Clinical education

The effectiveness of web-based learning in supporting the development of nursing students' practical skills during clinical placements: A qualitative study

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ABSTRACT

Web-based learning, on its own or in combination with traditional teaching methods, has become a consolidated practice in many countries, and has been described as a valid and effective method that supports practical learning in undergraduate nursing students.

The aim of this study was to explore the perception and effectiveness of web-based learning in facilitating the development of clinical skills in undergraduate nursing students. A qualitative descriptive study was conducted including online videos in three nursing schools of a university in Northern Italy. The participants were 26 undergraduate nursing students. A dedicated website was built including four videos and the respective checklists of four nursing techniques: insertion of a urinary catheter; insertion of a nasogastric tube; taking a blood sample; and the insertion of a peripheral intravenous line. Three Focus Groups were conducted, one for each nursing school. Thanks to its ease of use and unlimited access, web-based learning effectively supported students' clinical learning process by offering additional virtual visual support. Web-based learning could be effectively used to reduce the gap between theory and practice, and even as an upgrade for already qualified nurses.

1. Introduction

Various studies report that the time undergraduate students spend in class reduces the time spent in clinical placements, and consequently in learning practical skills (O'Connor et al., 2015). The acquisition of clinical skills is an essential part of the undergraduate program for nursing students. Inappropriate education and suboptimal clinical skills compromise the quality of care and patient safety (Alemán et al., 2011).

Technological innovation has radically changed the way people interact, and no least the teaching methods, changing the way education and training programs are provided (Sinclair et al., 2016). The global evolution of teaching methods increasingly employs technology, such as multimedia teaching materials, online teaching, and simulation labs to teach clinical skills (Moule et al., 2010; Dearnley et al., 2013). The need to change and expand nursing education through the use of

technology has prompted nurse educators to develop new teaching strategies and apply new educational models to improve the learning of practical skills, and consequently also quality of clinical practice (Dearnley et al., 2013).

In the last decade, mobile technology has been gradually introduced to help nursing students and professionals improve and refine the learning of practical skills and knowledge in the field of clinical practice. (Button et al., 2014). There is still no clear and unanimous definition for mobile technology and web-based learning. The term 'blended learning' – also known as 'hybrid learning', and 'mixed learning' – is generally referred to a learning method that enables students to complete and consolidate online what they have learned in class. In this way, students attend classes in the traditional way, but also have the opportunity to autonomously complete and consolidate online (web learning) the same topics they have been taught during their

lessons in class (https://www.blendedlearning.org/basics/). Web-based learning is now even more widely used than the traditional teaching models also in the field of nursing education, due to the large numbers of students and the need to effectively teach practical skills (Traynor et al., 2010; Pastirik, 2006).

The expansion of web-based learning is also supported by the technical evolution of mobile devices, giving life to the concept of 'mobile learning', which meets the demands of today's constantly evolving and flexible society (Clay, 2011). The most cited technical advantages of web-based learning include universal accessibility, the availability of constantly updated contents, and the possibility to link up with other topics (Learning Landscape, 2013). Several studies confirm that mobile devices can also be used to support and enhance the learning of clinical skills during clinical training or practice (Clay, 2011). For instance, mobile devices can help nursing students to improve their drug calculation skills, which are often considered to be inadequate and insufficient to ensure patient safety (Mettiäinen et al., 2014; Bagnasco et al., 2016; Weeks et al., 2013a,b). Many similar experiences are reported in the literature, such as the one described by Wakefield, who adopted the blended learning method, combined with traditional teaching with the purpose to teach students the concept of patient safety education and raise their awareness about it (Wakefield et al., 2008).

2. Background

2.1. Literature review

In the academic world, distance-learning sessions (i.e. e-learning) were initially introduced on a wide scale in the 1990s, but only to support traditional education (Richardson et al., 2016).

In the literature, there are various examples of innovative teaching and learning models in the field of healthcare, but these prevalently come from studies conducted in North America and the United Kingdom. These studies mostly include traditional teaching models associated with blended learning, which involves the use of innovative technology, such as simulation, on-line courses and tests, e-learning, virtual learning environments and the use of social media on mobile devices (Dearnley et al., 2013). Moreover, these studies mainly include technical innovations that support the development of clinical skills, testing approaches, and the exchange of feedback on clinical experience between teachers and students, and the use of web-based learning (McCutcheon et al., 2015). The use of blended learning is rapidly expanding, because it is particularly adapted to facilitate the transition from traditional teaching and learning to e-learning (Masic, 2008).

One study found that students who used web-based learning sometimes showed higher levels of anxiousness towards traditional teaching and technological communication, feelings of isolation and dissatisfaction because they had difficulty understanding how to use the software (Blake, 2010). It is also important to consider that blended learning courses should be carefully selected and shared, so that students have the chance to interact with their teachers, thus avoiding situations where students end up feeling isolated (Adams and Timmins, 2006). Instead, in other groups of students, no significant differences were reported between those who adopted the web-based method and those who used the traditional method (Ganyaupfu, 2013).

The intention to investigate the applicability of e-Learning stemmed from the need to manage larger numbers of students. Large classes make it difficult to offer everyone the equal opportunity to access optimal practice to learn clinical nursing skills (Kelly, 2009). In 2009, Lu and Li conducted a study on the application of web learning in clinical practice, in particular on how to correctly perform intramuscular injections. This study found that those who learned this technique through web learning obtained better results than those who had received only traditional teaching. Innovation plays an important role in facilitating practical training for undergraduate nursing students, but

this should not be used to totally substitute traditional lessons (Koch et al., 2010). Therefore, web-based learning has been widely used to teach practical skills, such as dressing wounds (Beitz and Van Rijswijk, 2012). This choice was adopted to ensure credibility and applicability of the technique to different clinical contexts (Sowan and Idhail, 2014).

3. Aim

To explore the perception and effectiveness of web-based learning in facilitating the development of clinical skills in undergraduate nursing students.

4. Methods

4.1. Study design and population

This was a qualitative descriptive study. A dedicated website "infermieristicamente.net" was built including four videos and a respective checklist of some nursing techniques, which included tutors who showed how to perform four specific clinical skills: the insertion of a urinary catheter, the insertion of a nasogastric tube, taking a blood sample, and the insertion of a peripheral intravenous line. Before starting the study, a preliminary meeting with the students was arranged to explain the purpose of the study and how to use the web-learning site we had developed. The students watched the videos 15 days before starting their clinical placements and, if they had any doubts they could watch them again during their clinical placements with their mobile devices. Web-based learning did not substitute students' traditional practical skill learning in labs with their supervisors. The duration of each educational video ranged between 25 and 30 min, according to the skill shown. An example of one these videos is shown in Fig. 1. The videos were made in a Clinical Skills Lab at one of our university sites.

These techniques were developed according to up-to-date evidence-based practice and –keeping with the usual practice at the University – British and Australian guidelines (NHS, 2016; Ministry of Health NSW Australia, 2013) were adopted and translated into Italian. Each video had a checklist regarding the equipment needed, actions required, and the rationale for each action. Three teaching sessions, one in each nursing school, were held with the second-year students that volunteered to participate. During these sessions, we illustrated the website and explained the purpose of this study.

4.2. Ethics

According to Italian legalisation, ethical approval is not required for studies where patient safety is not a concern, or if patients are not directly involved in the research. Therefore ethics committees consider it unnecessary to provide ethical approval for such studies (Bressan et al., 2016). The usual ethical procedure when conducting research with students is to seek permission from their Coordinators, who are in charge of each nursing education centre, which was duly sought in our case. The ethical principles applied in this study were those of beneficence and non-maleficence (Polit and Beck, 2010). Therefore, it was made clear to students that they were free to decide whether to participate or not, and that non-participation in the study would not affect their assessments and relationship with their teachers. All participating students provided their consent. All data were kept anonymous, securely stored, and confidentiality was assured.

4.3. Study sample

This study used a convenience sample of students from three of our university nursing teaching sites located in three different towns.

To recruit the students, their program coordinators sent an email to all the students with information about the purpose of the study and

Fig. 1. Screenshot of a video (https://www.youtube.com/watch?v=7yYlWgeou7k) where a tutor shows how to correctly perform a clinical skill.

Table 1
Demographics of student respondents.

Gender	Total = 26	Males: 16
		Females: 15
Age	Mean Age: 23.6	Under 23: 12
		Over 23: 14
Training sites	N = 3	Pietra Ligure: 8
		Savona: 8
		Imperia: 10

Table 2
Focus Group questions.

1	Introduction of participants: name, age, year of attendance.
2	Are you aware of video guides that support clinical learning?
3	At your centre, which teaching methods are used for clinical learning?
4	Do you think multimedia means are useful for clinical learning?
5	Do you think videos improve your performance in clinical learning?
6	In your opinion, would videos effectively improve clinical outcomes?
7	In your opinion, is this new method as effective as the traditional one?

inviting them to participate. The students who accepted to take part in the study were invited to telephone or send a text message to the principal researcher. A total of 26 (15 females and 11 males; mean age: 23 years) undergraduate nursing students from three nursing education centres belonging to one Italian University accepted to participate in our study Table 1. Then, they received instructions on how to access the website that illustrated the nursing techniques during their clinical placements, and while preparing themselves for their clinical skills test.

Inclusion criteria were: a) students had to be in their 2nd year, because this is when they attend most of their clinical placements and labs; b) passed all previous exams to ensure they are prepared to access clinical placements; c) have access to the Internet (either fixed or mobile); and d) voluntary participation. It is worthy to note that in Italy, entry-level nursing education programs are all bachelor degrees and, apart from paediatric nursing, there are only general nursing programs (i.e. no specific programs in a specific area of nursing).

4.4. Data collection

After the participating students had finished their 4-week clinical placement, three focus groups were conducted with them; one in each nursing education centre. The semi-structured interview consisted of seven questions (Table 2). During the Focus Groups we also observed the behaviours and how participants interacted with one another and measured the level of social partnership by using the Bales Grid. The Bales Grid (Bales, 1970) is a system that classifies the dynamics of interpersonal interactions within a group of people. After each question asked by the moderator, the observer took note of the most interesting things participants said and of their behaviours.

4.5. Data analysis

The focus groups were analysed using qualitative content analysis (Graneheim and Lundman, 2004; Morse and Field, 1995). The transcripts were read through several times to fully capture the meaning of what the students said and deeply analyse the data. Using line-by-line coding, codes were freely generated. Unrelated expressions were excluded and codes with similar meanings were grouped into categories (Graneheim and Lundman, 2004). Group interactions were analysed by completing the Bales Grid. The Bales Grid also enabled to analyse citations that initially could have been considered irrelevant. In addition, the Bales Grid is very useful to gain a clear understanding of group interactions and identify the participants' personal characteristics, such as leadership.

4.6. Rigour

An audit trail was kept throughout the process and the data analysis method was strictly implemented. To validate the codes and categories that emerged, the transcripts were read independently by two researchers.

5. Findings

Three themes emerged from the interview data: a) the use of web-based learning improves healthcare outcomes; b) technology to support traditional learning; and, c) not knowing which videos to use to support the learning of clinical skills.

All participants agreed on the effectiveness of the educational videos, and unanimously confirmed the effectiveness of this learning

methodology. The students' responses in relation to the three themes are discussed below.

5.1. *The use of web-based learning improves healthcare outcomes*

This theme reflects a topic of great importance with regard to how web-based learning can improve healthcare outcomes. Healthcare outcomes have considerably improved thanks to the scientific progress of modern medicine. In addition, students' knowledge about patient safety develops throughout their period of education and clinical apprenticeship. Skills and behaviours linked to patient safety should be acquired as soon as students enter a hospital, an outpatients' clinic or any other healthcare setting. Clinical learning is fundamental to prevent and know how to manage risky situations. Therefore, it is important to facilitate the learning of gestural skills, and can be effectively done with the support of technology. These learning instruments, which are easy to use and access, could reinforce the knowledge development process, by acting as a bridge between theory and practice. Below are some citations of what some students involved in this study said. Some students underlined how patients themselves, who are more informed and involved in the healthcare process, felt safer when they saw that different health professionals performed a technique in the same way, and also when all nurses perform a technique in the same way:

"… *In my opinion also patients, when they see that nurses do things all in the same way, for instance when they do an invasive procedure, this makes patients feel safer and more confident ….* (student, university teaching site 1)

Nowadays patients, thanks to Internet, are much more informed. Performing a procedure in the same way makes patients feel less doubtful and nurses run less risks of making errors …. (student, university teaching site 2)

As a student, you are always anxious and afraid of making mistakes, and hurting the patient, so watching educational videos that highlight also the relational-communication aspects would be helpful, also to manage particular situations, such as when patients are not compliant. (student, university teaching site 3)

I would like to watch the videos also after the procedure, the ideal thing in the field of education I think would be to see again how you did something to understand where you went wrong and not make the same mistake (student, university teaching site 3).

5.2. *Technology to support traditional learning*

From this theme emerged how students exhibit a more effective type of learning when learning through a mobile device is combined with lab training sessions and cognitive learning. Classroom lessons and skill demonstrations have been and are still currently used to teach clinical competencies in nursing undergraduate programs. These sessions usually take place in labs and include the demonstration of a structured technical skill through the use of a checklist, which contains a rationale.

Supervision in clinical settings by nurse supervisors, who are specifically trained to assist students, can strengthen the skill learning process. The use of multimedia devices offers students the opportunity to watch educational videos and see how skills are performed. In this way, videos enhance cognitive learning. In addition, the focus groups highlighted how the use of an App that constantly supports students throughout their curriculum would make students feel more confident in case of doubts:

"… *If this method is used to support traditional education, in my opinion, it has great potential …. it enables to clarify practical doubts and reinforces the concepts expressed in the checklist, and when you arrive in the ward you feel more confident …* (student, university teaching site 1)

…. .a little like a lesson of anatomy held in class but surely being able to look at a 3D image of the heart helps you to gain a better understanding. Our anatomy lecturer showed us an App on the i-phone that shows you the organs in a better way …. (student, university teaching site 2)

…. .I noticed that compared to before when I used to study only the checklists and I exercised myself in the lab, watching also the videos helped me make less mistakes … (student, university teaching site 3)

5.3. *Not knowing which videos to use to support the learning of clinical skills*

The students who participated in the study declared that they did not have a clear idea of which videos to watch, unless specifically pointed out by the educator. The web and many universities offer educational videos on various techniques and types of patients - from how to handle a device, how to dress a difficult lesion, to managing a tracheostomy in a child – but without a unanimous rational consistency, a clear and precise indication on the validity of the contents, based on scientific evidence and guidelines:

" *….I've never had the opportunity to watch videos with this purpose, I've seen something on the Internet but there was no consistent approach, some videos I saw on YouTube are too fast, and in addition since I was at home it was difficult for me to practice the technique because I didn't have all the materials I needed …* (student, university teaching site 1)

…. I didn't know until last year when my hygiene lecturer showed us a video produced by some students on how to correctly perform hand hygiene ….l found it more useful than the picture in the book … (student, university teaching site 2)

…. I have never spontaneously searched them, but only if my lecturer told me to, even because on the Internet it is quite difficult to find correct educational videos that are done well … (student, university teaching site 3)

6. Discussion

According to a recent estimate, by 2020 there will be a shortage of 1 million health professionals (Franceschetti, 2016). This suggests that e-learning could be the most appropriate educational methodology especially in non-industrialised countries, and could contribute to making nursing more appealing to young people and reduce this shortage (Carrol et al., 2009; Petty, 2013).

The integrated use of web-based learning in undergraduate nursing programs enables students to develop better clinical skills, with the potential to ensure a better quality of care and fewer risks for patients. Safety is an outcome that should be measured also in students, and not only in patients. The use of an application to learn practical skills could reduce the error gap between the experience with the manikin in the lab, and real life. Students can set an example for other health professionals that already work in the healthcare systems (WHO, 2011).

When outcome measurements are included within an evidence-based and patient-centred healthcare framework, responsibility and validity are ensured (Hansen et al., 2000). Some studies have examined the outcome measures related to knowledge, improved e-learning skills and clinical skills (Sinclair et al., 2016). Kleinpell et al. (2011) reported that there are a wide variety of web resources regarding e-learning materials and courses, divided into areas of specialization (e.g. critical care, and infections). However, high-quality trustworthy educational materials and courses are not always easy to find, and therefore not fully exploited by students. The web-based methodology has been found to be effective in terms of performance and outcomes, especially with regard to patient safety and compliance. However, students also underlined the need to talk to a teacher or a tutor, especially when a technique is explained for the first time. The use of practice labs is

described as instrumental to improve the manual skills each technique requires. Multimedia tools in a clinical learning environment are a valid teaching strategy that students highly appreciate. The creation and dissemination of educational videos for teaching courses is a complex process that needs to be carefully designed to positively and significantly influence learning. Clinical education is complex and requires a multidimensional approach to meet the students' needs. Rowe et al. (2012) and Cook et al. (2010a) highlighted how web-based education has a positive impact on the acquisition of nursing competencies. Students easily accept this methodology and are generally satisfied with self-study tutorials and virtual patients, but also with online discussions with teachers and other students.

With regard to blended learning, our study confirmed the results of other studies (Petty, 2013). The use of traditional teaching methods, such as classroom lessons and practical skill labs using manikins, blended with web-based methods improved student learning and the performance of correct gestures.

These positive results suggest the use of a mixed methodology, which at the same time requires the availability of a real social environment, a place where students can work together to improve also their communication skills, which are instrumental for nursing practice. In addition, this methodology has shown that it can contribute to bridging the theory-practice gap, which is often described as a limit of e-learning, enabling students to improve a series of clinical competences, as already highlighted by Rowe et al. (2012).

7. Limitations

The major limitations of the study are the small sample size and the single practice setting. The educational videos, prepared according to the guidelines, focus on learning practical skills, but omit the communication and relational aspects. Another limitation of this study was that during the clinical placement examinations, an objective evaluation of the students' performance based on this experience was not carried out, because only some of the students were involved.

8. Conclusions

Results suggest that the use of web-based applications for learning technical-practical skills also improve students' conceptual learning, ensuring high standards of care and patient safety, especially due to the increasing complexity of care (Sasso et al., 2017).

The use of web-based learning is rapidly expanding within nursing and healthcare. However, its use in teaching clinical skills to undergraduate students is not universal. Moreover, there are still few studies that provide evidence about the effectiveness of learning clinical skills through web-based learning (Qian et al., 2016).

Further studies on web-based learning and on blended learning have achieved promising results compared to traditional methods. In fact, interactivity, practical exercises, reviewing, and feedbacks seem to be associated with improved learning, but the great diversity of available sources still does not enable to draw unambiguous conclusions (Cook et al., 2010b). Therefore, further research is recommended in this field.

Conflicts of interest

None.

Ethical statement

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nursing education centre, which was duly performed in this case. Ethical principles applied in this study were beneficence and non-maleficence (Polit and Beck, 2010). This means that it was made clear to students that they were free to participate or not, that non-participation in the study would not affect their assessments and relationship with their teachers. All participating students provided their consent. All data were kept anonymous, securely stored, and confidentiality was assured.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.nepr.2019.02.009.

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