Noora Kihnula

Learning clinical competence with mobile technology in nursing education

A Descriptative Literature Review

Helsinki
Metropolia
University of Applied Sciences

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Integration of mobile technology has been reshaping education within last decades and likewise it has been increasingly incorporated into nursing education. Hence, research considering mobile technology in nursing education is essential, more specifically in clinical education. Clinical education composes more than half of the nursing studies in Finland. Therefore, the purpose of this literature review is to describe the use of mobile technology in learning of clinical competence in nursing education. Thus, the aim of this literature review is to produce new knowledge for the future development of learning clinical competence in pre-registration nursing education.

The articles were obtained from reliable databases such as CINAHL, Medic, Medline, ERIC and Science Direct. Preliminary research yield 678 titles, that were read, and based on inclusion and exclusion criteria 79 of them were taken into further consideration. Finally, 15 articles were chosen into this literature review. The principles of inductive and deductive content analysis were used in analyzing the data.

Based on the findings of this bachelor thesis, mobile technology has found its way to pre-registration nursing education. There are various devices, such as personal digital assistants, smart phones, laptops/tablets and media players, used to aid the learning clinical competence. They function as resource back, practice tool, documentation tool and communicational tool. Students perceive it mainly as beneficial aid, but certain aspects of mobile technology may create obstacles in learning process.

As almost every college students owns a smartphone it already gives educators mobile technological tool to work with. Therefore, research concerning smartphones in pre-registration nursing education is evident. Furthermore, the focus needs be switched towards the applications or simulations that are used in mobile learning. Additionally, research pertaining the current use of mobile technology in pre-registration nursing education in Finland would give a foundation to develop more advanced learning methods for future nurses.

| Keywords | mobile technology, clinical competence, nursing education, learning |

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Mobiiliteknologian käyttäminen osana opetusta on kasvanut viime vuosikymmenten aikana ja viime vuosina sen osuus on kasvussa myös sairaanhoitajaopinnoissa. Tutkimustieto mobiiliteknologian vaikutuksista opetukseen ja oppimiseen on arvokasta pääomaa tulevaisuutta varten. Kliinisen opetuksen osuus sairaanhoitajan koulutuksesta kattaa kaksi kolmas osaa kokonaiskoulutuksesta. Tämän opinnäytetyön tarkoitus on kuvailla kuinka mobiiliteknologiaa käytetään kliinisten aineiden koulutuksessa. Tavoitteena on kerätä tietoa ja hyödyntää saatua tietoa sairaanhoitajakoulutuksen kliinisen koulutuksen kehittämisessä.

Artikkelit kerättiin luotettavista tietokannoista, kuten CINAHL, Medic, Medline, ERIC ja Science Direct. Haku tuotti 678 tulosta. Otsikot käytiin lävitse ja sisäänottokriteereiden perusteella 79 artikkelia otettiin syvempään tarkasteluun. Lopulta 15 artikkelia valikoitui osaksi tätä kirjallisuuskatsausta. Induktiivisen sekä deduktiivisen analyysin periaatteita käytettiin materiaalin analysointiin.

Tämän opinnäytetyön tulosten perusteella mobiiliteknologia on löytänyt tiensä myös sairaanhoitajakoulutukseen. Kämmentietokoneet, älypuhelimet, kannettavat/tabletit sekä medialaitteet toimivat kliinisten taitojen oppimista edesauttavina laitteina. Ne toimivat lähdetietokantoina, harjotustyökaluina, domentointivälineinä sekä kommunikaatiötyökaluina. Sairaanhoitajaopiskelijat kokivat mobiiliteknologian lähinnä tukevan oppimista, mutta sen tietyt piirteet saattoivat myös vaikeuttaa oppimisprosessia.

Tänä päivänä lähes jokaisen ylemmän asteen opiskelijoiden omistaessa älypuhelimen, opettajilla on automaattisesti teknologinen työkalu käytettävissä. Täten on selvää, että lisätutkimusta tarvitaan koskien älypuhelimien käyttöä sairaanhoitajakoulutuksessa. isäksi tutkimusta tulisi kohdetaa nimenomaan niihin mobiiliapplikaatioihin tai simulaatioihin mitä koulutuksessa käytetään. Myöskin mobiiliteknologian käyttö suomalaisessa sairaanhoitajakoulutuksessa kaipaa lisää tutkimusta, jotta tulevien hoitajien oppimismenetelmiä voitaisiin kehittää edelleen.

Avainsanat	Mobiiliteknologia, sairaanhoitajakoulutus, oppiminen, kliininen osaaminen

Contents

1 Introduction

Clinical skills are the core of nursing profession and every nurse must be competent in performing them. EU directive Article 31 of 2013/55/EU regulates the amount of clinical studies, making it proportionally the largest content taught in nursing education in Europe. Increasing enrolment in to nursing programs corresponds to the international shortage of nurses (Zurn, Dolea & Stilwell 2005: 4, Hofler &Thomas 2016: 135), leading to increasing amount of newly qualified nurses entering in to the workforce. Concurrently experienced nurses and nursing leaders question the competence levels of recently qualified nurses (Advisory Board cited in Berman et al. 2014: 56; Lofmark, Smide & Wikblad 2006: 726). Therefore, more comprehensive ways to learn clinical skills are needed to decrease the gap between education and practice (Berman et al. 2014).

New technological innovations are constantly introduced in today's higher education institutions. The development has led to an integration of technology into a nursing education as well (Skiba 2015: 422). Pre-clinical lessons in higher educational institutions are hold in learning laboratories, in which simulations, videogames and other technological aids are increasingly used. Simulations allow nursing students to practice real-life-like-situations and develop professional identity in a safe environment (Gaba 2005: 2; Kelly, Berragan, Husebø & Orr 2016: 319). Videogames can be used to improve skills or to create new knowledge (Monti et al. 2015: 13; Cook, McAloon, O'Neill & Beggs 2012: 720). Video presentation of clinical procedures is found to be more effective learning method compared to didactic lecture (Lee, Boyd & Stuart 2007: 244). These technologies allow new approaches to learn and practice clinical skills more comprehensively.

Application of technology has a positive effect on the development of clinical competence among nursing students. Incorporation of traditional and experimental learning environments decreases the gap between the theory and the practice. (Rowe, Frantz & Bozalek 2012.) In addition, various technological innovations facilitate different types of learning compared to traditional teaching methods (Hammerling 2012: 318). Technological revolution has reached a point that 96 % of young adults in Finland and 86 % of young adults in USA were using smart phones in 2015 (Anderson 2015; Sanoma 2015). Integrating mobile technology into the curriculum increases the level of involvement and learning (Monti Fonseca et al. 2015: 13; Cook et al. 2012: 720).

In this literature review, the purpose is to describe how mobile technology is used in learning of clinical competence in nursing education. This study is conducted as a part of Aalto University and University of Applied Science Metropolia's research.

2   Background

An accessibility has led to integration of mobile technology into curriculums from preschool to higher education. Primitively mobile technology was thought as an extension of e-learning, but its distinct characteristics make it unique. Whereas mobile technology uses aspects of other types of learning, it also differs from them. Mobile learning has a unique potential to extend the experience of learning by incorporating interactivity and resources beyond traditional classroom settings. (Rikala 2015: 15, 46, 179; Park 2011). Different researches contribute the origin of mobile learning to different learning theories. Thus, diversified learning theories emphasize distinct aspects in the process of mobile learning. For example, mobile learning can be seen by the eyes of behaviorists as a tool to re-enforce the connection between reaction and stimulus. Organization of cognitive structures happens when information is processed and stored by mobile learning, thus supporting the cognitivist view of learning. Then again, socio-cultural, collaborative and conversational learning theories focus on the social aspect of mobile learning. (Keskin & Metcalf 2011: 203-204). Therefore, the underlying learning theory will guide the type of mobile application that is used in learning. Due to its adaptability, mobile learning has a potential to be harnessed by different schools of thought. Utilization of mobile technology creates new opportunities especially to innovative, student-centered pedagogies (Rikala 2015: 78).

Learning is a complex process in which a change happens. Definition by Merriam-Webster dictionary (2016), learning is "a process of gaining new knowledge or skill due to practicing, studying, being taught or an experience". It is strengthening, reshaping and refining previously acquired memory clusters or creating new ones (Leino & Leino 1997: 23). Various learning theories emphasize different factors effecting to the process of learning. Furthermore, it can be said, that learning theories represent different dimensions and aspects of learning. While theories have dissimilarities, most theories have

mutual characteristics as well. Major theories agree that learning is a process that happens when an individual experiences and interacts with the surrounding environment. Positive experiences, motivation, effective and skillful guidance from educator support learning. Concurrently negativity, fear of punishment or inappropriate material for learning hinder the process of organizing and relating the new information to the learner's past experiences. (Braungart & Braungart 2011: 81-83.) Thus, it can be established that learning is a process which can be approached from different viewpoints. Therefore, the learning takes time and requires the input from a learner as well from the instructor. After all, the aim of teaching is to produce learning (Leino & Leino 1997: 23). Considering the nature of nursing, learning must become a permanent experience to achieve the competence level set in professional standards. Major theories establish four factors in assisting learning becoming permanent. Firstly, organized, meaningful and positive experience that meets the learner's capacity to process information increases the likelihood of learning. Secondly, mental and physical practice in various circumstances and conditions allows learner to strengthen the previously learned subject. Thirdly, reinforcement allows learner to acknowledge that learning has occurred. Fourthly, to assess the permanency of learning the educator must evaluate the performance soon after learning experience as well as later times. Otherwise the learning experience becoming permanent cannot be proven. (Braungart & Braungart 2011: 83.) Considering the framework of this literature review, learning refers to a process in which learner acquires, combines, strengthens and practices skills and knowledge, organizing them in a way that the learner can use them regardless of surrounding circumstances.

Within the last two decades mobile learning has been gaining more attention, leading to researches and theories discovering and defining the phenomena (Park 2011). Since the rapid development of technology, the current theories consider mobile learning devices as a variable that contributes towards learning experience instead of considering certain kind of device. Pedagogical viewpoint considers technology just as an aid to enhance learning (Kearney, Schuck, Burden & Aubusson 2012). Early on the focus was on the device and its capabilities and limitations, but today's theories have switched the core unto the content of mobile learning (Keskin & Metcalf 2011: 202).

In the context of the thesis, the term "mobile technology" will include all mobile technology based tools that can be used to learn competence. Merriam Webster Online Dictionary (2016) defines technology as "a manner of accomplishing a task especially using

technical processes, methods, or knowledge". Mobile (cell) phone is defined as something that is "capable of moving or can be moved" (Merriam Webster 2016). Term mobile technology is commonly understood as technology that is related to mobile phones. This means, for example, virtual platforms, video recording, games, aids in simulations and other applications that can be operated on mobile phones or hand-held devices.

Margaret Koole's (2009) FRAME theory of mobile learning is widely acknowledged and its validity is still recognized. Although it was primarily created for nursing education, it has been adopted by other fields as well. Her model considers different aspects of mobile learning and their effects to the outcome of learning. According Koole's theory (2009) mobile learning is a process involving mobile technology, individual's capacity to learn and social interaction. Learning happens when all the three aspects overlap (Koole 2009: 38) as presented by Figure 1.
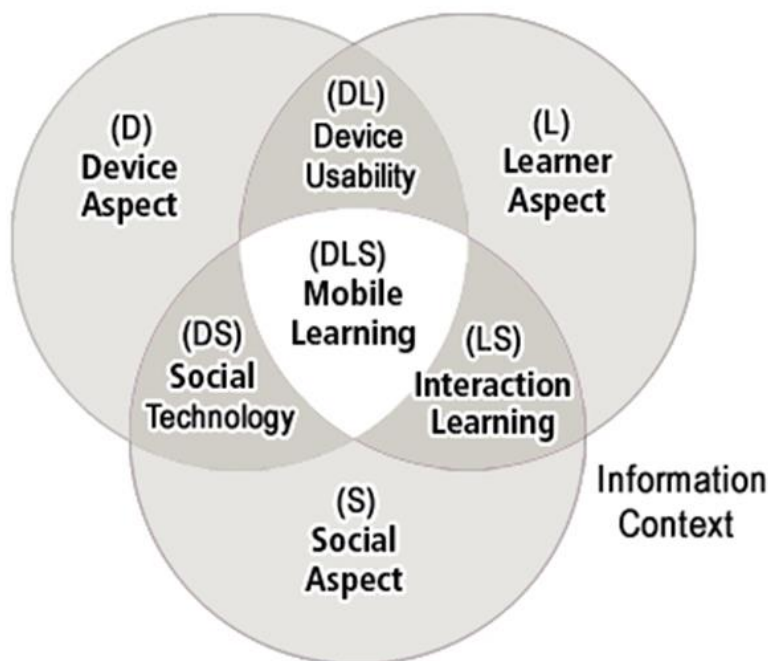

Figure 1. FRAME – the Framework for mobile learning by Margaret Koole (2009).

Besides not considering a certain type of mobile devices, Koole's (2009) model is not constricted by a learning theory either. It allows the learners aspect to utilize any theory. In the model, the learning aspect is merely the individual's ability to learn (Koole 2009: 29-31). However, FRAME leans towards social-cultural view of learning, considering the device and communicational aspects in conjunction with learner's individual abilities as

well. Although, the model was created two decades ago, current mobile learning theories build on it. For instance, studies by Kearney, Schuck, Burden & Aubusson (2012) and Rikala (2015) used FRAME as basis on their theoretical model, while taking a broader context in which mobile learning is considered. Newer theories recognize mobile learning exceeding beyond a set context, thus allowing learning to take place across contexts (Park 2011). Theoretical background of mobile learning has been evolving with the development of mobile devices (Kearney et al 2012). Although researches focusing on mobile learning have been conducted, the concept of mobile learning and cohesive theoretical background is still missing (Kearney et al. 2012; Park 2011). The range of proposed theories range from multicomplex to more simplified versions, but themes such as mobility of devices and learners (exceeding time and space) as well as emphasis on social aspects (interactivity, communication) have aroused (Park 2011).

In this thesis, clinical competence is defined as having adequate knowledge and skills with an ability to apply them in practical situations pertaining hands-on patient care. The concept of competence is a complex and multidimensional, therefore is no clear consensus. However, Merriam - Webster Dictionary (2016) defines competency as "the quality of being mentally competent", "the quality or state being legally qualified or adequate", and "an ability or skill". And competence as "the quality or state of being functionally adequate", "a sufficiency of means for the necessities and conveniences of life", "quality or state being competent", "possession of sufficient knowledge or skill" and "legal authority, ability or admissibility". Competence in nursing can be defined as "the ability to perform the task with desirable outcomes under the varied circumstances of the real world" (Benner 1982: 304). Competence can also be seen as a combination of knowledge and as ability to undertake required actions according to the policies of certain situations (Nolan 1998: 27; McDonnell 2001: 14). While other authors explain competency as a potential of skills and knowledge and competence as a combined action of skills and knowledge in performance (McDonnell 2001: 14), they are mainly used interchangeably within nursing research literature (Cowan, Norman & Coopamah 2005: 26). The Finnish Ministry of Education and Culture (2016) defines clinical competence as having adequate knowledge to observe a patient, take actions accordingly and to evaluate the effectiveness of the treatment while maintaining patient safety and promoting health. Standard actions include the basic and advanced patient care. Clinical competence is a capability to undertake the duties directly related to patient care on an acceptable level (PubMed 2017).

As per EU directive (2013/55/EU article 7) graduate as a general nurse, one must successfully complete nursing studies for three years and 4600 hours of study. A half must consist of clinical studies and one-third theoretical studies. The Nursing and Midwifery Council (NMC 2010: 9) legislates equal (2300 hours – 2300 hours) ratio for theory and practical training in the UK. Nursing students in Finland must successfully pass 105 credits, 2835 hours, of clinical studies. That means 535 hours more than the EU standard concerning clinical studies (Eriksson, Korhonen, Merasto & Moisio 2015: 35; Opetusministeriö 2006: 17). Overall, in most countries the portion of lessons focusing on hands-on practice of clinical skills varies from 30-60% of the entire nursing education (Dobrowolska et al. 2015: 40). Clinical studies aim to develop student's clinical skills and consequently the level of competence. Competence standards and clinical competence are also mentioned in major guidelines for nursing ethics. Delivering good quality and safe patient care has been defined as nurses' responsibility in the ethical guidelines of The International Council of Nurses and Nursing and Midwifery Council. To uphold the obligation, one must achieve a certain level of competence.

3   Purpose, Aim and Study Questions

The purpose of this literature review is to describe the use of mobile technology in learning of clinical competence in nursing education. Thus, the aim of this literature review is to produce new knowledge for the future development of learning clinical competence in pre-registration nursing education.

The research questions are formed as follows:
- ➢ What kind of mobile technological devices are used in the learning of clinical competence in pre-registration studies of nursing?
- ➢ How is the mobile technology used in pre-registration nursing studies?
- ➢ How does the nursing students perceive learning with mobile technology in pre-registration studies?

4   Methods

Literature review is a research method that takes previous researches under analysis and composes cohesive summary concerning the topic of interest. The previous knowledge is critically evaluated and organized to reveal what is already known. Literature review does not just describe what has been done, but compares studies to each other to find out their consistencies and contradictions (Parahoo 2014: 118-119, Polit & Beck 2014: 116). Descriptive review allows researcher to a consider broad selection of different types of literatures. It aims to analyze, interpret and present the existing knowledge while presenting connections between the aspects of the topic and offering a new interpretation of the subject of interest. Although, it has been criticized for its lack of rigor, the clear selection of parameters applied for the data selection and analysis as well as the explanation of methodology and documentation of each stage of the process diminishes the possibility for bias and subjectivity. Also, descriptive literature reviews can take advantage of the aspects of systematic review process without being constricted by systematic methodology. (Coughlan, Cronin & Ryan 2013: 14-15.) Therefore, the principles of systematic data collection and analysis are used in conducting this review.

4.1   Data Search and Study Selection

Databases such as CINAHL, Medic, Medline, ERIC and Science Direct were used in data collection as they contain nursing educational and health care science related articles. The databases were found in Metropolia University of Applied Science's libguides. CINALH, Medline and Medic are considered traditional nursing scientific databases, and therefore, valid for this research. Learning and educational viewpoint was taken in count by involving Educational Research of Institute Center's database, ERIC. Science Direct is a database concentrating on scientific, medical and technological research. Acknowledging the purpose of this bachelor thesis, the inclusion of Science Direct is justified to gain more access to technological researches.

Research articles found were limited to English and Finnish languages. As the phenomenon is relatively new, specific years were not used as a limitation or exclusion criteria. Expertise of Metropolia's informatics were also sought in the process of discovering the appropriate search terms. Furthermore, the Boolean connectors "OR" and "AND" were

used in retrieving results from the databases along with the search terms are presented in Table 1. Data search.

Table 1. Data search

	Data search				
Database	**Cinalh**	**Medline**	**Medic**	**Eric**	**Science Direct**
Search terms	(Educational technology **OR** Mobile technology **OR** hand held **OR** smartphone **OR** mobile application**)** **AND** **(**learning **OR** teaching, mobile learning **OR** m-learning**)** **AND** (clinical **OR** nursing skill)	(Educational technology **OR** Mobile technology **OR** hand held **OR** smartphone **OR** mobile application**)** **AND** **(**learning **OR** teaching, mobile learning **OR** m-learning**)** **AND** (clinical **OR** nursing skill)	educational technology **AND** **(**learning **OR** learning**)** **AND** clinical	Mobile learning **AND** nursing	"mobile technology" **AND** nursing education **AND** **(**clinical competence **OR** clinical skill**)**
Limitations	Finnish and English				
Hits	376	66	11	34	191

The selection process started by reviewing all the material revived from the data search. Based on the inclusion and exclusion criteria titles and abstracts were evaluated and chosen for further review. Preliminary search yielded all together 678 titles. Selection by the title and abstract left 79 articles. The five articles that required payment to gain access were automatically excluded. Five more articles were removed as doubles. Sixty-nine articles were read in full. However, each database search and selection of the data was conducted as their own, therefore duplicates were removed after final selection of the articles. Remaining articles were carefully read, and final selection was done based on the inclusion and exclusion criteria introduced in Table 2. Inclusion and exclusion criteria.

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
• Articles	• Articles
▫Focusing on pre-registration nursing education	▫Focusing on continued nursing education or professional development
▫Concerning clinical nursing education using mobile technology	• Referrering to computers as mobile technology
▫Written in English or Finnish language	• Written in languages other than English or Finnish

If the article was not related to the research question, study sample did not include un-dergraduate nursing students, study used other specific technology than mobile phones or devices, or the content of e-learning was not transferrable to use in current models of mobile technology, it was discarded. The process of selecting data is illustrated in Figure 2. Data selection process.

Figure 2. Data selection process
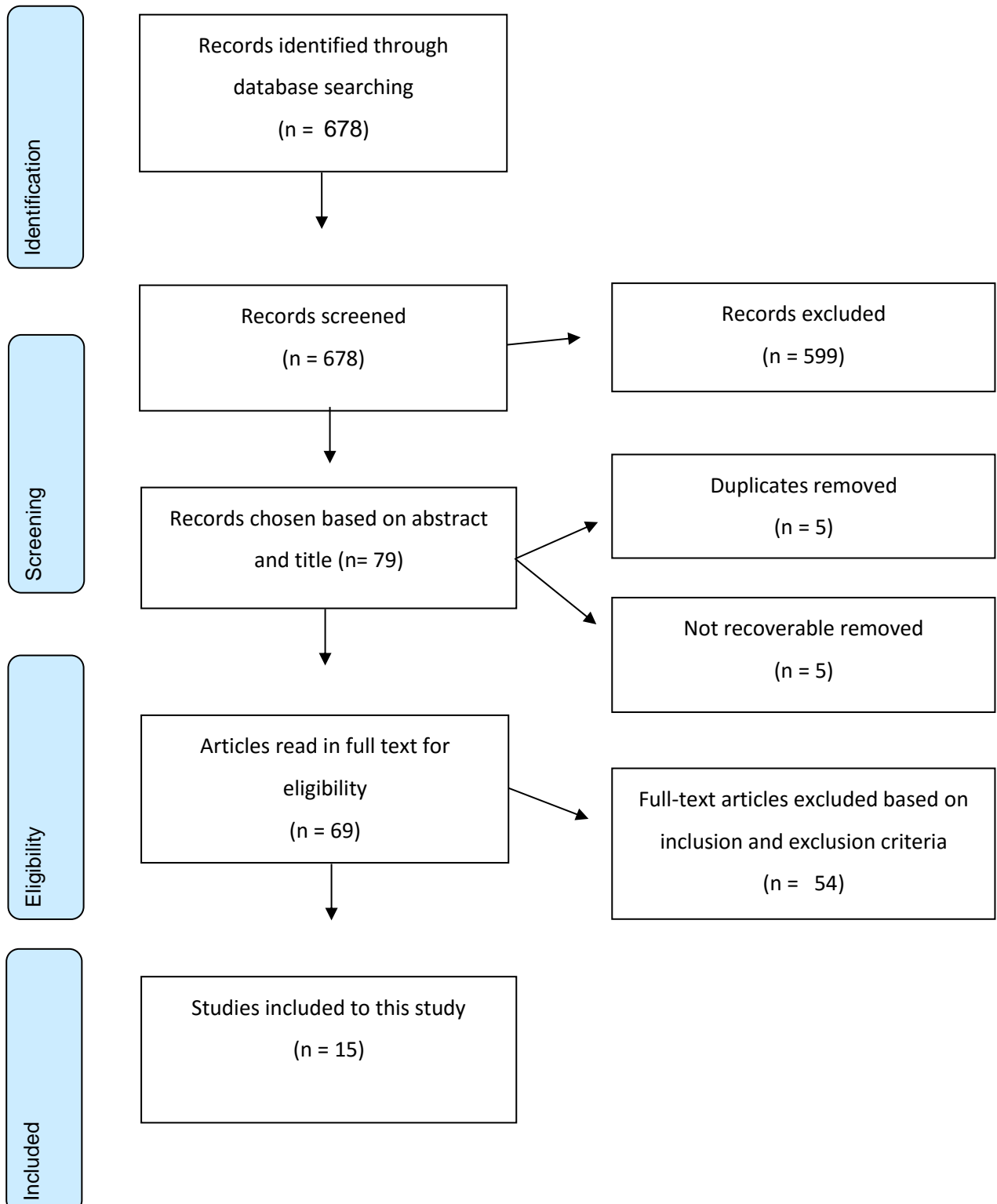
4.2   Data Analysis

The purpose of the content analysis is to describe, increase understanding and knowledge about the topic of interest (Cavanagh 1997: 15). In this bachelor theses, the principles of inductive and deductive content analysis were applied within the process. To answer the first study question "What kind of mobile technology is used in pre-registration nursing education?" deductive analysis was implemented. Once the types of mobile technology were identified, subcategories were formed accordingly based on their functions.

The principles of inductive content analysis process described by Elo & Kyngäs (2007) were implemented in the analysis of research questions two and three. An inductive content analysis means, that the categories were derived directly from the data (Polit &Beck 2004: 580). The process of inductive analysis starts by open coding, creating abstracts and categorizing the codes. The open codes are grouped, abstracted and categorized in a way that model or conceptual map can be clearly presented. Thus, the body of data is abstracted based on the themes deriving from the data itself. (Elo & Kyngäs 2007: 109-111.) Therefore, the process of analysis started by familiarization with the data. Phrases were extracted, and similar expressions were grouped together. The groups were then categorized in a way that they composed categories. The results are discussed and presented accordingly by the categories, which rose from the data.

Although concept analysis as a technique requires enormous amounts of work (Cavanaugh 1997: 15), it has been proven to be beneficial in analyzing multidimensional phenomenon studied by nursing research (Elo & Kyngäs 2007: 114.) To ensure the validity of the results, each question was answered separately. Thus, the inductive analysis process was performed twice and deductive analysis once.

5   Results

Comprehensive data search and selection process yield fifteen (n = 15) articles to be reviewed for this thesis. The selection included both qualitative and quantitative studies. All the studies were international studies. Four (n = 4) of the researches were conducted in United States of America and two (n = 2) in Canada. Asian studies were dominant in elected articles; four (n = 4) of the studies were carried out in Taiwan, one (n = 1) in

Singapore and one (n = 1) in South Korea. Europe was represented in studies executed in Sweden (n = 1) and United Kingdom (n = 1). The studies are introduced in Appendix 1. Articles selected for Review.

The results answers for the three research questions; types of mobile technology used in pre-registration nursing education, functions of mobile technology in pre-registration nursing education and the perceptions of mobile technology in nursing education. The inductive analysis of the students' perceptions is dissected further into main categories that the use of mobile technology brings along. Those main categories are: benefits and obstacles.

5.1 Types of Mobile Technology used in pre-registration nursing studies

The types of mobile technology were formed by deductive analysis. The analysis process was used to structure four main categories: Personal digital assistants, smartphones, tablets/laptops and media players. The main categories and their subcategories are visualized in Table 3. Types of Mobile Technology. The types and their functions are explained in more detail in this chapter.

The focus of mobile technology in nursing education concentrated on the learning material and its outcomes. Therefore, the type of mobile device was not specified if the student was able to use the gadget to access the learning material (Grierson, Barry, Kapralos, Carnahan & Dubrowski 2012; Alvarez, Dal Sasso, Iyengar 2017; Lin & Lin 2016; Lin 2013; Wu, Hwang, Tsai, Chen & Huang 2011). However, five types of devices that aided the learning of clinical competence were identified in the studies. Mobile technological devices were physical machines that were operated by different applications and software to support learning. Some extra accessories such as QR or RFID readers were required in more advanced simulation game settings (Wu et al. 2011; Lin & Lin 2016). Also, specific mobile applications were used in practicing skills that developed clinical competence (Alvarez et al. 2017; Yoo & Lee 2015).

Table 3. Types of Mobile Technology

Devices and their functions used in Pre-registration Nursing Education

Personal Digital Assistants	Smartphones	Tablets and Laptops	Media Players
•internet access •word-processing programs •calendar •calculator •softwares eg. drug guides, clinical guidelines	•learning material •mobile applications •internet access	•internet access •virtual clinical simulaions •educational literatute	•podcasts •mobile applications •reference materials •internet access

Personal digital assistants (PDA) are handheld devices that have a capability to connect internet and work as a platform for software. Commonly used programs in nursing education included nursing diagnostic tools, drug guides and clinical guidelines. (Schlairet 2012; Miller, Shaw-Kokot, Arnold, Boggin, Crowell, Allegri, Blue & Berrier 2005; Johansson, Petersson & Nilsson 2013; George, Davidson, Serapiglia, Barla & Thotakura 2010.) Palm OS and Hewlett-Packard iPAQ were examples of PDAswhich have a memory capacity that can be expanded (Miller et al. 2005; Schlairet 2010). In addition, PDA's inbuilt programs contained word-processing programs, calendar and calculator (Johansson et al. 2013).

Students used their personal smartphones as mobile devices for educational purposes (Yoo & Lee 2015; Beauregard, Arnaert & Ponzoni 2017; Chuang & Tsao 2013). Sending messages to deliver learning material harnessed on function of the smartphone (Chuang & Tsao 2013), while others considered its effect on learning as a whole with all its functions (Beauregard et al. 2017). Smartphones were also used as platforms to operate mobile applications directed to learning of clinical assessment (Yoo & Lee 2015).

Laptops and tablets were mentioned in conjunction with internet mediated networks (Lin 2013; Alvarez et al. 2017). They were introduced as one of the tools that students used in studying online learning material and participating in online discussions. (Lin 2013.) Students engaged in clinical simulations held in virtual settings and reviewed educational literature on laptops and tablets (Alvarez et al. 2017).

Students downloaded online learning materials and podcasts to media players (Lin 2013; Vogt, Schaffner, Ribar & Chavez 2010). Convenience and portability of media players allowed students to listen podcasts whenever and wherever they had the time available (Vogt et al. 2010). A questionnaire after technology-based learning activities revealed that the mp5-players used were preferred and considered more helpful than computers (Lin 2013). Newer generation media players such as iPod provided the students with an access to various nursing applications to be used in assessment practice and as a reference for medications. IPod facilitated information concerning students' performance, allowing students and teachers to monitor the development of clinical skills. Moreover, medication database along with patient educational materials aided students when they educated patients. (Koh, Phang, Tang, How, Chioh & Soo 2014).

5.2   Functions of Mobile Technology in pre-registration nursing studies

Based on the inductive analysis of the data, four main categories were formed concerning the functions of mobile technology used in pre-registration nursing studies. Those four categories were: resource bank, practice tool, documentation tool and communicational tool (Table 4. Functions of Mobile Technology). In this chapter they are introduced in more depth.

Table 4. Functions of Mobile Technology

Functions of Mobile Technology in Pre-registration Nursing Education			
Resource Bank • Accessing information • Demonstrations of clinical skills • Drug calculations	**Practice Tool** • platform for learning • provides authentic learning experience	**Documentation Tool** • note taking • keeping skill and performance records • enhances communication during clinical practises	**Communication Tool** • provokes and activates face-to-face discussion • access to online discussions

Mobile technology functioned as resource bank for nursing students (Millet et al. 2010). It worked as a tool to access information in planning and implementing care plans as

part of learning activity in the classroom (Schlairet 2012). Students used tablets and mobile phones to retrieve information concerning clinical questions and drug related matters (Schlairet 2012; Miller et al. 2005; Koh et al. 2014). Mobile devices were tools to calculate drug dosages (Millet et al. 2005; Johansson et al. 2013). Handheld gadgets provided an easy connection to reliable information sources in clinical environments (Beauregard et al. 2017; Miller et al. 2005; Johansson et al. 2013). Teaching of various topics were provided (Grierson et al. 2013; Alvarez et al. 2017; Lin 2013) and demonstrations of clinical skills viewed using mobile platforms (Grierson et al. 2013; Lin 2013; Johansson et al. 2013). Learning materials were delivered to the gadgets, allowing students to use the material later as a resource (Chuang & Tsao 2013). Mobile technology aided the delivery of patient education (Beauregard et al. 2017; Johansson et al. 2013).

Secondly, mobile technology was a practice tool in nursing education. Mobile technological interventions worked as tools for students to practice clinical skills (Alvarez et al. 2017; Wu et al. 2010; Lin & Lin 2016; Yoo & Lee 2015). It was used as the only platform for the learning (Alvarez et al. 2017) or as one component supporting the learning process (Wu et al. 2010; Lin & Lin 2016; Yoo & Lee 2015). Real-life like situations were creased by mobile technological interventions to provide authentic learning experiences for students to practice holistic patient care and assessment (Alvarez et al. 2017; Yoo & Lee 2015; Wu et al. 2010).

Thirdly, various gadgets were used as documentation tools. Tablets, smartphones and other mobile devices functioned as notepads in clinical environments (Johansson et al. 2013). Nursing students took notes and collected clinical information to their devices (Miller et al. 2005; Johansson et al. 2010). Documentation of skill records and monitoring the development of students' performance was also facilitated via handheld gadgets (Wu et al. 2010; Koh et al. 2014; Alvarez et al. 2017).

And fourthly, mobile technology was used as a communicational tool. Various mobile technological equipment worked as a booster to increase communication. It was used to provoke and activate discussion, in which students shared and reflected upon clinical nursing topics (Waugh & Donaldson 2016). Conversations were also held on online platforms that supported mobile technology (Lin 2013). The presence of mobile devices also enhanced the communication during clinical practices. The students were more capable to stay connected with their mentor, other faculty members as well as the teacher and other students (Beauregard et al. 2017).

5.3   Perceptions of Mobile Learning in Pre-registration Nursing studies

The main theme perceptions of mobile learning included two main categories: benefits of mobile learning and obstacles of mobile learning. The process of inductive analysis was implemented in construction of the results. The categories were built upon the sub-categories that were found from the data.

5.3.1   Benefits of mobile learning

Benefits of mobile learning - main category along its subcategories (Table 5. Benefits of mobile technology in learning) are introduced in more detail in this chapter. The subcat-egories were: portability, positive impact on knowledge, improved performance, in-creased interaction, reinforced learning and positive experiences.

Table 5. Benefits of mobile technology in learning

Perceptions of Mobile Learning
Benefits

Portability	Positive Impact on Knowledge	Improved performance	Increased Interaction	Reinforced Learning	Positive Experiences
• anytime • anywhere • autonomy • independency	• applying knowledge in real-life situations • improved retention of knowledge • increases the confidence in knowledge	• Enhanced critical thinking • Prepared for practice • Monitors performance • improves efficiency	• supports student-teacher communication • supports interaction among students • helps in coordinating with faculty and preceptors • triggers discussions • triggers reflections	• increases self-study • increases the use of evidence based materials • learning continues after activities • helps in finding answers in real time • supports learning process and outcomes • effects leaning attitudes positively • increases participation to learning activities • decreases cognitive load	• considered as helpful tool for learning • increased student satisfaction • useful in answering clinical questions • positive feedback from mentors and patients • more time to spend with the patients • increased the feeling of confidence

Portability gave students the freedom to choose where they wanted to study (Yoo & Lee 2015). Podcasts were listened to while attaining to everyday duties such as exercising or driving a car (Vogt et al. 2010). Students could return to taught subjects after the organized activities on their own time (Chuang & Tsao 2013; Yoo & Lee 2013). While mobile technology was used in classrooms (George et al. 2010, Schlairet 2012), it was used also in clinical environments (George et al 2010, Johansson et al 2013, Wu et al, Beauregard et al. 2017) and in simulations settings (Yoo &Lee 2013).

Mobile technology allowed students to access information and return to the taught material anytime and anywhere and as many time as they wanted (Johansson et al. 2013; Alvarez et al. 2017; Vogt et al. 2010; Yoo&Lee 2015; Chuang and Tsao 2013; Beauregard et al. 2017; Schlairet 2010). Thus, promoting the autonomy and independency of a student (Alvarez et al. 2017; Beauregard et al. 2017). It allowed students to study at their own pace (Alvarez et al. 2017; Yoo & Lee 2013). Flexibility allowed students to use mobile technology less than once a week or up to dozens of times a day or hours at time (Johansson et al. 2013; Koh et al. 2014; Miller et al. 2005; Beauregard et al. 2017). Mobile technology's use varied from dozens of times to less than once a day (Johansson et al 2013, Koh et al 2014). The majority of the nursing students reported using mobile technology at least once a day (Beauregard et al 2017, Johansson et al 2013, Koh et al 2014).

The use of mobile technology had a positive impact on knowledge (Chuang & Tsao 2013; Grierson et al. 2012; Wu et al 2011). Simulations and games allowed students to practice real life situations and apply the learned knowledge in practical way (Grierson et al 2012). It improved the retention of knowledge (Chuang & Tsao 2013), increased the confidence level of students concerning their skills and ability to apply knowledge (Wu et al. 2011). However, compared to learning with textbooks the knowledge score was not significantly different (Schlairet 2010). Use of mobile technology improved the retention of knowledge in comparison to human patient simulation (Yoo & Lee 2015). Involving technology promoted learning in general, however increasing interaction within students benefited in the process of gaining knowledge and developing critical thinking skills (Lin 2013) and applying acquired knowledge in a practical way (Grierson et al. 2012). Comparing the outcomes of using mobile technology to the other learning methods the difference was not significant. In simulation settings personal digital assistants were as useful as textbooks, based on the knowledge score or baseline attitude (Schlairet 2010).

Implementation of mobile technology into the preregistration nursing education also positively affected the level of preparation for a clinical practice. The use of mobile technology enhanced critical thinking skills (Beauregard et al. 2017; Lin 2013). It prepared students for clinical practice (Waugh & Donaldson 2014). And improved performance (Wu et al 2011). Thus, led to improvement in efficiency in clinical nursing practice (George et al 2010; Schlairet 2010). Mobile technology permitted students to record their nursing interventions and monitor their performance, thus reducing the gap between the theory and practice (Koh et al 2014). However, practice with a human simulator or mobile application produces equal skills in nursing assessment (Yoo & Lee 2015). Incorporating mobile technology into clinical practice sanctioned nursing students to look up information and answers to patients' and their relatives' questions, redeeming more time to spend on bed-side with the patient, which contributed positively towards patient safety (Schlairet 2010; Miller et al. 2005; Koh et al. 2014; Beauregard et al. 2017; Johansson et al. 2013). Having resources on hand helped students to use their time more efficiently and organize their work in a more advanced way in a clinical environment (Schlairet 2010, Johansson et al. 2013; George et al. 2010).

Enfolding mobile technology into the nursing education extended and strengthened interaction. It supported the student-teacher communication, helped students to keep in touch with other students and coordinate scheduling with the faculty and preceptor during the clinical practice (Beauregard et al 2017). It worked as a trigger for discussion and reflection in classroom and after the organized activities (Waugh & Donaldson 2016; Lin 2013; Schlairet 2010). Increase in interactivity contributed positively in the learning outcomes (Grierson et al. 2012; Lin 2013). Discussions after the mobile technological interventions produced moments that lead to learning of unmeasurable skills such as compassion and family centered care (Waugh & Donaldson 2016).

Mobile technology reinforced learning (Wu et al. 2011; Lin & Lin 2016; Alvarez et al. 2017; Chuang & Tsao 2013). It increased the learning activities regulated by the students, thus leading to increase in self-study (Wu et al. 2011; Johansson et al 2013; Lin&Lin 2016; Alvarez 2017; Miller et al. 2005). The use of evidence based research materials increased when the students had mobile technology available in various environments (Miller et al. 2005). Mobile technology encouraged students to continue learning after organized learning activities (Wu et al 2011, Lin&Lin 2016). Having access to information allowed student nurses to find the answers to their questions in real time (Johansson et al 2013; Beauregard et al. 2017; Miller et al. 2005), which supported the

learning process and outcomes (Wu et al. 2011; Lin & Lin 2016; Alvarez et al. 2017) and effected the learning attitudes positively (Lin & Lin 2016). In addition, incorporation of mobile technology prompted increased participation in learning activities (Alvarez et al. 2017). The presence of mobile technology in clinical nursing learning activities effected to cognitive load, either by increasing or decreasing it, however the use of mobile technology increased learning in either way, suggesting that the cognitive load was not too heavy for the students (Lin & Lin 2016; Wu et al. 2011).

Nursing student used positive expressions in describing their experiences concerning mobile learning. Mobile technology was received as a positive addition to education. Students expressed how mobile technology was helpful tool in learning (Koh et al. 2014; Beauregard et al. 2017; Vogt et al. 2010; George et al. 2010, Schlairet 2012). It increased the satisfaction among students (Vogt et al. 2010; Lin & Lin 2016; Chuang & Tsao 2013; Schlairet 2012). The satisfaction levels also correlated with the outcomes, more satisfied the students were with the learning process, the better scores they received in knowledge tests (Chuang& Tsao 2013). Students who participated in clinical activities involving mobile technology pointed out how blending real life and virtual reality facilitated their learning experience beneficially (Wu et al. 2011).

Mobile technology gave nursing students the sense, that they were charge of their own learning and allowed them to find out answers to questions they had (Johansson et al. 2013; Beauregard et al. 2017; Schlairet 2012; George et al 2010; Alvarez et al. 2017). Students appreciated having an ability to access information on the bedside to find answers to patients' and their relatives' questions without leaving the room (Johansson et al. 2013; Beauregard et al. 2017; Schlairet 2012; Miller et al. 2005). Likewise, the patients and their relatives along with clinical preceptors saw the presence of mobile technology as a positive component in the care process (Johansson et al. 2013; Beauregard et al. 2017). Student nurses felt that having appropriate resources contributed positively towards the patient care they delivered (Beauregard et al. 2017; Johansson et al. 2013; George et al. 2010; Schlairet 2012). Mobile technology was also considered as a beneficial tool to connect with a patient and to deliver patient education (Beauregard et al. 2017). Thus, the nursing student felt more confident in practice when they had mobile devices in use during clinical practice (Johansson et al. 2013). Student nurses would prefer using mobile technology in their future work (Johansson et al. 2013; George et al. 2010).

5.3.2   Obstacles of mobile learning

Obstacles of mobile technology in nursing education is explained further in this chapter. During the inductive analysis of data process the following subcategories were formed: technical problem, increased requirements, negative experiences and declining effects of long term use. The outcome of the analysis is presented in the Table 6. Obstacles of mobile technology in learning.

Table 6. Obstacles of mobile technology in learning

Perceptions of Mobile Technology

Obstacles

Technical Problems	Increased Requirements	Declining Effects of Long Term use	Negative Experiences
• Restrictions of Mobile Technology • Lack of Technological Knowledge	• Requires extra training • Increases cognitive load • Costs more than benefits	• Reduced benefits over the time • Decreased reliance on the mentors	• Negative stigma towards mobile technology • Increases fear to face real patients • Mobile learning lacks face-to-face teaching

Nursing students reported inadequate functions of mobile devices (Johansson et al. 2013), connectivity problems (Koh et al. 2014) and limitations concerning the physical aspects of mobile device (Miller et al. 2005; Lin 2013). Small screens combined with troublesome scrolling added extra challenge to users (Miller et al. 2005). Students owned mobile phones, but not all of them supported the format used by the application (Waugh & Donaldson 2016) creating a challenge to execute mobile teaching without providing necessary devices. Additionally, technical problems contributed negatively in the experience of using mobile technology as part of learning. Lack of teaching how to use the devices and applications were considered as barrier. (George et al. 2010.) Some students admitted, that their poor technological skills and understanding hindered them from using mobile technology (Johansson et al. 2013). Negative feelings such as frustration

emerged in the situations where the information was not found, or the user was not capable to do what they wanted to do with the device (Schlairet 2012). Limitations or underdevelopment of the technology were pronounced as restricting factors (Miller et al. 2005; Johansson et al. 2013). Users were hoping for more broad aspects of contents and functions (Johansson et al. 2013).

Enfolding mobile technology into nursing education required extra training and teaching how to use it (Johansson et al. 2013; Vogt et al. 2010; Beauregard et al. 2017; Yoo&Lee 2015; Lin & Lin 2016; Alvarez et al. 2017; Miller et al. 2005; Schlairet 2010). Besides the additional training sessions and technical support that was provided, technical problems were the most commonly reported barriers (George et al. 2010; Miller et al. 2005; Schlairet 2012). Besides, compared to traditional teaching methods, use of mobile technology increased cognitive load. However, the results were preeminent. (Wu et al. 2011.) Also, the cost of mobile technology compared to the profits were considered inadequate (Miller et al. 2005).

While podcasting did not yield better result in overall scores than traditional teaching, its beneficence reduced with time. The students learning with podcasts did better within the first topic, but the performance significantly reduced by the last one. (Vaugh et al. 2010). Nursing students using personal digital assistants in clinical practice were active information seekers, however they relayed on them more than their mentors. Within 14-month intervention students decreased the amount on questions asked from the faculty and started to use PDA's as their primary source of information. (Miller et al. 2005.)

Nursing students felt that mobile technology had a negative stigma and by using it they could lose their professional image (Koh et al. 2014; Beauregard et al. 2017; Johansson et al. 2013). Students expressed the worry how they would be seen by the faculty and the patients when they were seen on their phones (Johansson et al. 2013; Beauregard et a. 2017; Koh et a. 2014). They understood how it could seem like they would be texting or on social media, even though they would be searching answers for clinical related questions (Johansson et al. 2013; Beauregard et al. 2017). The feeling restrained the students from using the mobile technology in clinical environments. (Beauregard et al. 2017; Johansson et al. 2013). Besides, the faculty of mental health facilities were concerned how patients and relatives could see the presence of mobile technology and therefore, restricted its use on the wards (Johansson et al. 2013). Nursing students thought they missed opportunities to learn and teach the patient by not having mobile

devices with them in practice (Beauregard et al. 2017). Some students suggested how the increased presence of mobile technology in health care settings could lead to dilemmas with confidentiality (Beauregard et al. 2017). Students insinuated preferring face-to-face lectures over podcasting, as podcasting took away from contact lectures (Vaught et al. 2010). Additionally, the students' fear to face real patients increased after simulation practice (Wu et al. 2011).

6   Discussion

This thesis describes what kind of mobile technology is used in the learning of clinical competence in pre-registered nursing education, how it is used and how does the students perceive the learning with mobile technology.

According to the studies several different types of mobile technology devices were used in learning clinical competence in pre-registration nursing education. Personal smartphones were utilized as well as devices such as media players, tablets, laptops and personal digital assistants. Unspecified types of mobile technology along with the variability of mobile technology reflects the current trend in mobile learning, in which the content supersedes the technological gadget as previously stated by Keskin & Metcalf (2011: 202). Additionally, all the devices used in learning provided an internet access for students to attain reference materials, thus focusing more on the content rather than the technological intervention. Technological development was evident within the reviewed studied as the newer studies indicated that students' personal smartphones (eg. Beauregard et al. 2017) instead of providing for example PDA for the students to ensure the existence of mobile technology. Still in latest studies, some more advanced virtual simulations required extra tools to be connected with the smartphones (Wu et all. 2011; Lin & Lin 2016). While five types of different devices to aid learning were identified, their functions were discussed only briefly within the context of learning, thus promoting the subject matter. This result correlates with Kearney et al. (2012) finding regarding the mobile technology's role as an aid to promote the learning process itself. The findings of this thesis indicate, that the type of mobile technology is not as significant as the content and the aspects that mobile technology brings along.

Based on the results of this review mobile technology had four primary ways to enhance the learning of clinical competence. Mobile technology functioned as a resource to find

information (resource bank), tool to practice clinical skills (practice tool), storage for notes and other documents (documentation tool) as well as communication tool. For example, the FRAME theory (Koole 2009) included social aspect as one of three essential parts in mobile learning. In pre-registration nursing education mobile technology enhanced interaction and was used as a communicational tool. The results are similar as demonstrated by findings of the previous studies that discovered that the involvement of mobile technology increased the level of involvement and learning (Monti Fonseca et al. 2015: 13; Cook et al. 2012: 720). However, it was concluded that use of mobile technology does not require social aspect, but including interaction to mobile learning the learning outcomes improved. Therefore, the results of this review reaffirmed the theory that Koole founded already in 2009. Likewise, Rikala (2015:15) and Park (2011) came to conclusion, that mobile technology has an ability incorporate interactivity and resources beyond traditional lectures, thus extending the experience of learning. Additionally, the diversity of studies reflects the transferability of mobile technology. The adaptability to different kind of environments can be considered as one of its greatest benefits. Therefore, mobile technology as a learning aid can be used as part of clinical practice, activities in the classrooms, clinical simulations and solely as a platform in which the learning takes a place.

In accordance to this literature review, presence of mobile technology allowed students to continue learning outside of classroom settings and during their everyday duties. Podcasts were listened while driving a car. Technological interventions permitted students to practice their clinical skills without compromising patient safety. Mobility of mobile learning gave students the possibility to learn where and when they chose to do so. Students could also retrieve the study material and rehearse clinical scenarios after organized learning activities. Notes that were taken during the clinical practice as well as achievements in clinical skills were recorded to the mobile devices the students carried around. All these features reflect Rikala's (2015) proclamation how utilization mobile technology creates more innovative and student-centered pedagogies. Additionally, according to this study, students' satisfaction levels were linked with the outcomes of learning process. As students' satisfaction levels were above average when mobile technology was used, it could be assumed that the outcomes of learning would be better if mobile technology is implemented in pre-registration nursing education. Still, based on the results, students needed more support in technological questions.

Whereas mobile interventions promote students' self-determination in learning, technology does not take away the need for mentors and educators in the learning process. The presence of mobile technology may lead to less dependency upon mentors in clinical environments, students named lack of contact lessons as a disadvantage of mobile learning. These findings support the idea that mobile technology promotes autonomy of the learner as they can decide what kind of information they need and when. However, as stated by Braungart & Braungart (2011: 81-83), the process of learning happens through an active process in which both the educator and the learner has an important role. Thus, teacher lead well-constructed learning activities gives framework and direction to the learning process. While the involvement of mobile technology provides the means for students to continue learning after the activity in a way they feel necessary.

Overall the studies in this review indicated, that mobile technology affected learning outcomes positively. The transferability in time and space provides more time and possibilities for student to learn, thus explaining the increase in knowledge and improvement in the outcomes of learning. Continuing access to learning materials increased self-learning, accordingly it reinforced learning and improved the retention of knowledge. Incorporation of mobile technology into simulations provided effective practice environments where students could take on the role as a nurse and practice an or some essential clinical skill, as also demonstrated in other previous studies (Gaba 2005: 2; Kelly, Berragan, Husebø, & Orr 2016: 319). It may take an extra effort to learn and operate mobile technology causing heavier cognitive load, however the results suggest that the its worth the while. Instead of mastering only the subject matter, they had to learn to use applications and devices aiding the learning process. Adding mobile technology in pre-registration nursing education improved nursing performance, prepared students for the practice and chanced critical thinking skills leading to saver patient care. The presence of mobile technology increased the students' confidence and improved efficiency and organizational skills during clinical practice. According to the results of this study, mobile technology can provide comprehensive ways to learn clinical skills and therefore, could be a solution for Berman et al. (2014) request to find ways to decrease the gap between education and practice. Although, it is noteworthy that in one study (Wu et al. 2011), students were more anxious to face real patients after simulation experience, while the confidence level concerning their knowledge increased. The consequence can reflect the cultural demands of perfection or simply be common feeling of fear in facing patients as the researchers explained.

As a previous study by Rowe, Frantz & Bozalek (2012) suggested, the application of technology had a positive effect on the clinical competence as it improved the knowledge level as well as practical skills. The findings of this study reveal, that the positive outcomes of mobile technology were similar with the results of using videogames to improve clinical skills and create new knowledge (Monti et al. 2015:13; Cook, McAloon, O'Neill & Beggs 2012:720). The results indicate the beneficence of mobile technology in nursing education, especially concerning learning of clinical competence. The results also suggest, that the students along with the patients benefits of the presence of mobile technology in clinical environments. The students also considered it as an important tool to learning during practice and they would prefer using it future workplaces. Therefore, the conclusion could be drawn that, the use of mobile technology contributes positively towards the competence of future nurses and ultimately improves patient safety.

7   Ethical Considerations

The Responsible Conduct of Research Guidelines were applied in conducting this literature review to ensure ethical reliability and trustworthiness. The core values of good ethical research, such as honesty, accuracy in every phase (evaluating different researches, presenting and recording results) as well as general meticulousness was obtained. Accepted and ethically proven data collection methods and research methods were used. Honesty and reliability in communication was maintained during the whole process. Work of other authors was respected and acknowledgement with references are shown properly to maintain the value of their work. Research permissions were no needed as this is solely a literature review. Nor financial aid was not sought or received to conduct this thesis (TENK, 2012: 30-31.) This thesis did not cause any harm for anyone and there were no other participant relating issues (written informed consent, anonymity, confidentiality, justice, privacy). All in all, to strive to high standards, integrity and avoidance of all kind of research misconduct were adhered. (Polit & Beck 2013: 140-141.) To ensure the absence of plagiarism, the work was checked with Turnitin. Conflicts of interests would have been declared. (Wager & Wiffen 2011: 132-133.)

8   Validity

Databases used in this review are considered reliable and recommended by the library of Metropolia University of Applied Sciences as well as many other respectable re-search committees (Burns & Grove 2001:110-111, Polit & Beck 2014: 119-123). However, Metropolia's license was not validated by ERIC and therefore advantaged search methods were not used. Thus, explaining the simplified and distinct search terms used in ERIC. In-debt data reach build a strong foundation for the research. The usage of two or more databases, consultation of the informatics for proper search terms increased the validity of this literature review. Data collection aimed to collect sufficient number of articles that answers the research question(s). (LoBiondo-Wood&Haber 2014: 66, 70, 72-73.) Multiple data sources to compare results accounts towards reliability and validity of the results. (Burns & Grove 2001:119.) Self-reflection was practiced confirming that the interpretations were solely from the data and not researcher's subjective view (Polit & Beck, 2013: 185, 493).

Although this study was conducted by only one researcher, the thesis seminars and the guidance of the mentor in the process contributed towards validity. As the data analysis method, the content analysis was used, which is a commonly used method in qualitative research. Its reliability is ensured when the data is simplified and categorized properly. Therefore, the analysis process has been demonstrated clearly to show the link from the data to the results. The findings and data collection methods and selection criteria are stated clearly. Trustworthiness of the work was enhanced by using legitimate sources. (Elo&Kyngäs 2008: 108,112.) Concern about measurement reliability is not related to this study, since no measurement tools were used in conducting this literature review.

Diversity of educational backgrounds needs to be considered in evaluating the results of this study. However, the results are similar with previous studies the articles chosen based on the data search had homogenous conclusions. Thus, supporting the validity of the results.

Including both older and newer mobile technology that might have influenced the results of this study. Although the oldest article was published in 2003, the technology has been involving rapidly since. For example, the use of PDAs is not as common anymore, while smartphones are widely distributed. Additionally, the attitudes along with technological

knowledge may have changes over the decades. Therefore, the results need to be viewed in context of the technological development of the time of publication.

9 Conclusion and Recommendations

Based on the findings of this bachelor thesis, mobile technology has found its way to pre-registration nursing education. There are various devices, such as personal digital assistants, smart phones, laptops/tablets and media players, used to aid the learning clinical competence. They function as resource back, practice tool, documentation tool and communicational tool. Students perceive it mainly as beneficial aid, but it may also be an obstacle the process of learning. More detailed outcomes of the use of mobile technology are presented previously in table 5. Benefits of mobile technology in learning and in table 6. Obstacles of mobile technology in learning.

As almost every college student owns a smartphone it already gives educators mobile technological tool to work with. Thus, the need for more research solely concerning smartphones in pre-registration nursing education is evident. Additionally, the focus needs to be switched towards the applications or simulations that are used in mobile learning. The knowledge gained from this study can be used to develop or create new mobile applications to be used in clinical education. Furthermore, by comparing mobile applications, more data concerning their effectiveness can be derived and they can be developed even further. Providing more real life-like learning experiences will reduce the gap between education and practice.

The finding of this study shows that, mobile technology improves learning in pre-registration nursing education. However, it could be assumed that, the usage of mobile technology improves learning in general. Therefore, this knowledge could be used to improve continued education as well. Nursing management can use this knowledge to implement mobile technology into simulations and other continuous education/learning activities in hospital environments. Overall, mobile technology is an accessible tool that provides low cost solutions to improve learning outcomes. Therefore, mobile technology should be implemented even more in education.

The transferability of mobile technology opens new horizons for nursing education. Combining the possibilities provided by mobile technology with traditional teaching methods

allows a nursing student to experience and learn practical skills during the schooling, thus providing the future nurses more tools to take on the responsibilities and duties as graduated nurses. Therefore, future research on how to implement mobile technology in more systematic way in nursing education is recommended. Especially how mobile technology can provide new opportunities for learning under the guidance and supervision of a teacher or a mentor.

Finally, within the data search it became evident that there are no Finnish studies concerning the effects or outcomes of using mobile technology in learning clinical competence. Finland is one of the world's leading countries in education and technological development, therefore the resources and environment for future research already exists. More research pertaining the current use of mobile technology in pre-registration nursing education would give a foundation to develop more advanced learning methods for future nurses.

References

Alvarez, A, Dal Sasso, G, & Iyengar, M. (2017). Persuasive technology in teaching acute pain assessment in nursing: Results in learning based on pre and post-testing. Nurse Education Today, 50, 109-114.

Anderson, M. (2015). Technology Device Ownership: 2015. <http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015/> Read 15.12.2016

Beauregard, P, Arnert, A, & Ponzoni, P. (2017) Nursing students' perceptions of using smartphones in the community practicum: A qualitative study. Nurse Education Today, 53, 1-6.

Beischel K.P. & Davis D.S. (2014) A time for change: QSENizing the curriculum. Nurse Educator 39(2), 65–71

Benner, P. (1982) From Novice to Expert: Excellence and Power in Clinical Nursing Practice Addison-Wesley. Menlo Park, CA

Berkow S., Virkstis K., Stewart J. & Conway L. (2009) Assessing new graduate nurse performance. Nurse Educator 34(1), 17–22.

Berman A, Beazley B., Karshmer J., Prion S., Van P., Wallace J. & West N. (2014) Competency gaps among unemployed new nursing graduates entering a community-based transition to practice program. Nurse Educator 39(2), 56–61.

Braungart, M. & Braungart R. (2011) Principles of Teaching and learning. In Susan B. Bastable, S., Gramet, P., Jacobs, K. & Sopczyk D (eds.) Health Professional as Educator. Sudbury, MA: Jones & Barnett Learning. 51-89.<http://www.jblearning.com/samples/0763751375/chapter2.pdf> Read 21.12.2016

Burns, N., Grove, S.K. (2001) The practice of nursing research: conduct, critique & utilization. 4th edition. Philadelphia (PA): W. B. Saunders

Cavanagh S. (1997) Content analysis: concepts, methods and applications. Nurse Researcher 4, 5–16.

Chuang, Y-H. & Tsao, C-W. (2013). Enhancing nursing students' medication knowledge: The effect of learning materials delivered by short message service. Computers & Education. 6, 168-175.

Cowan, D.T., Norman, I.J., Coopamah, V.P. (2005) Competence in nursing practice: a controversial concept: a focused review of literature. Nurse Education Today, 25 (5), 355–362.

Dobrowolska, B., McGonagle, I., Jackson, C., Kane, R., Cabrera, E., Cooney-Miner, D., Di Cara, V., Pajnkihar, M., Prlić, N., Sigurdardottir, A., Kekuš, D., Wells, J., & Palese, A. (2015) Clinical practice models in nursing education: implication for students' mobility, International Nursing Review, 62(1) 6-46.

Elo, S. & Kyngäs, H. (2008) 'The qualitative content analysis process', Journal of Advanced Nursing, 62(1), 107–115.

Eriksson, E., Korhonen, T., Merasto, M., Moisio, E-L. (2015) Sairaanhoitajan ammatillinen osaaminen – Sairaanhoitajakoulutuksen tulevaisuus –hanke. Ammattikorkeakoulujen terveysalan verkosto ja Suomen sairaanhoitajaliitto ry.
<https://sairaanhoitajat.fi/wp-content/uploads/2015/09/Sairaanhoitajan-ammatillinen-osaaminen.pdf> Read 11.10.2016

European Parliament and of the council directive of the recognition of professional qualifications and regulation on administrative corporation through the internal market informal system 2013/55/EU Issued in Strasbourg 20.11.2013.

Gaba, D. (2004), 'The future vision of simulation in health care', Quality & Safety in Health Care. 13(1), 2-10.

George, L, Davidson, L, Serapiglia, C, Barla, S, & Thotakura, A. (2010). Technology in Nursing Education: A study of PDA Use by Students. Journal of Professional Nursing 26 (6), 371-376).

Grierson, L, Barry, M, Kapralos, B, Carnahan, H & Dubrowski, A. (2012) The role of collaborative interactivity in the observational practice of clinical skills. Medical Education, 46, 409-416.

Hammerling, JA (2012), 'Best Practices in Undergraduate Clinical Laboratory Science Online Education and Effective Use of Educational Technology Tools', Laboratory Medicine, 43 (6), 313-319.

Hofler, L. & Kendal T. (2016) Transition of New Graduate Nurses to the Workforce: Challenges and Solutions in the Changing Health Care Environment, North Carolina Medical Journal, 77 (2), 133-136.

International Council of Nurses (2012). The ICN Code of ethics for nurses.
<http://www.icn.ch/images/stories/documents/about/icncode_english.pdf> Read 5.11.2016.

Johansson, P, Petersson, G, & Nilsson, G. (2013). Nursing students' experience of using a personal digital assistant (PDA) in clinical practice – An intervention study. Nurse Education Today, 33, 1246-1251.

Kelly, M., Berragan, E., Husebø, S., & Orr, F. (2016) Simulation in Nursing Education-International Perspectives and Contemporary Scope of Practice, Journal Of Nursing Scholarship 48 (3), 312-321.

Keskin, NO & Metcalf, D. (2011). The current perspectives, theories and practices of mobile learning. The Turkish Online Journal of Educational Technology 10(2), 202-208). <http://www.tojet.net/articles/v10i2/10220.pdf> Read 10.1.2017

Koh, GM, Phang, CH, Tang, LS, How, AL, Chio MS & Soo, T. (2014). Evaluation of the use of iPod Touch drug guide by nursing students. Singapore Nursing Journal, 41 (1), 10-14.

Koole, M. (2009) A model for mobile learning. In Ally,M. (ed.) Issues in Distance Education : Mobile Learning : Transforming the Delivery of Education and Training. Edmonton, CA: AU Press, 25-48.

Lee, J., Boyd, R. & Stuart, P. (2007), Randomized controlled trial of an instructional DVD for clinical skills teaching. Emergency Medicine Australasia, 19(3), 241-245.

Lin, Y-T, & Lin, Y-C. (2016). Effects of mental process integrated nursing training using mobile device on students' cognitive load, learning attitudes, acceptance, and achievements. Computers In Human Behavior, 55, 1213-1221.

Lin, Z-C. (2013). Comparison of technology-based cooperative learning with technology-based individual learning in enhancing fundamental nursing proficiency. Nurse Education, 33, 546-551.

LoBiondo-Wood, G. & Haber, J. (2014) Nursing Research: Methods and Critical Appraisal for Evidence-Based Practice. St. Louis, Missouri: Elsevier.

Lofmark, A., Smide, B., & Wikblad, K. (2006) Competence of newly-graduated nurses -- a comparison of the perceptions of qualified nurses and students, Journal Of Advanced Nursing, 53 (6), 721-728.

Matthew Kearney, M., Schuck, S., Burden, K. & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. Research in Learning Technology, 20. <http://www.researchinlearningtechnology.net/index.php/rlt/article/view/14406> Read 20.1.2017.

McConnell, EA. (2001) 'Competence vs. competency', Nursing Management, 32 (5), 14 McGraw Hill Society.

Merriam Webster Dictionary. (2016). "Competence" <https://www.merriam-webster.com/dictionary/competence> Read 5.11.2016.

Merriam Webster Dictionary. (2016). "Competency" <https://www.merriam-webster.com/dictionary/competency> Read 5.11.2016.

Merriam Webster Dictionary. (2016). "Learning" <https://www.merriam-webster.com/dictionary/learning> Read 5.11.2016.

Merriam Webster Dictionary. (2016). "Mobile" <https://www.merriam-webster.com/dictionary/mobile> Read 5.11.2016

Merriam Webster Dictionary. (2016). "Technology" <https://www.merriam-webster.com/dictionary/technology> Read 5.11.2016

Miller, J, Shaw-Kokot, J, Arnold, M, Boggin, T, Crowell, K, Allegri, F, Blue, J & Berrier, S. (2005) A study of personal digital assistants to enhance undergraduate clinical nursing education. Journal of Nursing Education 44 (1), 19-26.

Monti Fonseca, L, Del'Angelo Aredes, N, Vilela Dias, D, Silvan Scochi, C, Amado Martins, J, & Alves Rodrigues, M (2015), Serious game e-Baby: nursing students' perception on learning about preterm newborn clinical assessment, Revista Brasileira De Enfermagem, 68 (1), 9-14.

Neal F. Cook, Toni McAloon , Philip O'Neill , Richard Beggs (2012) Impact of a web based interactive simulation game (PULSE) on nursing students' experience and performance in life support training — A pilot study. Nurse Education Today 32, 714–720.

Nolan, P. (1998) 'Competencies drive decision making', Nursing Management, 29 (3), 27-29.

Nursing and Midwifery Council (2010) Standards for competence for registered nurses. < https://www.nmc.org.uk/globalassets/sitedocuments/standards/nmc-standards-for-competence-for-registered-nurses.pdf> Read 11.10.2016.

Nursing and Midwifery Council (2015) The Code: Professional standards of practice and behaviour for nurses and midwives. <https://www.nmc.org.uk/globalassets/sitedocuments/nmc-publications/nmc-code.pdf> Read 11.10.2016.

Opetusministeriö (2006) Ammattikorkeakoulusta terveydenhuoltoon. Koulutuksesta valmistuvien ammatillinen osaaminen, keskeiset opinnot ja vähimmäisopintopisteet. Opetusministeriön työryhmämuistioita ja selvityksiä 24. Available online <http://www.minedu.fi/export/sites/default/OPM/Julkaisut/2006/liitteet/tr24.pdf.> Read 11.10.2016.

Parahoo, K. (2014) Nursing research, principles process and issues. 3rd edition. Hampshire, UK: Palgrave Macmillan.

Park, Y. (2011). A Pedagogical Framework for Mobile Learning: Categorizing Educational Applications of Mobile Technologies into Four Types. The International Review of Research in Open and Distributed Learning, 12 (2).

Polit DF & Beck CT (2004) Nursing research: principles and methods. Philadephia, Usa: Lippincott Williams & Wilkins. 7th edition.

Polit DF & Beck CT (2013) Essentials of Nursing Research: Appraising Evidence for Nursing Practice. Philadelphia, USA: Wolters Kluwer Health.

Prentice, K. & Tang, C. (2007) The Society for Research into Higher Education: Teaching for Quality Learning at University. 3rd edition. New York (NY).
PubMed MeSH terms. (2017). "Clinical competence"
<https://www.ncbi.nlm.nih.gov/mesh/68002983> Read 2.1.2017.

Rikala, J. (2015). Designing a Mobile Learning Framework for a Formal Educational Context. University of Jyväskylä: Department of Mathematical Information Technology.
<https://jyx.jyu.fi/dspace/bitstream/handle/123456789/47324/978-951-39-6311-8_vaitos06112015.pdf;sequence=1> Read 10.1.2017.

Sanoma (2015). Sanoman mobiilitutkimus: älypuhelin taskussa kasvaneet käyttävät laitteitaan monipuolisesti pitkin päivää. <https://www.sanoma.com/fi/uutiset/sanoman-mobiilitutkimus-alypuhelin-taskussa-kasvaneet-kayttavat-laitteitaan-monipuolisesti>
Read. 15.12.2016

Schlairet, M. (2012). PDA-assisted simulated clinical experiences in undergraduate nursing education: A pilot study. Nursing Education Perspectives, 33 (6), 391- 394.

Skiba, DJ (2015), 'Emerging Technologies Center', Nursing Education Perspectives: National League for Nursing, 36 (6), 422-424.

TENK (2012). Responsible conduct of research and procedures for handling allegations of misconduct in Finland.
<http://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf> Read 11.10.2016

Vogt, M, Schaffner, B, Ribar, A, & Chavez, R. (2010). The impact of podcasting on the learning and satisfaction of undergraduate nursing students. Nurse Education In Practice, 10, 38-42.

Wager, E., Wiffen, P. (2011) Ethical issues in preparing and publishing systematic reviews. Journal of Evidence-Based Medicine. 4 (2), 130-134.

Waugh, A, & Donaldson, J. (2016). Students' perceptions of digital narratives of compassionate care. Nurse Education Today 17, 22-29.

Wu, P, Hwang, G, Tsai, C, Chen, Y, & Huang, Y. (2011). A pilot study on conducting mobile learning activities for clinical nursing courses based on the repertory grid approach. Nurse Education Today, 31(8), 8-15.

Yoo, I-Y, & Lee, Y-M. (2015). The effects of mobile applications in cardiopulmonary assessment education. Nurse Education Today, 35, 19-23.

Zurn, P., Dolea, C. & Stilwell, B. (2005). Nurse retention and recruitment: developing a motivated workforce. World Health Organization Department of Human Resources for Health.
<http://www.icn.ch/images/stories/documents/publications/GNRI/Issue4_Retention.pdf> Read 20.11.2016

Articles selected for Review

	Author, Date, Country	Aim and Purpose	Study Design	Study Sample	Mobile Application	Results
1	Alvarez, A,. Marcon Dal, G., & Sriram Iyengar, S. 2016, Brazil.	To evaluate the outcomes of learning in pre-registration nursing students about acute pain assessment in adults and newborns before and after the online education intervention.	three questionnaires, including multiple choice and open questions. SPSS 21.0 ®.	120 students from the second to fourth year of year of an undergraduate nursing course	m-OVADor ® victual object technology developed to be accessed from mobile devices	Overall performance significantly increased in most students. Two out of 120 student's level of performance decreased, and three students' improvement level was not significantly different. The performance of most students increased along with the mean performance. Satisfaction level was 8.58/10 within the students using mobile devices to support the learning process of nursing
2	Beauregard, P., Arnaertn A. & Ponzoni, N. 2017, Canada.	To explore nursing students' perceptions of using smartphones in the community practicum.	A qualitative descriptive design. An inductive analysis.	8 nursing students	Personal smartphone	Students' shared the idea that smartphones would improve the commutations with preceptors, students, faculty, other healthcare workers as well as patients. Smartphones were viewed as supportive tool to enhance learning and improve the patient care. Smartphones were access to relevant information regardless of the time and location, thus supporting the learning process. Regulations forbiting the usage of smartphones derived students from possible benefits of having access to the evidence based and educational materials. Students expressed the concern of losing their professional imagine as nurses if they used smartphones in the practice.

3	Chuang, Y-H. & Tsao C-W. 2013, Taiwan.	To evaluate the effectiveness of using text messages (SMS) to improve medication knowledge among nursing students.	A quasi-experimental study design. SPSS 20.0.	111 nursing students currently enrolled to pharmacology course. a mean age of 16.59 years.	learning materials received by SMS	The intervention groups medication knowledge was significantly higher compared to control group. Also, the satisfaction level was reported to be higher in intervention group. The results were regarded to popularity to mobile phones and their usefulness as a tool to provide learning material that students can access anytime and anywhere.
4	George, L. Davidson, L. Serapiglia, C. Srinivas, B. & Thotakura, A. 2010, USA.	To describe the use of PDAs by nursing students during their studies.	A descriptive study. An 18-question survey.	the 48 nursing students undergraduate students (n=43), graduate students (n=5)	PDA with software applications eg. a drug guide, laboratory and diagnostic handbook and medical dictionary	Ninety-six percent of the students used their PDA's in clinical environment and 67% in the classroom while 80% of the participants used PDA in both clinical and classroom setting. The main applications used in descending order were: the drug guide (98%), medical dictionary (83%). According the results, all the participants considered PDA's as an effective educational tool and 78% of the students claimed that the use of PDA added to their efficiency. For participants' the ease of use was ranked as the most important aspect using PDAs.
5	Grierson, L. Barry, M. Kapralos, B. Carnahan, H. & Dubrowski, A. 2012, Canada.	To explore how manipulating the level of feedback delivered to trainees effects the learning benefits they gain from observing video-based simulation laboratory performances via a collaborative Internet-mediated educational environment.	An experimental study design. Pre- and post tests. ANOVAs.	36 nursing students from the University of Toronto	video-recording, educational networking site	Interactivity effects positively to the process in which student connects new information to previously acquired knowledge.

6	Johansson, P,. Petersson, G. & Nilsson, G. 2013, Sweden.	To discover nursing students' experience of using a personal digital assistants in clinical practice.	Intervention study. SPSS 18.0. Content analysis.	67 Nursing students from a university in southern Sweden.	The PDA (a Palm TX) containing for example pharmaceutical and medical resources, guidelines/techniques and nursing acts and regulation.	The nursing students reported the following benefits in using PDA's during clinical practice: "gives a higher degree of confidence in their work", "increase the quality of care, and patient safety", "provides access to accurate information". The use of PDA gave nursing students the access to a relevant information on bedside, allowing them to spend more time with the patients. Thus, the students considering the use of PDAs contributing towards improved quality of care. Students regarded PDA as beneficial tool in nursing practice also for the newly graduated nurses to aid for example in patient education. However, some raised concerns how staff nurses would view the use of PDA's in the hospitals.
7	KOH, G. PHANG, C. TANG, L. HOW, A. , CHIOH, M. & SOO, T. 2014, Singapore.	To evaluate the usefulness of iPod Touch to enhance learning among nursing students. The research question was: how useful was iPod Touch NPALM to the learning in nursing students?	A Sobel test, Descriptive statistics. Spearman's correlation analysis	A polytechnic nursing students (n=578)	ipod touch or iphone, The two main apps are the NPALM nursing assessment and the NPALM drug guide.	96.5.% of participants considered iPod Touch being useful in learning. Students used the following statements explaining the benefits: usefulness of drug guide", "faster means to information" and "drug guide enhance students' ability to render patient care". In addition, accessibility to information and tracking skill performance were mentioned. The student's main concerns were technical problems and the being misjudged as unprofessional if they would use gadgets in clinical practice. Usage of iPod touch for learning: daily 65.1%, one or two hours a day 44.3%
8	Lin Y-T & Lin Y-C. 2016, Taiwan.	To develop a mobile interactive learning and diagnosis system that supports problem based learning in a clinical nursing course.	A quasi-experiment. The testing-based diagnostic approach.	36 students and 1 instructor.	a mobile interactive learning and diagnosis (MILD) system	The mobile device mediated problem based learning increased learning performance, decreased cognitive load, positively contributed to achievement of learning achievements in foundations of nursing course. Integration of mobile technology had a positive effect on the level of self-learning and learning attitudes.

9	Lin, Z-C. 2013, Taiwan.	To evaluate the outcomes of technology-based cooperative learning with technology-based individual learning in nursing students' critical thinking in catheterization knowledge gaining, error discovering, skill acquisitions, and overall scores.	An experimental study design. SPSS 17.	second year nursing students (n=98) participating in fundamental nursing skill course.	MP5 player	Integration of cooperative learning and technology increases critical thinking skills and knowledge compared to individual technology-based learning. evaluation of experimental group's and control group's performances reveal that cooperative learning enhances knowledge, but the skill acquisition wasn't significantly different. During the study, some technical problems, such as limited wireless capacities, decreased the interactivity, the quality and quantity of discussions among the students.
10	Miller, J. Shaw-Kokot, J. Arnold, M. Boggin, T. Crowell, K. Allegri, F. Blue, J. & Berrier, S. 2005, USA.	to evaluate effectiveness of the personal digital assistants to prepare future nurses who value and seek new and evidence based information	An experimental study.	Second-degree students entering the 14-month accelerated baccalaureate nursing degree, second-degree students in the 24-month BSN degree.	The Palm OS. A document reader/converter program, Documents to Go®, came packaged with the Palm devices.	Use of PDA supported positively nursing students information seeking behavior. PDAs were used to retrieve information, read health journals and review procedure manuals and care plans. Accessibility to information via PDA increased the number of questions pertaining to clinical situations. However, the study reports that the students were relaying on PDA to find answers instead of asking the faculty. Quick access and readability of the materials correlate with student satisfaction and usage levels of PDAs.

11	Schlairet, M. 2012, USA.	To determinate if the knowledge of nursing students concerning computer-use attitude scores following a PDA-assisted clinical experience would be corresponding to text-book-assisted scores.	Question-naires and surveys.	44 first-semester baccalaureate students, 89% female, mean age 22 (range 22-47)	Hewlett-packard iPAQ handheld (drug guides, lab manuals, clinical diagnostic tools, medical information channels and additional resources)	The knowledge level of the students were tested twice after intervention. In the first test the knowledge level of the group using PDAs declined slightly, while in control group small increase was detected. However, no significant difference was found. In addition, usage of PDA did not make a difference in the attitudes of the students. The main finding is related to the impact that incorporation PDA had on learning within clinical course. 100% of the students reported positive impact. 21 out of 44 students gave credit to PDA's on improvement in practice, learning or recall. Almost half of the students (20) make changes in the way they care for their patients, 18 of the students already implemented new ways of care for the current patients. PDA's use influenced towards nursing practice in 10 students reports. Almost one-third of the students (12 out of 44) were frustrated while using PDA's during the clinical experience and one student said that it had a negative effect on learning.
12	Vogt, M. Schaffner, B. Ribar, A. & Chavez, R. 2010, USA.	To examine how pod-casting influences the nursing students' learning and satisfaction levels.	A comparative study.	Two classes (n = 63) and (n = 57) of junior baccalaureate nursing.	mp3-files to be played with any device	The study reports that students had a positive attitude towards podcasting and were satisfied with the learning method. They especially endorsed podcasting because of its mobility. However, most of the students in experimental group expressed that they would rather attend to face-to-face lecture. Also, the learning achievement went down after further the study went. The scores of the experimental group in the first exam was higher that control groups', same on the second and worse on the third exam.

13	Waugh,A. & Don-aldson, J. 2016, UK	to assess the use of digital narratives of compassionate care as a learning resource.	A qualitative design. A thematic analysis.		mp3 and mp4-files that can be played in various mobile devices	From the feedbacks of the students the main areas to en-hance of learning were identified: preparation for practice, mentorship preparation and reflection and discussion. In-creased level of participation and engagement in learning process as well as opening for students discussion for their experiences in practices were results of using digital nar-ratives in classroom setting. Students regarded that the digital narratives of compassionate care work as a tool to develop the skills related to compassionate care and there-fore improve the patient care and job satisfaction.
14	Wu, P-H,. Hwang, G-J,. Tsai, C-C , Chen Y-C. & Huang Y-M. 2011, Taiwan.	To create a clinical mo-bile learning system that offers learning guidance for nursing courses based on the repertory grid ap-proach.	A quasi-ex-perimental design.	two senior classes (48 students) of the Nursing Department	the RFID reader on the mobile device	Comparison of the results reveal that the learning achieve-ments were higher in experiemental group compared to control group. While usage of mobile technology increased the cognitive load, the significantly higher learning achieve-ments imply that the load was still in an acceptable level. In addition to improved learning achievements the activity seemed to encourage continuing the learning process by self-studying more about the diseases. Although the stu-dents' willingness to face patients decreased after the ex-periment, their understanding concerning diseases and symptoms related to them increased significantly.
15	Yoo I-Y. & Lee, Y-M. 2015, South Ko-rea.	To examine the effec-tiveness of using a mo-bile application for car-diopulmionary assess-ment education	a quasi-ex-perimental study. Pre- and post-as-sessment and clinical as-sessment skill demon-stration. SPSS 21.0.	22 univer-sity stu-dents from second year under-graduate nursing pro-gram from South Ko-rea	iStethoscope ex-pert by current clinical strate-gies publishing	The satisfaction level was the same in both groups. The post assignment indicated the intervention group's knowledge significantly higher after 4 weeks concerning the lung assessment, while the basic knowledge reminded the same. After 4 weeks both groups had improved, but there was no significant difference between groups. However, the retention of the knowledge higher in mobile application group. The mobile application groups' knowledge was significantly higher only on the lung as-sessment.