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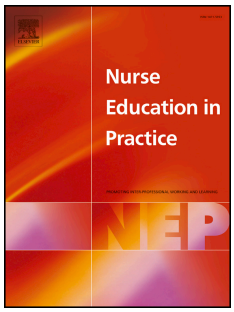

Mobile technology in clinical teaching

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PII: S1471-5953(16)30176-7

DOI: 10.1016/j.nepr.2016.11.001

Reference: YNEPR 2166

To appear in: *Nurse Education in Practice*

Received Date: 17 June 2015

Revised Date: 6 July 2016

Accepted Date: 9 November 2016

Please cite this article as: Mackay, B.J., Anderson, J., Harding, T., Mobile technology in clinical teaching, *Nurse Education in Practice* (2016), doi: 10.1016/j.nepr.2016.11.001.

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Title Page

MOBILE TECHNOLOGY IN CLINICAL TEACHING

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(Word count 4564)

Acknowledgements

The authors would like to acknowledge ICT Services for technological support and all our Nursing Department managers; without their support, this project would not have been possible. Also acknowledged are Jane Arlidge and the clinical nursing lecturers for their active and enthusiastic participation in data collection.

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INTRODUCTION

In the clinical setting the traditional model of nursing education has been one where students are assigned patients and work under the care of an instructor (Hayden, Smiley, Alexander, Kardong-Edgren & Jeffries, 2014). In this model students are challenged to problem-solve through the recall of knowledge at the bedside. However, health technology is a rapidly developing area and an increasing number of mobile devices are being incorporated into the clinical learning environment in nursing education (Doswell, Braxter, Dabbs, Nilsen & Klem, 2013). Mobile technology now enables more active learning in which the learner can actively construct knowledge through drawing on a wide range of internet enabled resources (Mather & Cummings, 2015b). Along with knowledge development, this ability to immediately access resources in a clinical setting has the potential to support student nurses' skill development and improve their practice (O'Connor & Andrews, 2015). Nursing educators are being challenged to integrate technological innovation to assist students develop their knowledge base, critical thinking and clinical competencies. Given the ubiquity of mobile communication devices there can be no doubt that they will play a significant role in the teaching and learning arena. There will be increasing recognition of their usefulness in guiding student learning at 'point of care' (Kenny, Park, Van Neste-Kenny, Burton & Meiers 2009; Mather & Cummings, 2015a). In New Zealand entry onto the register of nurses is controlled by the Nursing Council of New Zealand (NCNZ) who set the standards for programmes leading to nurse registration. With respect to information technology (IT) the NCNZ state "the programme specially requires students to demonstrate, in practice at a graduate level … the use of information technology and health information management" (NCNZ 2010, p.6). The potential of supporting student learning with mobile technology motivated the decision to explore the introduction of a mobile smart device into teaching practice in the clinical setting at a regional New Zealand polytechnic.

BACKGROUND

The term mobile device is used liberally in the nursing literature with little differentiation in regard to type of device or functionality. According to O'Connor and Andrews (2015) this is a deficit in the research in this area of practice. It is evident that the literature on the introduction of mobile devices in the clinical nurse education environment reflects the initial focus on personal digital assistants (PDAs) and their usefulness in immediate access in clinical situations to stored information (Day-Black & Merrill, 2015; Farrell & Rose, 2008; George, Davidson, Serapiglia, Barla & Thotakura, 2009; Hudson & Buell, 2011; Johansson, Petersson, & Nilsson, 2013;

Kenny et al., 2009). According to Sánchez-García, López-Montesinos and Fernández-Alemán (2013) PDAs initially received the most attention in nursing research but there has been increasing focus on mobile devices with wireless capability. The iteration of the mobile smart device is the latest mobile technological development for wireless capability. A mobile smart device is not only portable but also has multiuse features and a web portal supporting ubiquitous computing properties (Poslad, & Charlton, 2009). Two examples of smart devices: the smart phone and the tablet are gaining in popularity. The first smartphone was introduced in 2002 (Doswell et al., 2013) and the tablet; which is essentially a mobile personal computer (PC), emerged in the health arena around 2004 (Schuerenberg, 2006). The iPad with its smart device features is becoming the tablet of choice for many and is increasingly used in higher education (Lane & Stagg, 2014) and health (Boruff & Storie, 2014).

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Along with mobile smart devices is a growing pool of smart applications with a plethora available to nurses and others working in health (Tuck & Sheets, 2014; Xu & Liu, 2015). In nursing, smart device applications can be used effectively in the clinical learning environment for a variety of purposes including: the teaching of drug calculations; retrieving medication information, guides to the interpretation of laboratory results; and guiding nursing management decisions (Innocent, 2010). As noted by Trangenstein (2008) there have been efforts by nurse educators to incorporate them into their repertoire of teaching methods; however, the challenge has been to learn to use them and appropriately use them to their fullest capability.

To date the research on mobile technology in clinical nursing education has focused on the student experience but there is little from the perspective of the clinical teacher. O'Connor and Andrews (2015) in their literature review on mobile technology and its use in clinical education outline a range of the available literature which focuses on the student experience. It is evident the predominant focus is student centred use and not on the perspective of the clinical lecturer. This focus on students rather than teaching staff was also found within higher education (Lane & Stagg, 2014). Hence, there is a lack of empirical evidence which focuses on the experience of the clinical nurse lecturer. Farrell and Rose (2008) also found that students felt some clinical teachers were not prepared to support students in the use of mobile technology in their clinical practice.

A previous project introduced m-support via etxt and student's mobile telephones to communicate with and support students in primary health care settings throughout the region in which this polytechnic is situated (Mackay & Harding, 2009). It was found that there were ongoing issues with communication and time

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management as lecturers went out on clinical practice with students because of lack of access to online resources such as email and the student learning system. This led to consideration of the usefulness of a mobile smart device to overcome these barriers to effective m-support and enhance the existing m-support currently restricted to etxt. At the time of writing little research had been undertaken to investigate the use of mobile smart technology in New Zealand nursing education therefore this project sought partially to fill this gap to inform nurse educators' practice.

AIM

To describe the process of introducing teaching innovation, and to explore clinical nurse lecturer perceptions and experience of the use of mobile smart devices to support student learning.

METHOD

This qualitative descriptive study was undertaken in three phases. The project team consisted of two researchers and six clinical lecturers from the same nursing department. The clinical lecturers contributed knowledge from the clinical context and worked with the researchers as the project unfolded generating a climate of collaborative enquiry. A climate of collaborative inquiry enables shared reflection and professional support with the aim of improving teaching (Jackson, McGrane, Street, & Temperley, 2010).

During all phases regular meetings were held for planning, discussion of the findings and decision-making with respect to the next phase of the project. The formation phase involved developing the initial idea, fact finding and planning. The scope and focus of the research was established and approval gained. The study was approved by the Polytechnic Research Committee. In the implementation phase six clinical lecturers adopted iPads in clinical teaching practice and commenced a journal. In the analysis phase all lecturers attended a focus group and data, including participant's entries and final impressions in journals were analysed and themes developed. The literature, meeting summaries and journals guided development of the final report. This analysis phase provides a basis for further planning and development of the project in future.

Formation phase

Two key decisions during phase one were: (1) the research focus; and (2) the choice of mobile device. Initially, two research locales were envisaged: the real-world clinical practice and the classroom setting. It soon became

apparent, however, that this was beyond the scope of the available resources. The decision was made to focus solely on the clinical setting as this was the initial choice to build on the etxt project. The classroom setting would be another phase at a later date. An iPad and smart phone were trialled with a clinical lecturer. The second key decision was the choice of iPads rather than smart phones because of the larger screen size and the ability to 'push' data as well as 'download' data. Using 3G as well as wireless connectivity provided access regardless of the clinical setting.

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At an early stage it was evident that further resourcing and support would be required. Meetings with senior management and ICT information services resulted in the support of the team which facilitated the provision of financial and technological support for the introduction of the iPads and their applications. Six iPads were purchased. Following the decision for the study to be undertaken in clinical settings a brief literature search was undertaken. This supported the initial decision to use iPads in clinical practice and also highlighted appropriate applications to be downloaded onto the devices. This information was shared at project meetings and in journals. At this stage research approval was obtained.

Implementation phase

In Phase Two six clinical lecturers used the six iPads and incorporated them into their clinical teaching. ICT provided support, on request, to individual lecturers as the project rolled out. The previous literature search and anecdotal evidence about useful applications from other nurse educators guided the lecturers with respect to the range of applications utilised. In a climate of collaborative inquiry the lecturers provided support for one another via journals and face-to-face meetings to learn about the applications and the use of the iPads. This phase continued for a period of eight months. During this time the clinical lecturers maintained journals and these informed the analysis phase of the study.

Analysis phase

The analysis phase explored six clinical lecturer perceptions and experience of iPads to support student learning in clinical settings. The participants were a convenience sample of all clinical lecturers who were allocated iPads as part of the project. All were invited to a focus group interview and asked to keep online reflective journals on a shared portal site. When focused on an area of interest focus groups help to bring to light new information and obtain a variety of viewpoints (Lopez & Whitehead, 2013) and in this case the discussion supported the climate of collaborative inquiry generated at the start of this project. The climate of collaborative inquiry was also informed by journaling. Journaling as a form of data collection allows participants

to share their experiences on an area of interest in a progressive and evolving manner (Rebar, Gersch, Macnee, & McCabe, 2011). In this project journals were shared with the researchers and other participants.

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In the focus group the facilitator (a researcher) used a semi-structured interview schedule to guide the discussion and acted as moderator to ensure that the questions were answered. A method recommended by Krueger and Casey (2009) to enhance validity. An iPad recorded the discussion and another researcher took field notes about key points which arose in the discussion. The key points were relayed to clinical lecturers at the end of the focus group and they were asked to verify the summary. They also had the opportunity at this point to include additional information. At the end of the interview, the two researchers verified that the key questions were covered. As mentioned previously, these six participants also recorded their experiences of the use of the iPad in a series of reflective journals. Four of the six also added a concluding entry in their journal on their final impressions.

The researchers carried out data analysis using the focus group recording and field notes to identify themes. Using a strategy recommended by Harding and Whitehead (2013) two researchers worked independently on the data and then conferred until agreement was reached. Data from the thematic analysis of the journals added to the richness of the data from the focus group. Together this data informed the development of the themes emerging in the analysis phase.

FINDINGS

The findings of the thematic analysis reveal that there are both enabling and constraining factors which influence the use of iPads for teaching in the clinical setting. There were two themes which could be categorised as enablers: *resources and technology*; and, *management and technology support*. There were also two themes which were identified as constraining factors: *clinical staff engagement*; and *lecturer experience with technology*. Additionally, there were two themes which crossed across both categories and which, depending on the context, could either enable or constrain the efficacy of iPad use in the clinical setting. These were c*onnectivity* and *student engagement and learning*.

Resources and technology

The use of the iPad enabled a rich range of resources to be available to both the lecturer and the student. These included mobile applications, internet sites, YouTube videos and the Polytechnic's learning management system. The iPad applications included three-dimensional modelling of human anatomy, nursing procedures, pathophysiology and medication resources. The nurse lecturers in this study shared lists of these resources via

their journals; they used all these types of applications in their teaching with students. One lecturer listed some of the resources.

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> *I have many reference apps such as Medscape and I use eBooks for anatomy and physiology text. I use many mobile office applications Dropbox, Pages, PDF expert, I use moodle easy interface. I am using some MOOCs and iTunes U. I find most apps through trawling through the app store or by recommendation of others in similar fields.*

Management and information computer technology (ICT) support

The support obtained from senior management and the ICT Department was an essential factor in enabling the project to proceed and in providing the support needed by the lecturers in learning to use the devices. An action point at the first meeting was to approach senior management with an outline of the costs and for approval to progress. "Action Point 2. ...to follow up with….re costs and approval to progress." This approval and support to proceed was subsequently given. At the second meeting a member of ICT was present for discussion on costs and appropriate devices. ICT then continued to provide support for individual lecturers. One lecturer commended "ICT set up email and that has been very helpful this week". Another noted "this week I had a problem with 3G connection … ICT was able to add a setting that I needed".

Clinical staff engagement

Some of the lecturers thought that a constraining factor was negative perceptions of clinical staff regarding the use of the iPad. It was seen as a social device and not an educational tool. One of the lecturers provided an example:

> *I was having a discussion with a senior nurse manager last week. She expressed a view that the Smartphone use on the ward was to be discouraged. Her concern was that nurses were using the technology for social networking. My assertion that the iPad and iPhone were important new technologies was dismissed.*

Lecturer experience with technology

Experience with an iPad and knowledge of suitable applications were other constraining factors in setting up the devices. Applications were found and tested through trial and error as at the time of this study there appeared to be no substantive list that could provide information either in the literature or on the internet. One lecturer commented:

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Barriers at the start were around learning to use the technology – has now become routine. There are still issues if you change your password. This seems to create problems and often ICT has to help sort it out.

There was also considerable variation in the clinical lecturer's ability to use the iPad to its fullest potential in clinical settings. There appeared to be a considerable difference in the experience and perception of usefulness between those using the iPad extensively for a number of tasks and the new users who had not had enough time or opportunity to use the iPad in appropriate settings. As one noted:

I think the biggest barrier has been time. I think if I had more time to look at more apps and what else the iPad is capable of, then I would probably have more uses for the iPad.

Connectivity

The lecturers were very positive about the immediate and portable connectivity to a rich range of resources. The iPad enabled student access to formative work and editing of files. The lecturers also found access to email to be very useful in enhancing communication with colleagues and students. According to one:

It has had a huge impact when I'm in clinical as I have access to resources, our learning platform, internet and portable files. I have connectivity whenever I want it – can help students learning by accessing resources at the right time – can check my emails. I can use it at meetings.

While another noted it "helped me make the most of the time I have, i.e., can use downtime (waiting for a student) to respond to emails etc and be organised." Two lecturers commented that when their iPad could not connect they "felt naked without it."

However, connectivity was not always viewed positively. Issues with the connectivity compounded the problem of lecturers' inexperience with the technology. In some settings, a wireless connection was not available and reliance was on connection via 3G. Loss of carrier signal or connection was a recurring event. Within the polytechnic itself, there were recurrent problems with being able to connect or being locked out of the network. One lecturer described their experience, "this week I had a problem with 3G connection, so missed a day using iPad while sorting that out". While another added "[it was a] good week apart from trouble with locking myself out from my account … and running out of battery power when travelling around the north."

Student engagement and learning

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This technology enabled nurse lecturers to take advantage of opportunities to enrich the student learning experience. When asked about the impact of iPad use on student learning, one lecturer commented:

> *The ability to give instant feedback on any issue that the student may request more information on. The learning is instant, there is no need to look things up at a later date – it is available to the student at the point of enquiry.*

There were reports that it enhanced the students' critical thinking. The technology enabled catering for different learning styles as the applications used audio (auditory learning), video (visual learning) and manipulation (kinaesthetic learning). According to one lecturer *"*This student had the opportunity to have a deep learning experience using visual/auditory/kinesthetic learning styles with the latest technology."

The lecturers believed that learning alongside the students changed the power base in the teaching-learning interactions. The use of the iPad allowed for the shared construction of knowledge between the teachers and the students. One comment was "I found the immediacy of this learning immensely powerful for my own learning and the student's… able to look together. In fact, one student pulled their iPhone and said, "I'll race you!" While another commented, "off into the internet to find out together!" to find the answer to a clinical question that neither knew the answer to.

The usefulness of the iPad in supporting student engagement and learning was not always viewed positively. A perception expressed by some lecturers was that the use of iPad technology interfered with the quality of the student-teacher interaction or interaction with staff at the placement. One lecturer asked, "Could the use of technology get in the way of relationship building?" This issue was exacerbated by lecturer inexperience with the iPad or the use of the available applications which impacted on both the time available and the quality of the interaction. One commented, "time has been a major factor in learning to use the iPad to its capacity …time with the students is precious and I don't want them to feel my focus isn't on them."

DISCUSSION

The results of this project demonstrate that the use of mobile smart technology has the potential to enhance teaching practice in the clinical setting but that there are still some areas of concern. Their usability, portability and flexibility are recurring positive themes in nursing research on student use of mobile devices in clinical

settings (O'Connor & Andrews, 2015) and this current research suggests this also applies to use by clinical teachers. The immediacy of communication and the ability to attend to administration while away from the office is also a recurring theme in the use of mobile technology in healthcare (Garrett & Klein, 2008; Blake, 2013); and in this study was enhanced by the smart functionality of the iPad. Perceived ubiquity (being omnipresent or everywhere) and perceived reachability are also key factors in adopting mobile technology (Sanghyun & Garrison, 2009). In this project the iPads being taken out into clinical settings facilitated student and teacher connectivity with the internet providing immediate and portable access to a range of resources, e.g., applications, YouTube, and the learning institutions intranet. The iPads enabled the lecturers to bring relevant teaching applications to the clinical setting, as noted earlier, including three-dimensional modelling of human anatomy, nursing procedures, and pathophysiology. Innocent (2010) argues that iPad applications can be used to teach drug calculations, look up drugs and their interactions, and in this study the application used allowed the students to search for drug resources. The ability to access reference material when needed fosters a culture of evidence-based practice in a point-of-care context (Philippi & Wyatt, 2011). This is essential not only for teachers but for students in preparing them for safe clinical practice.

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The immediacy of the technology enabled opportunistic teaching in response to students' learning cues and there was enhanced ability to engage with the student, and to cater for different learning styles through the device providing audio, video and manipulative functionality. The teacher can connect with the student and reinforce their learning regardless of where they are situated. Such 'just in time' and 'point-of-care' learning is becoming increasingly popular. According to Sharples, Taylor and Vavoula knowledge and mobile technology enable shared conversations in context, supporting students to construct their understanding of their environment. This is supported by Sanchez-Garcia, Lopez-Montesinos and Fernadez-Aleman (2013) who found that mobile devices not only allow the teacher to adapt teaching to individual needs and students' learning styles but also promote active learning, reflection and critical thinking.

Although the use of mobile devices can clearly enhance the teaching and learning experience, the introduction of such devices can be challenging for nurses who continue to work from a traditional cultural paradigm where they are deemed unacceptable in the workplace. There can be a perception that their use is unprofessional (Mather & Cummings, 2015b; McNally, 2015; Skiba, 2011; Strandell-Laine Stolt, Leino-Kilpi & Saarikoski, 2015). Effective communication skills are essential to nursing practice and there is anxiety for some that the technology will create a barrier to this essential competency (McNally). The challenge for nurse educators is not only to use these devices but to use them appropriately (Trangenstein, 2008). This is required to allay

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anxieties associated with the paradigm shift in clinical education. Educators will need to choose the appropriate moments and settings to demonstrate the potential for enhancement of learning and critical thinking in order for mobile technology to be accepted as an appropriate adjunct to clinical practice. According to Mather and Cummings (2015b) clinical educators' role modelling of professional behaviour around mobile technology along with changes in policy in health organisations will assist in facilitating acceptance of mobile technology in the clinical environment.

While the technology can provide a powerful adjunct to clinical teaching and learning, the teachers' lack of familiarity with the device, relevant applications and recurrent issues with connectivity can create a potent barrier to educators choosing to use mobile devices in their teaching. These barriers are consistent with those identified in research on smart mobile devices in clinical setting in undergraduate medical education (Boruff & Storie, 2014). Another recent review on studies on use of mobile devices in clinical practicum (Strandell-Laine, et al. 2015) also found that issues with connectivity and technology literacy were major barriers to their adoption.

Lecturers' experiences of the usefulness of mobile technology in the face of recurring connection issues and their experience with using the technology have implications in their choosing to use mobile devices for teaching. According to O'Connor and Andrews (2015) until these sociotechnical barriers are solved nurse educators will not readily adopt these devices. Davis (1986, cited in Sanghyun & Garrison, 2009) conceptualised the Technology Acceptance Model (TAM) which proposes that the perceived ease of use of technology has a direct link to perceived usefulness. This, in turn, impacts on the behavioural intent to use the technology or variable usage being the end result. Attitude has a part to play as well but is not as influential. According to Sanghyun and Garrison (2009) this model is also applicable in understanding an individual's acceptance and use of mobile wireless technology. A study of nurses' technology readiness (Kuo, Liu & Ma, 2013) validated the TAM model in understanding adoption of the use of mobile technology but also found that personality, characteristics of optimism, innovativeness, discomfort and insecurity are influential. The first two factors have positive impact on perceived ease of use of technology whereas the latter two characteristics have a negative impact. In their study, a strategy to enhance technology literacy and reduce ongoing anxiety and negative attitudes was ongoing education and training. This key strategy was also identified by Lane and Stagg (2014) in their study on staff adoption of iPads in higher education. There is a suggestion that the climate of collaborative enquiry and a community of practice generated in this study supported lecturers to develop their facility with the iPad. This approach was also an integral feature in other studies on supporting lecturers with

iPad literacy (Kelly & Schrape, 2010; Oldfied & Cochrane, 2011) and in integrating iPads to support student learning (Cochrane, Narayan & Oldfield, 2011). Adequate funding, time and organizational support for professional development of staff are also strategies for successful integration (Doyle, Garrett & Currie, 2014).

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The study was undertaken in one nursing department and findings cannot be generalised. However, the results from this study may provide a guide to other nurse educators and nursing departments when introducing mobile technology into teaching practice. Much of the potential for using mobile smart technology such as the iPad are still in the domain of visionary technology, and lacks empirical support. Mobile technology, according to Kukulsk-Hulme and Jones (2011) has the potential to take teaching beyond the classroom but guidance and examples of good practice are required to support teachers in advancing this. Areas for future research include, but are not limited to, strategies to support uptake of mobile smart technology by nursing lecturers, including communities of practice.

CONCLUSION

The aim of this research was to describe the process of introducing teaching innovation, and to explore clinical nurse lecturer perceptions and experience of the use of mobile smart devices to support student learning. The clinical environment became the focus of this study. It is evident that the use of a mobile smart device such as an iPad can have a positive impact on nursing lecturers' teaching practice. They have the potential to enhance teaching in clinical settings through improved connectivity, access to resources and taking advantage of 'just in time' teaching using a variety of teaching approaches catering to a range of learning styles. However, sociotechnical barriers have the potential to constrain the use of these devices in teaching practice. In order for these to be successfully integrated into clinical teaching consideration needs to be given to the lecturers' professional development needs, adequate resourcing and ICT support. Nursing lecturers must keep up with the rapid advances in mobile technology not only to inform their own practice but also that of their students.

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Conflict of interest statement

Conflicts of interest: none