

## Review

# Use of mobile devices in nursing student–nurse teacher cooperation during the clinical practicum: An integrative review



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## SUMMARY

**Objectives:** To identify and appraise study findings on the use of mobile devices, in particular for what purposes and how, in nursing student–nurse teacher cooperation during the clinical practicum.

**Data Sources:** A systematic literature search was conducted using the PubMed/Medline, CINAHL, PsycINFO and ERIC for primary empirical studies published in English.

**Review Methods:** An integrative literature review was undertaken. Quality appraisal of the included studies was conducted using design-specific standardized checklists. Studies were thematically analyzed.

**Results:** Based on the inclusion and exclusion criteria, eleven studies were included in the review. Weaknesses in designs, samples, questionnaires and results, compromised comparison and/or generalization of the findings of the studies. Three main themes were identified: (1) features of mobile devices (2) utility of mobile devices and (3) barriers to the use of mobile devices. Problems of connectivity were the main challenges reported in the use of mobile devices. Participants used mobile devices primarily as reference tools, but less frequently as tools for reflection, assessment or cooperation during the clinical practicum. Interest in mobile device use during the clinical practicum was reported, but training and ongoing support are needed.

**Conclusions:** As only a small number of eligible primary empirical studies were found, it is not possible to draw firm conclusions on the results. In the future, rigorous primary empirical studies are needed to explore the potential of mobile devices in providing a supplementary pedagogical method in nursing student–nurse teacher cooperation during the clinical practicum. Robust study designs, including experimental ones, are clearly needed to assess the effectiveness of mobile devices in nursing student–nurse teacher cooperation during the clinical practicum.

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## Introduction

The use of mobile devices (personal digital assistant, smartphone or tablet PC) in nursing education has increased in recent years (Grady, 2011; SánchezGarcía and LópezMontesinos, 2013; Doyle et al., 2014) and has been positively received among nursing students (Johansson et al., 2013; Doyle et al., 2014). Mobile devices appear to have the potential to support nursing students in decision-making, improve access to relevant information (Johansson et al., 2012, 2013), and enhance learning during the clinical practicum (Clay, 2011; Johansson et al., 2012). Of the fact that most nursing students are technology literate Millennials who use social networking tools effectively in their daily communication (Hansen and Erdley, 2009) may impact on teaching and learning methods in nursing education (Grady, 2011) such as the implementation of the clinical role of nurse teachers (NTs).

The clinical role of NTs has been debated and subject to changes since the 2000's (Price et al., 2011; Saarikoski et al., 2013), mainly in response to financial rather than, pedagogical pressures (Saarikoski et al., 2009). The clinical role of NTs is variously described internationally; terms used include link teacher, link tutor, instructor, facilitator, clinical lecturer, clinical educator and nurse educator. In this review, the concept nurse teacher (NT) refers to an educationally certified teacher, employed by an educational institution, whose clinical role covers all the variations in the roles and functions of NT in nursing students' clinical practicum. The concept clinical practicum refers to studies of nursing students conducted in clinical practice (European Commission, 2013). Globally, the fundamental clinical role of a NT is to support (Price et al., 2011; Killam and Heerschap, 2013) and facilitate (Ousey and Gallagher, 2010) the learning of nursing students during the clinical practicum; however countries differ widely in the actual implementation of the role (Saarikoski et al., 2013). In the United States, Canada, Australia (McSharry et al., 2010) and Taiwan (Lin and Shen, 2013) the NT mainly works with nursing students during the clinical practicum. In many European countries (Saarikoski et al., 2013) and in New Zealand (Ousey and Gallagher, 2010) the NT's function inclines more

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towards liaison, with nursing student–NT cooperation mainly conducted via e-mail, telephone or virtual learning environment-assisted communication from the educational institution with little or no face-to-face contact (Saarikoski et al., 2013). However, during the clinical practicum, nursing students have limited access to communication technology (Kenny et al., 2009; Wu and Lai, 2009) and they have described feelings of isolation from NT and peers (Kenny et al., 2009; Killam and Heerschap, 2013) and limited opportunities to cooperate with the NT (Wu and Lai, 2009). There is a clear need for introducing mobile devices to allow anytime and anywhere nursing student–NT cooperation during the clinical practicum in keeping with the communication habits of Millennials. Some studies have explored this topic with no consistency (Doyle et al., 2014; Martyn et al., 2014).

## Aim

This review aimed to identify and appraise study findings on the use of mobile devices, in particular for what purposes and how, in nursing student–nurse teacher cooperation during the clinical practicum. Based on the findings, recommendations for future research are made.

## Methods

### Search

An integrative review was undertaken (Whittemore and Knaf, 2005). A systematic literature search was conducted on four electronic databases: PubMed/Medline, CINAHL, PsycINFO and ERIC. The following similar text search terms were used across databases: student\*, nurse, nursing, teacher\*, tutor\*, instructor\*, facilitator\*, lecturer\*, educator\*, faculty, university, practice, clinical, placement\*, personal digital assistant\*, PDA\*, handheld\*, mobile, device\*, wireless, smartphone\*,

tablet PC\*, tablet computer\*, support\*, isolation, interacti\*, communicat\*, cooperat\*, connect\*, collaborat\*, learning, m-learning, and teaching. The search was limited to publications in English from the launch of the databases until March 2014. Supplementation of the electronic database searches by footnote chasing and author search (Kable et al., 2012), yielded no additional references. The inclusion criteria were: (1) primary empirical studies, (2) pre-registration nursing students, nurse practitioner students and/or NTs as participants, and (3) studies reporting findings on mobile device use in nursing student–NT cooperation during the clinical practicum. The exclusion criteria were: (1) review, discussion, proceedings and editorial articles, (2) studies in domains other than nursing education, and (3) studies reporting findings on mobile device use in classroom or skill lab education.

The database searches identified 278 references which were imported into the bibliography management tool RefWorks for removal of duplicates. In the initial screening, references were selected independently by two authors (MSt and C S-L) through title, and in the abstract screening against the inclusion and exclusion criteria followed by a consensus discussion. Full-text articles were then screened against the inclusion and exclusion criteria independently and after a consensus discussion 11 studies were included in the review (Fig. 1).

### Data Abstraction and Synthesis

Data extraction was performed and documented (see Table 1) from the included studies ( $n = 11$ ) according to author, year, country, design, sample, data collection method, questionnaire and original research aim. Thematic analysis (Miles and Huberman, 1994; Whittemore and Knaf, 2005) of studies led to identification of nine sub-themes related to mobile device use in nursing student–NT cooperation. No single sub-theme was identified across all studies. The

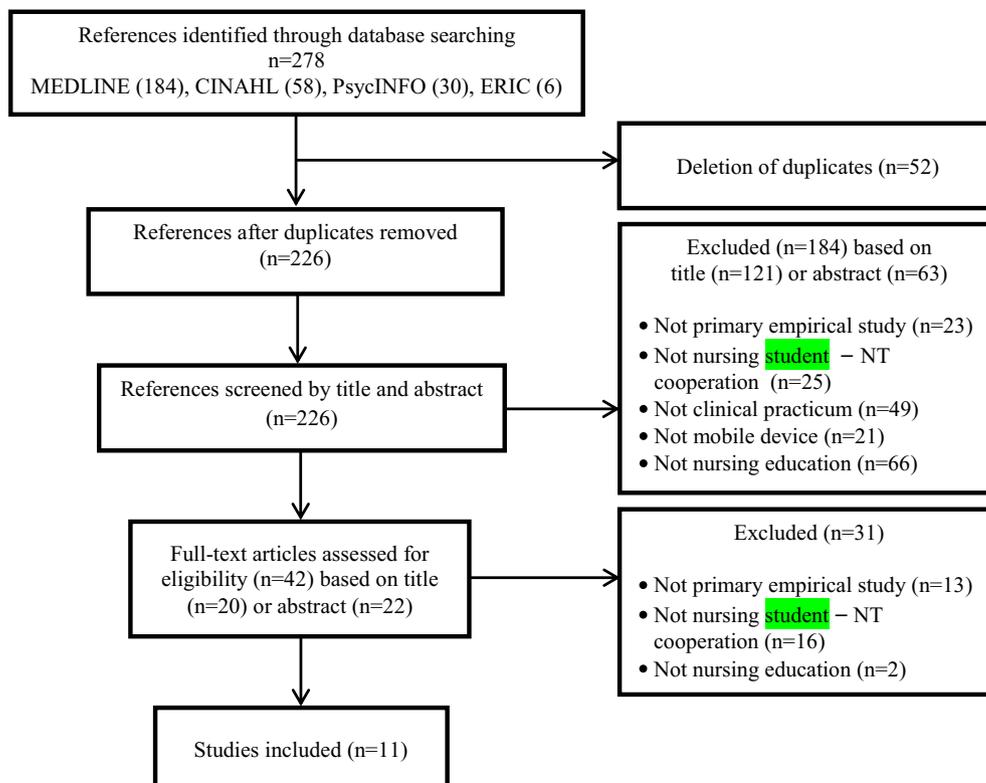


Fig. 1. Flow diagram of study selection process (Moher et al., 2009).

**Table 1**

Summary and quality appraisal checklist scores of the included studies (n = 11).

Authors (Year) country	Design	Sample				Data collection method	Questionnaire		Original research aim	Check-list score
		Students	Nurse practitioner	Nurse teacher	Other		Validated earlier	Developed by authors		
Wu (2014) Taiwan	Quasi-experimental comparison group post-test	n = 36		n = 1		Post questionnaire In-depth interviews Learning portfolio data	+	-	To explore how an online learning community influence the behavior of nursing students and to assess the perceptions and satisfaction of nursing students towards the platform.	7/22 <sup>a</sup>
Martyn et al. (2014) Australia	Quasi-experimental one group pretest-posttest	n = 40				Pre-post online survey Focus groups Discussion data Journals	+	-	To investigate the benefits and constraints of portable media player in distance education.	6.5/22 <sup>a</sup>
Wu and Sung (2014) Taiwan	Quasi-experimental comparison group pretest-posttest	n = 68		n = 1		Pre-post questionnaire In-depth interviews	+	-	To assess the advantages of mobile devices and Cloud learning in a public health practice course.	7.5/22 <sup>a</sup>
Kenny et al. (2012) Canada	Descriptive cross-sectional	n = 83		n = 17	Practical nurse students n = 38	Online survey	+	-	To assess the current use of mobile devices by nursing faculty and students in their teaching and learning and assess their readiness to engage in mobile learning by measuring their mobile self-efficacy.	12.5/22 <sup>b</sup>
Wyatt et al. (2010) USA	Quasi-experimental interrupted time series		n = 22			Pre-posttest questionnaire Focus groups	-	+	To explore how cooperative and interactive m-learning techniques enhance classroom and clinical nursing education at multiple locations and to determine the relationship between m-learning and students' learning styles.	6.5/22 <sup>a</sup>
Young et al. (2010) UK	Quasi-experimental one group post-test	n = 59				Online questionnaire Telephone interviews Face-to-face interviews SMS texting statistics Post-survey Focus group interviews	-	+	To investigate whether health care students would benefit from having an additional mechanism of support in practice placements.	5.5/22 <sup>a</sup>
Bogossian et al. (2009) Australia	Quasi-experimental one group post-test	n = 3				Post-survey Focus group interviews	-	+	To investigate the use of the clinical practice performance electronic portfolio in the clinical environment.	5/22 <sup>a</sup>
Kenny et al. (2009) Canada	Experimental comparison group post-test	n = 17				Post survey Interviews Cell phone download statistics	-	+	To evaluate whether the implementation of mobile devices in a practice education setting would be feasible and practical, and to assess if nursing students and instructors would fine the use of such devices to be comfortable and helpful in assisting their learning.	8/25 <sup>c</sup>
MacKay and Harding (2009) New Zealand	Quasi-experimental one group post-test	n = 41		n = 1		Questionnaire eTXT and mobile phone message statistics Field notes	-	+	To assess the value of SMS project in providing mobile support to student nurses during primary health care clinical placements.	6.5/22 <sup>a</sup>
Wu and Lai (2009) Taiwan	Quasi-experimental one group post-test	n = 6		n = 1	Nurses n = 4	Questionnaire Reflective journals Interviews Field observation	-	+	To evaluate the effectiveness of a wireless handheld learning environment.	5.5/22 <sup>a</sup>
Garrett and Jackson (2006) Canada	Quasi-experimental one group post-test		n = 6		Medical students n = 4	Post questionnaire Focus group interviews Log of activities	-	+	To design, implement and evaluate a PDA based tool to support reflective learning in practice.	5.5/22 <sup>a</sup>

<sup>a</sup> TREND Statement maximum score 22.

<sup>b</sup> STROBE Statement maximum score 22.

<sup>c</sup> CONSORT 2010 maximum score 25.

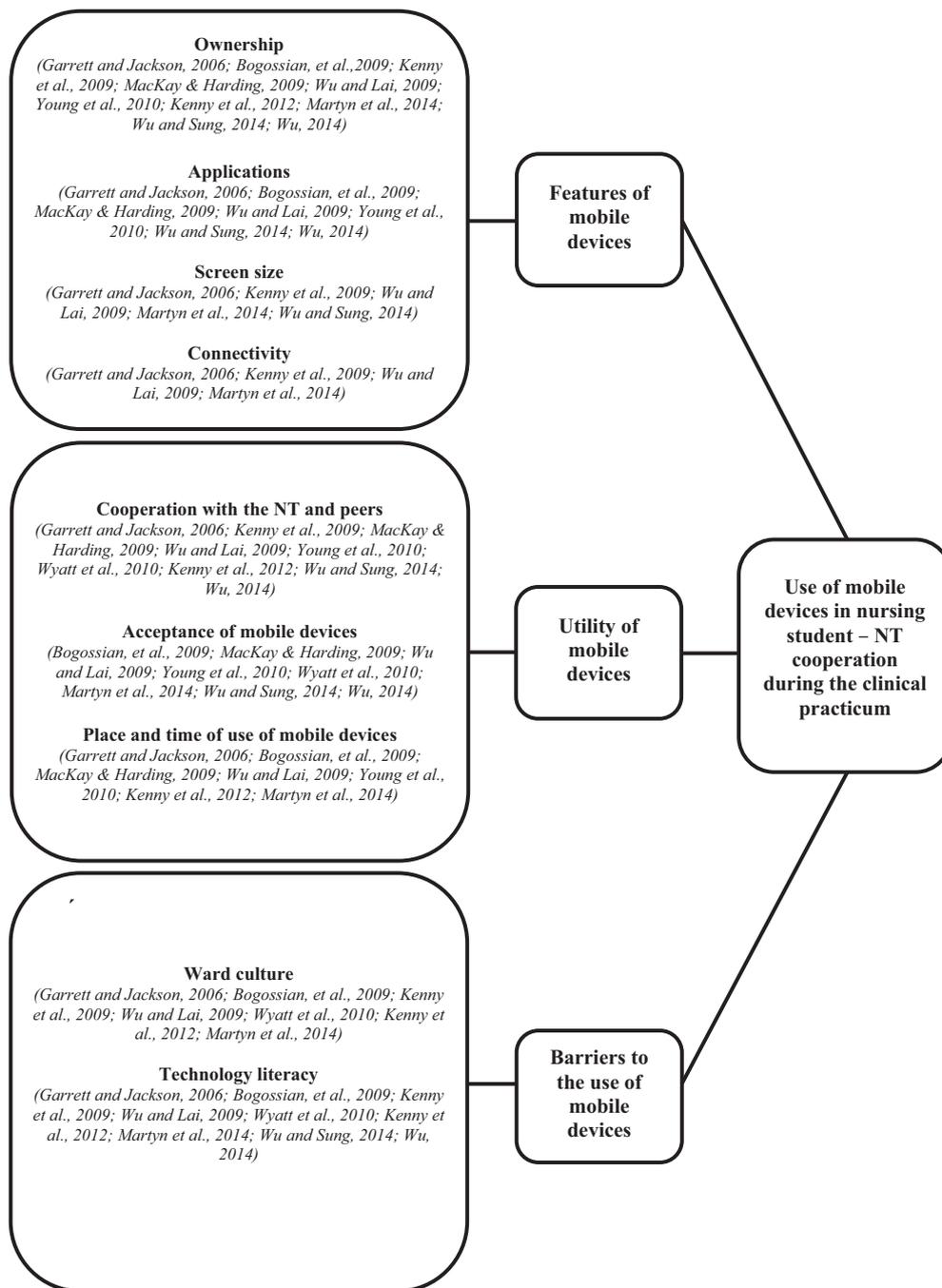


Fig. 2. Summary of themes identified in mobile device use in nursing student-NT cooperation.

sub-themes were further analyzed and synthesized to yield three main themes: (1) features of mobile devices (2) utility of mobile devices and (3) barriers to the use of mobile devices (Fig. 2).

#### Quality Appraisal

The included studies ( $n = 11$ ) were critically appraised using standardized study design-specific checklists. CONSORT 2010 (Moher et al., 2012) was used for experimental studies ( $n = 1$ ), STROBE Statement (von Elm et al., 2007) for descriptive studies ( $n = 1$ ) and TREND Statement (Des Jarlais et al., 2004) for quasi-experimental studies ( $n = 9$ ). The agreement was resolved by consensus discussion (MST and C S-L). The quality appraisal did not indicate high quality studies (see Table 1).

## Results

#### Study Characteristics

The studies were published between 2006 and 2014 in peer-reviewed journals. One article in press (Wu, 2014) was retrieved. A quasi-experimental design was used in nine studies, mainly with a one-group design (see Table 1). Ten studies were undertaken in authentic learning environments in private or public hospitals, in primary health care settings or in home care services in community settings. Convenience sampling, mainly with volunteers, was used in the studies, except for Kenny et al. (2009), who used purposive sampling. In the analysis of the studies three main themes were identified: (1) features of mobile devices, (2) utility of mobile devices, and (3) barriers to the

use of mobile devices. A more detailed description of the themes is given below.

### *Theme 1: Features of Mobile Devices*

The first theme was found in all studies ( $n = 11$ ) through four identified sub-themes related to mobile device ownership, applications used in nursing student–NT cooperation, screen size and connectivity with the wireless network. A more detailed description of the themes is given below.

*Ownership* of the mobile devices varied across studies. Participants used either their own (MacKay and Harding, 2009; Young et al., 2010; Wu and Sung, 2014) or loaned mobile device during the study. The loaned mobile devices were tablet PCs (Bogossian et al., 2009; Wu, 2014), pocket PCs (Kenny et al., 2009), portable media players (Martyn et al., 2014) and PDAs (Garrett and Jackson, 2006; Wu and Lai, 2009). Kenny et al. (2012) reported high level of ownership of mobile devices among nursing students.

*Applications* used to promote nursing student–NT cooperation comprised e-portfolios (Garrett and Jackson, 2006; Bogossian et al., 2009), reflective journals, discussion forums (Wu and Lai, 2009), and SMS text messaging (MacKay and Harding, 2009; Young et al., 2010). Social networking services were used as learning platforms integrating applications for communication, positioning and route-planning, and article posting and sharing (Wu and Sung, 2014; Wu, 2014).

*Screen size* was too small for reading whole text (Garrett and Jackson, 2006; Wu and Lai, 2009), and led to scrolling vertically and horizontally (Kenny et al., 2009; Martyn et al., 2014) on the touch-screen. Screen size was acceptable for mobile formatted applications (Kenny et al., 2009), but not for Internet PC-based web pages (Wu and Lai, 2009; Wu and Sung, 2014).

*Connectivity* problems with the wireless network in clinical practice (Garrett and Jackson, 2006; Kenny et al., 2009; Wu and Lai, 2009; Martyn et al., 2014) and outside the campus (Martyn et al., 2014) were reported. Applications with an offline viewing and editing feature as well as Bluetooth and infrared allowed wireless sharing between mobile devices, providing flexibility in the use of the mobile device without connectivity problems (Wu and Lai, 2009).

### *Theme 2: Utility of Mobile Devices*

The second theme was found in all studies ( $n = 11$ ) through three identified sub-themes related to the nursing students' cooperation with the NT and peers, participants' acceptance of the mobile devices and the place and time of its use.

*Cooperation with the NT and peers* increased due to mobile device use (MacKay and Harding, 2009; Wu and Lai, 2009; Wyatt et al., 2010; Kenny et al., 2012; Wu, 2014). Mobile devices enhanced feelings of support (MacKay and Harding, 2009; Young et al., 2010; Kenny et al., 2012) and motivation (MacKay and Harding, 2009), reduced stress among nursing students (Wu and Sung, 2014; Wu, 2014), promoted flexibility in cooperation (MacKay and Harding, 2009) and reduced nursing students' sense of isolation from peers and faculty during the clinical practicum (Garrett and Jackson, 2006; Young et al., 2010). Mobile devices allowed privacy in cooperation with the NT in wards where nursing students' calls could be overheard by staff (Young et al., 2010). Conflicting results were reported in Kenny et al. (2009) and Garrett and Jackson (2006) where mobile devices were not used in cooperation with the NT or peers.

*Acceptance of mobile devices* was reported in most studies. Nursing students were both interested in and satisfied with the use of mobile devices during the clinical practicum (Wu and Sung, 2014; Wu, 2014) and accepted personal mobile devices as a private (MacKay and Harding, 2009; Young et al., 2010) and informal communication tool (MacKay and Harding, 2009). Wyatt et al. (2010) in turn did not find any changes in nursing students' opinions on the usefulness of mobile devices during

the clinical practicum. Nursing students' prior computer experience was not associated with their views on mobile devices and social network service use. No statistically significant differences were found between participants who used mobile device and social network services and those using traditional methods of cooperation (Wu and Sung, 2014). Wu and Lai (2009) in turn found that prior use of computers influenced participants' views on using mobile devices. Lack of emoticons, short battery life (Wu and Lai, 2009), the need for an application account (Martyn et al., 2014), and the inconvenience of carrying the device in one's uniform pocket (Bogossian et al., 2009) were reported as negative aspects of mobile device use. In turn, the mobile devices allowed the NT to monitor student discussions and home visits more democratically (Wu and Sung, 2014; Wu, 2014), implement more in-depth discussions (Wu and Lai, 2009), provide timely feedback (Wu and Lai, 2009; Wu and Sung, 2014; Wu, 2014), support nursing students (Young et al., 2010; Wu, 2014) and communicate asynchronously with nursing students (MacKay and Harding, 2009).

*Place and time of use of mobile devices* were mainly outside of the clinical practicum. NT (MacKay and Harding, 2009) and nursing students (Wu and Lai, 2009) reported the use of mobile devices to be time saving. Participants used mobile devices at least weekly, primarily as communication tools (Kenny et al., 2012). In Young et al. (2010) mobile devices were used mostly in the daytime and less in the evening. In Bogossian et al. (2009) mobile devices were not brought regularly into wards. Entries were made rather at home (Garrett and Jackson, 2006; Bogossian et al., 2009; Wu and Lai, 2009), in local restaurants (Martyn et al., 2014) and on the bus (Wu and Lai, 2009). Participants considered it acceptable to use mobile devices on night shifts (Bogossian et al., 2009) and at lunch time (Kenny et al., 2012) but reported discreet use in front of staff and avoided use at the bedside (Bogossian et al., 2009).

### *Theme 3: Barriers to the Use of Mobile Devices*

The third theme was found in nine of the eleven studies through two identified sub-themes related to the ward culture during the clinical practicum and participants' technology literacy.

*Ward culture* complicated participants' use of mobile devices. Prohibitions on use in wards (Kenny et al., 2009; Wyatt et al., 2010), negative staff attitudes (Martyn et al., 2014) and hospital policies (Kenny et al., 2012) hindered the use of mobile devices. Bogossian et al. (2009) and Wu and Lai (2009), however, found a ward culture conducive to mobile devices. Busy wards with distractions and interruptions (Garrett and Jackson, 2006; Bogossian et al., 2009; Martyn et al., 2014) and a short clinical practicum (Kenny et al., 2009) hindered nursing students' use of mobile devices. Participants reported concerns about risk of theft of the mobile device (Bogossian et al., 2009; Wu and Lai, 2009), infection control (Kenny et al., 2012) and damage to the device (Kenny et al., 2009, 2012), which also hindered the use of mobile devices in wards.

*Technology literacy* varied across nursing students, some had prior experience of mobile devices (Kenny et al., 2009, 2012; Wyatt et al., 2010; Wu and Sung, 2014) and others used mobile devices for the first time (Wu, 2014). Martyn et al. (2014) found lack of both confidence and technology literacy among nursing students. A need for training in the functions and interfaces of the applications of mobile devices to ensure their full use in the clinical practicum was reported (Wu and Lai, 2009; Wyatt et al., 2010; Wu and Sung, 2014; Wu, 2014). Participants who received appropriate training did not need subsequent technical support or training (Garrett and Jackson, 2006; Bogossian et al., 2009; Kenny et al., 2009).

## **Discussion**

This integrative review identified and appraised study findings on the use of mobile devices in nursing student–NT cooperation during the clinical practicum from the very early beginning of the mobile device development up to ones which should reflect the current use of

the rapidly changing mobile technology. The quality of the studies varied, and weaknesses in designs, samples, questionnaires and results were found. Some studies lack utility owing to poor reliability and generalizability of the findings. One experimental post-test-only comparison group design with purposive and random stratified sampling method was found in this review (Kenny et al., 2009). Most of the studies were post-test-only designs. In some studies, the participants included medical students or practical nurse students, rendering it occasionally hard to separate out mobile device use by the nursing students. It was not always clear whether the results were in fact describing mobile use in nursing student–NT cooperation. Ten studies used convenience sampling, with volunteers, which could lead to response bias caused by more positive answers from participants familiar with mobile devices.

Mobile devices were mainly found to be a valuable tool enhancing both nursing student–NT and peer cooperation (MacKay and Harding, 2009; Wu and Lai, 2009; Kenny et al., 2012; Wu, 2014) while at the same time decreasing the feeling of isolation from the NT and peers (Killam and Heerschap, 2013). Mobile devices allowed the privacy needed for nursing students to cooperate with the NT in the ward (Young et al., 2010) and at more convenient times and locations (Clay, 2011) using indirect synchronous and asynchronous communication methods which, unlike phone calls, do not interrupt the work of ward staff or the NT. Through their use of wireless technology, mobile devices may be valuable as a tool mediating cooperation with the NT and peers (Wu et al., 2012), also making it possible to utilize spare moments to cooperate irrespective of location and so support the technology-oriented communication habits of nursing students. Mobile device use in nursing student–NT cooperation enhanced the students' sense of support, indicating the potential value of mobile devices to NTs in supporting nursing students during the clinical practicum (Price et al., 2011; Killam and Heerschap, 2013). However, it seems that multiple applications were used together to promote nursing student–NT cooperation and any application specially developed for the nursing student–NT cooperation was found in the studies.

This review found that the most important factors in the successful use of mobile devices in nursing student–NT cooperation during the clinical practicum were training in and familiarization with the use of the chosen mobile device, ongoing technological support and a well-functioning wireless connection. These results do not support the assumption that technology literate nursing students are necessarily ideal adopters of mobile devices (Hansen and Erdley, 2009). However, this review supports Johansson et al. (2012) and Johansson et al. (2013), who found that mobile devices are valued as reference and time-saving tools. Nursing students used mobile devices less frequently as reflection, assessment or communication tools. Nevertheless, mobile devices could be valuable tools in nursing student–NT cooperation, at least in those European countries where nursing students–NT face-to-face contacts during the clinical practicum have decreased (Saarikoski et al., 2013). Generally, nursing students and NTs reported a positive attitude towards and satisfaction with mobile devices (Young et al., 2010; Wu and Sung, 2014; Wu, 2014) and were willing to try them (Wu and Sung, 2014) and to continue using them after the study (Wu, 2014).

#### Strengths and Limitations of the Review

This review has strengths and limitations. In the systematic comprehensive electronic database searches, the number of filters was limited to as few as possible: (1) English language and (2) peer-reviewed primary empirical studies. The same text search terms planned by two authors (MSt and C S-L) were used across the databases to avoid bias in the search. The data abstraction and quality appraisal were conducted independently by the above mentioned two authors and agreements were resolved by consensus discussions. The quality appraisal of the included studies was conducted using study design-specific standardized checklists.

The database search has limitations. Although a systematic search strategy was used, the search was probably not exhaustive. Computer science research indexed in databases other than those used in this review was excluded. Moreover, unpublished data could yield more up-to-date knowledge of more recent improvements in mobile device use in nursing education. The database search captured a limited number of eligible studies for review. Despite these limitations, this review finds mobile devices to be a beneficial educational tool that can lead to increased nursing student–NT cooperation during the clinical practicum. It is, however, difficult to draw firm conclusions on the basis of so few eligible studies.

#### Conclusions

In the literature there is an obvious gap concerning mobile device use in nursing student–NT cooperation. It is evident from this review that although research on the mobile device use in nursing student–NT cooperation during the clinical practicum has increased in recent years, it remains limited: themes vary and the findings lack consistency and generalizability. Moreover, the latest mobile technology is not represented in the studies. Nevertheless, mobile devices are not yet replacing face-to-face meetings between nursing students and NTs. Mobile devices have potential for implementing nursing student–NT cooperation in new ways in keeping with the communication habits of technology literate nursing students. Because of the high interest in and prevalence of mobile devices among nursing students, more robust study designs for exploring the utilization of the existing technologies in nursing student–NT cooperation in authentic learning environments are needed in future studies.

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