duration	Intervention and evaluation	Competencies (study aims) and results
Carbonaro et al. (2008)	Yes, BL and F2F	Medical, Dental, Dental Hygiene, Medical Laboratory Science, Nursing, Nutrition, Occupational Therapy, Pharmacy, Physical Therapy students. A total of 23 students in 'blended' group, 28 students in F2F group Country: Canada Duration: n.d. 81 social work students Country: UK Duration: September 2007–March 2008	Intervention: Blended synchronous (VoIP, Eliminate)/asynchronous interaction using (interactive whiteboard, IM, voice) and WebCT (course and content management) Evaluation: Pre- and post-intervention, using a survey among volunteers	Competencies: Inter-professional team process skills (knowledge, skills, attitudes), team dynamics, team decision-making, conflict resolution, reflection Result: No significant difference between BL and F2F groups
Cooner (2010)	No	88 physical therapy students Country: UK Duration: January–March 2002	Intervention: Online lectures delivered via WebCT, along with links to further resources, video case studies, small group discussion, online and hardcopy workbook Evaluation: (1) survey and (2) focus group discussions with two randomly selected groups of nine people	Competencies: Development of reflective skills Result: No difference in marks compared to previous years, but presentations demonstrated better reflective analysis and deeper theoretical understanding
Davies et al. (2005)	No	73 randomly selected paramedics from local municipalities, attending classes on stroke education and clinical competencies Country: USA Duration: January–October 2000	Intervention: Lecture session initially with video and small group discussion, then IT practical sessions, access to video on CD, which were linked to WebCT and had MCQ for individual formative assessment Summative assessment also online Evaluation: Focus groups and open-ended, semi-structured interviews	Competencies: Develop neurological observational skills, which aspects had helped prepare/hinder them in preparation for clinical placement Result: The combination of traditional group-based activities, practical sessions and computer-based tools helped students to bridge the gap between theory and practice
Gordon et al. (2005)	No (self-control with pre-test)	41 medical students and 9 in the control group Country: USA Duration: January 2002–July 2005	Intervention: Lectures and interactive instruction (small group discussion/practical sessions), then video case scenarios and review in instructors, final evaluation in game show format Evaluation: Pre- and post-intervention, using a MCQ questionnaire	Competencies: Case scenarios to evaluate knowledge of stroke, skills evaluation, history taking, neurological examinations, communication skills Result: Led to improved knowledge and clinical competencies such as history taking, patient examination, reporting and patient management
Lewin et al. (2009)	Yes	26 nursing students in the blended learning group and 24 in the F2F group Country: Korea Duration: 21 February 2004–23 November 2004	Intervention: Four interactive online modules that augmented clinical learning. The online environment allowed students to interact with virtual patients and objects, e.g. SOAP notes, medical folders, patient handouts Evaluation: Post-intervention survey using Likert scales and free text responses	Competencies: Documentation skills, complex patient interactions, case studies and patient education Result: Students better understood relationship between theory and practice in real-world clinical scenarios
Sung et al. (2008)	Yes (BL with e-learning component and F2F lectures only)	Eight groups of 9–10 final year physiotherapy students. A total of 83 students participated in the blogging assignment, 45 students had their posts coded and evaluated Country: Australia Duration: February–December (no year)	Intervention: Web-based e-learning programme that included components on clinical cases, medication administration and relevant content Evaluation: Pre- and post-test (one immediate and one after 6 months)	Competencies: Self-efficacy, medication administration and knowledge of medication Result: Knowledge and self-efficacy improved more in the BL group
Tan et al. (2010)	No	Workshops, handouts regarding blogging. Each student had to write one original reflection per week, and to comment on two other reflections per week Evaluation: Qualitative study using reflective blog posts as primary data	Intervention: All students allocated to blogging groups, workshops, handouts regarding blogging. Each student had to write one original reflection per week, and to comment on two other reflections per week Evaluation: Qualitative study using reflective blog posts as primary data	Competencies: Clinical reasoning during clinical placements Result: Blogging is a viable tool to facilitate clinical reasoning and metacognition through peer learning strategies while on clinical placement

Notes: BL, blended learning; F2F, face-to-face; IT, information technology; MCQ, multiple choice questions; SOAP, Subjective, Objective, Action, Plan notes; VoIP, Voice over Internet Protocol (e.g. Skype).

scope of blended learning interventions further emphasises the challenges of research in this area, and highlights the need for more well-designed studies that look at the long-term effects of these changes in teaching practice.

Interventions

None of the interventions used in any of the studies were alike. Interventions included the use of a range of technologies, all used in different ways to enhance and expand the clinical experiences of healthcare students. In some cases, the individual technologies were mentioned specifically, and these included Voice over Internet Protocol, interactive whiteboards, course management systems, online lectures, video on CD, online multiple choice questions (MCQs) and blogs. However, not all of the technological interventions were well described, with some studies leaving out essential details making it difficult to replicate these studies in other areas and domains. The face-to-face components of the blended approaches included lectures, small group discussion, completion of workbooks, practical sessions and game show formats for evaluation. These results showcase the range of environments and contexts in which blended learning was implemented and highlight the many different approaches that could be used. Even though there are many different approaches to implementing blended learning, it should be remembered that the primary emphasis is not on specific tools that should be used. Once the learning outcomes of the module have been selected, the tools should be chosen that best facilitate the achievement of those outcomes. Indeed, '... a mix of teaching and learning methods will always be the most efficient way to support student learning' (Laurillard 1996). Blended learning in clinical education may therefore be an appropriate method of using technology to implement custom interventions designed to address specific gaps in students' repertoire of clinical competencies.

Clinical competencies

In all but one of the studies, results showed some measure of improvement in students' competencies, including reflective thinking skills (Cooner 2010), clinical skills, e.g. history taking, examination, reporting, documentation and patient management (Gordon et al. 2005; Lewing et al. 2009), self-efficacy (Sung et al. 2008) and clinical reasoning (Tan et al. 2010). In addition, two studies suggested that using a blended approach helped students to bridge the gap between theory and practice in clinical scenarios (Davies et al. 2005; Tan et al. 2010). There is thus evidence (if only on a small scale) to suggest that a blended approach to clinical education does have potential in addressing the highly contextual, complex needs that are essential to be fulfilled if healthcare graduates are to perform competently in clinical practice.

Ethical considerations

It is a concern that of the seven articles in this review, only two contained details of the ethical considerations undertaken by the researchers. With an increasing emphasis on the ethical

treatment of human subjects in research (Medical Research Council 2001), the lack of attention to reporting on this fundamental component of research seems to be problematic. It is recommended that authors engaged in student research ensure that they not only conform to ethical research protocols but that they include the details in their reporting.

Limitations

While every attempt was made to incorporate as much of the current evidence as was available, only a limited number of articles could be found for this review. However, owing to the rapidly developing field of technology and the emergence of blended learning as a versatile and flexible approach to teaching and learning, it is likely that publications already exist that would enhance or challenge the results of this review.

Conclusion

There is limited research available on the appropriate use of technology-enhanced learning environments as part of a blended approach to the clinical education of healthcare students. However, in the small number of studies that looked at the development of students' clinical competencies as a result of implementing a blended strategy, there was some evidence of improvement demonstrated. This did not always manifest in better grades but did address clinical competencies that were highlighted as being important for the development of practice knowledge, including improved reflective skills and clinical competencies, clinical reasoning and bridging of the gap between theory and practice. This limited pool of evidence therefore suggests that there may be practical benefits to further explore the use of blended learning in clinical education among healthcare students. However, owing to the lack of depth in the literature, broad claims of improvement are difficult to make. The results of this review indicate that further research in this area is necessary before educators make assumptions about the long-term effects of blended learning in clinical education.

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innovative pedagogical practices in higher education including the affordances of educational technologies to improve teaching and learning.

Note

1. For additional explanation of each of these approaches, see Lekkas et al. (2007) and Stroschein et al. (2002).

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