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Technologies in Nursing Education in Finland

A Literature Review

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Abstract

Finnish universities utilise different digital learning environments quite comprehensively. The strategies of educational institutions have taken into account the future development of e-learning and promote education planning from a digital pedagogical perspective.

The purpose of this literature review was to gain an understanding of existing literature concerning the actual level of technology used in nursing education in Finland. The aim was to conduct a literature review and provide an overview of the sources, concerning using technologies in nursing education to further future development in this field.

The research method of this thesis was descriptive literature review. Material for the literature review was retrieved from reliable academic databases: ScienceDirect, Theseus, PubMed, Finna and Google Scholar. In the information retrieval, 530 articles were collected, of which 14 were selected for the review. The data was analyzed by using inductive content analysis.

This literature review showed that studies concerning technology implementation in nursing education in Finland are very few. Nevertheless, according to the results of this research, technology is used in Finnish polytechnic universities quite comprehensively. Technology usage in nursing education implemented in numerous ways such as mobile technology, computer-based hardware, virtual reality, simulation environment and telehealth. The studies included in this review highlighted the improvement of learning outcomes by using technology and demonstrated a positive attitude towards usage. It requires further research and development basing on already gained knowledge.

Key words
Nursing Education, E-learning, Technology, Literature Review

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1 INTRODUCTION

Technology has tremendously developed during the last decades as well as different innovations arise constantly. Different digital services and applications are invented to make people's daily lives easier.

Nursing education must be aware of changes in society and health care and be up to date. So, that nurses will be able to promote people's health and well-being and provide high-quality, effective and cost-effective care services to the population. Requirements of nurse's competence changes along with service needs of the population. Service's change is coming in the next few years, as Finland's population ages faster than in most other countries, as well as an immigration and multiculturalism increase. (Seppälä 2020, 2.)

As the health sector changes, learning environments must also change proportionally and flexibly. (Seppälä 2020, 2). Teaching methods could not stay aside from the development of technology. Technology is reflected nowadays as e-learning as well as virtual simulations. Twenty-first-century students have grown to use ICT (information and communication technology) in their daily chores, so its use in education helps to support different learning styles and structure knowledge. E-learning has gradually become a part of nursing education as well. (Liias, Lehtinen & Suvanen 2021, 5.)

2 PURPOSE, OBJECTIVE AND RESEARCH QUESTIONS

The purpose of this literature review was to gain an understanding of existing literature concerning the actual level of technology used in nursing education in Finland.

The objective was to conduct a literature review and provide an overview of the sources, concerning using technologies in nursing education to further future development in this field.

The main research question was:
How technologies are defined and applied in nursing education in Finland?

3 TECHNOLOGY

According to the Encyclopedia Britannica, technology, the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment. The term technology, a combination of the Greek technē, “art, craft,” with logos, “word, speech,” meant in Greece a discourse on the arts, both fine and applied. (Website of Encyclopedia Britannica 2021.)

Technology in nursing is a broad spectrum of envelopment: portable monitors, smart pumps for the administration of medication, patient electronic health records, technology-enhanced equipment and therewith tele-health. All these amenities help to diminish errors, enhance communication and allow to provide quality care. (Website of NurseJournal 2021.)

3.1 Technology in nursing education

New technologies and e-learning are intended to facilitate ways of working and communicating between students and teachers and also to motivate both to develop their practices. E-learning and technology comprise enriching factor in the learning process and pedagogy and as technology evolves, they should empower each other. Technology creates opportunities for the availability of materials and learning that supports different conceptions of learning. (Karvonen, Nurmi & Sädekallio 2019, 13.)

Traditional teaching methods including practical training, needed for achieving the necessary psychomotor and cognitive skills, nowadays are used as well as technology assisted learning - teaching methods based on the Internet, videos, virtual games, smartphone applications, and social media. (Ilonen, Klami 2017, 16.)

4 NURSING EDUCATION

The first nursing training school was initiated by Florence Nightingale at St Thoma´ s Hospital in London in 1860. Since then, nursing education turned more to higher education. The first university schools were established in 1923 in the United States, in the UK in 1956 and in Australia in 1974. (Website of Wikipedia 2021.)
According to EU directive Article 31 of 2005/36/EC for acquiring a diploma of a registered nurse, the one must complete study for at least 3 years on a full-time basis or 4600 hours or 180 ECTS (European Credit Transfer and Accumulation System) study points of theoretical and clinical training. The duration of theoretical training lasts at least one-third and the clinical training at least one half of the training (WHO Regional Office for Europe 2009, 3.)

4.1 Nursing education in Finland

Nursing studying is regulated by the Health Care Professionals Act (559/94), the Regulation (564/94) and health care legislation. The educational program adheres to the requirements of the current guidelines of the Ministry of Education and Culture and also the Ministry of Social Affairs and Health. (Ilonen & Klami 2017, 2).

Finnish nursing education consists of 210 ECTS for Registered Nurses, therefore, it is 30 credits wider than the EU directive requires. Studies consist of basic, professional, and elective studies, clinical practice, thesis and maturity test (Eriksson, Korhonen, Merasto & Moisio 2015, 13).

According to educational qualification requirements for nurses issued by the Ministry of Education in Finland in 2006 (Opetusministeriö 2006), “a qualified nurse is a specialist of nursing care”. “The specialist role of the nurse consists of competences in the following areas: 1) Ethics, 2) Health promotion, 3) Nursing decision-making, 4) Supervision and instruction, 5) Collaboration, 6) Research and development work, and management, 7) Multicultural nursing, 8) Social activity, 9) Clinical nursing, and 10) Pharmacotherapy (medication)” (Numminen 2010, 37.)

Lately, the areas of nurse competence of nursing students in Europe which have been previously identified, became clearer thanks to the new research conducted within EU countries (Kajander-Unkuri 2015, 68). Such classifications nowadays are: (1) Professional/ethical values and practice, (2) Nursing skills and Interventions, (3) Communication and interpersonal skills, (4) Knowledge and cognitive ability, (5) Assessment and improving quality in nursing, (6) Professional development, (7) Leadership, management and teamwork, (8) Teaching and supervision, and (9) Research utilization (Kajander-Unkuri 2015, 4).

Nurse's clinical competencies include eight main areas:
1) Basic clinical nursing competence 2) Internal medicine nursing competence, 3) Surgical and perioperative nursing competence, 4) Child, adolescent and family nursing competence, 5) Competence in mental health and substance abuse care, 6) Competence in elderly nursing, 7) Competence in nursing in different service environments (entrepreneurship practise) and 8) Competence in nursing in need of special support. (Website of Savonia 2020.)

Nowadays almost half of the nursing studies take places in different healthcare organisations and learning facilities. Thus, students acquire the right theoretical knowledge and ability to practice it during an internship. Consequently, they obtain a comprehension of the actual nurse's competence. (Savonia 2020.)

4.2 Technological competence

Professional competencies in nursing strongly involve digitalisation and technology. (Göös & Haapalainen 2021, 40.) It requires deep theoretical knowledge as well as the ability to manage and apply different hardware and software technologies. (Liias, Lehtinen & Suvanen 2021, 9). The employee should be able to use basic technologies such as the Internet, email, instant messaging, mobile devices and mobile applications. Also, the nurse should be able to use basic computer functions such as word processing and spreadsheets and be able to communicate through

various devices of communication. In addition to this, the professional must be able to use various information technologies, such as searching for information about medications and using various medical devices such as health monitors. (Göös & Haapalainen 2021, 20.)

Mastering clinical skills are essential for nurses qualification and also for patient safety. Technological progress makes it possible to use e-learning methods, such as online simulations or educational games. Thus, learning clinical skills is more effective and the gap between theory and practice can be narrowed. Computer-based simulations and role-playing techniques merely enhance learning experiences. (Karvonen, Nurmi, Sädekallio 2019, 39.)

4.3 E-Learning

There are many terms related to e-learning and e-studying. In the 1960s, the term computer-based education was used. Later in the 70s, the concept split in two: computer-based learning and computer-assisted learning. (Karvonen, Nurmi, Sädekallio 2019, 6). In the 1980s, the term computer-assisted learning has changed to e-learning. (Wikipedia 2021). The concept of e-learning embraces a wide range of different learning strategies and it can include computer-assisted learning, web-based learning, learning in a virtual classroom or digital laboratory and utilising various additional advanced technologies. (Kehus 2016, 4.) E-learning rendered by advanced technologies gives access to a multi-channel and accessible learning environment that can include computer-assisted learning, web-based learning, a study in a virtual classroom or digital laboratory. (Kehus 2016, 4.)

E-learning belongs to Information and Communication Technologies (ICT) developing nowadays at full pelt. (İlkay & Zeynep 2014, 1285). The term information and communication technology (ICT) was born in the 1980s. (Wikipedia 2021). ICTs provide innovative methods of education and make it more affordable in numerous ways. E-learning enriches learning opportunities hence students can attend

classes through websites in a group or asynchronously, according to own schedule. (İlkay & Zeynep 2014, 1285.)

Designed simulations for nursing students allow engaging interaction with virtual patients here with practising gained knowledge avoiding risks with encountering real patients. Furthermore, learning material can be presented to students in different forms: tutorials, simulations, games, studying modules etc. Along with traditional methods, e-learning can be used as an alternative and must involve an extensive understanding of student needs. (İlkay & Zeynep 2014, 1286—1287.)

There was a pilot study conducted in UK to estimate nursing students' perceptions of video-based serious games educational value, usability, individual factors, and preferences regarding future use. (Johnsen, et al. 2018, 1.) "Serious games (SGs) are computer-based simulations that incorporate principles from multimedia and gameplay for the purpose of improving health professionals' knowledge, skills, and confidence." (Johnsen, et al. 2018, 2). This emerging model of e-learning education allows nursing students to practise their clinical reasoning and decision-making skills immersing in simulation environment without causing any harm to patients (Johnsen, et al. 2018, 2). Through performing two simulation practises for nursing students, one for home health care and one for hospital medical-surgical wards, the GS model was implemented into action (Johnsen, et al. 2018, 7). The nursing student evaluated the SG method as educationally valuable, potentially useful in nursing education programs and recommended its future development and implementation. Nevertheless, this educational method should be discerned as a supplemental to traditional teaching and learning models. (Johnsen, et al. 2018, 15.)

In Sweden, an Information Technology (IT) course is optional in nursing curricula. However, nursing students essentially need to have basics IT skills to succeed in further education and work experience. The educational program requires submitting works electronically, creating presentations, participating in online courses, communicating online outside of the classroom, etc, consequently, technology can facilitate and improve the transmission of educational content. After obtaining the IT skills students will be able to complete projects for other classes and conduct

literature searches using electronic databases thus to increase the use of library resources. Furthermore, computer-assisted learning will become more used in-patient education, along with extensive utilization of online conferencing through electronic web-boards in nursing practice and nursing education. (Ragneskog & Gerdner, 2006, 126-127.) Nursing educators play a key role in facilitating and providing basics IT skills to students so the educators level of IT skills must be on a sufficient level. Critical computer skills for nurses such as word-processing, e-mailing, accessing and using the hospital information system must be incorporated in the nursing curriculum to prepare for demands associated with the rapid advancement of IT in health-care settings. (Ragneskog & Gerdner, 2006, 126-130.)

The nursing curriculum should reconsider the standards for the IT course to identify minimum competency skills in IT for students, develop the skills and implement on practise throughout all the study plan to prepare for the future role as a registered nurse. (Ragneskog & Gerdner, 2006, 131.)

Hybrid or blended teaching methods of education have appeared once emerged a desire to retain advantages of contact learning and combine with advantages of online learning. Online only education has been evaluated by nursing students being in clinical supervision within clinical practice in UK low, due to a lack of social presence, instructor feedback and a failure to consider the students' learning preferences. Nevertheless, continuous developing of e-learning and software, such as gaming, augmented reality and virtual reality have a chance to diminish these barriers in learning. (McCutcheon, O'Halloran & Lohan 2018, 31-39.)

In the UK was conducted a study, which intended to evaluate objective and subjective worth of podcasts of pharmacology lectures for undergraduate nursing students. The podcasts were provided to students by the virtual learning environment WebCT in the format of mp3 ("MPEG Audio Layer-3"), with a possibility to listen to it via mobile phones or other devices. The podcasts were offered as an extra learning tool for improving understanding of pharmacology and following implementing it within clinical practice. Nowadays aural learning method may become more widespread due to developing of advanced technologies, a proliferation of mobile

phones and pc among students and rising of distance education. (Meade, Bowskill & Lymn 2009, 2-3.) The objective result of using this tool for revising, understanding and studying lectures showed up the improved exam`s performance along with subjective aspect, which was described by students as helpful for the learning method. (Meade, Bowskill & Lymn 2009, 10-11.)

Another innovative example of applying aural methods of education on learning pharmacology course for nursing students was studied in the UK. "Audience response technology (ART), such as the keypad system (KS) comprises of several small handheld devices and a wireless receiver connected to the computer delivering the lecture". Usually, the system also includes remote control and keypads. Different types of questions were integrated into pharmacology lectures, for example, multiple-choice and true/false style questions. Questions concerning the material of the previous lecture were tested at the beginning of each lecture and through a new lecture were given questions concerning the new topic. This method allowed students to immerse into the material, identify understanding, deepen the knowledge of main concepts and it also delivers to a teacher insight of assimilation of a given material consequently enables to focus on weak spots in the comprehension of the material by the students. (Meade, Bowskill & Lymn, 2009.)

4.4 E-learning in Finland

The use of e-learning has become more popular in Finland and internationally in all learning fields during the last decade. (Karvonen, Nurmi, Sädekallio 2019, 5).
Finland stands as one of the preeminent countries in the development of education. In the future, more resources must be allocated to competence development in order to secure this. The identification of competence and goals is the starting point for development work to meet the challenges posed by digitalisation. (Sivula & Sonninen 2019,7.)
Nowadays, Finnish universities utilize different digital learning environments quite comprehensively. The strategies of educational institutions have taken into account the future development of e-learning and promote education planning from a digital

pedagogical perspective, what is in conjunction directed toward empowering lifelong learning. The most extensively used digital learning environment in Finnish universities is Moodle. (Sivula & Sonninen 2019,14.) Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalised learning environments. (Website of Moodle 2020). It includes a set of powerful student-centred tools and collaboration-based learning environments that enhance teaching and learning. Moodle offers a flexible set of tools that support different pedagogical models, such as embedded learning and reverse classroom. Moodle is a generic and well-established programm for use in polytechnics. (Seppälä 2020, 3.)

In addition, widely used digital platforms include Adobe Connect, Microsoft Office 365, Optima and Mooce (Massive Open Online Course). (Sivula & Sonninen 2019,14.) MOOC means free, often offered by universities, online courses, that can be attended by a large number of people at a time. Many MOOCs courses can be used for accomplishing personal studies. The courses do not necessarily meet the criteria of the curricula. Thus, they serve more as supplementary courses for teachers and students alongside the main study. (Seppälä 2020, 3.) The usage of all of these programmes enables an individual's own path of personal and continuous learning. (Sivula & Sonninen 2019,14.)

Also, the simulations classes are actively used in nurse's education and serve as a bridge between theory studies and working life. The aim is to model real-life and thus challenge students to look for alternative solutions on complicated tasks. Reflection, gathering new information, problem-solving, and group work are skills learned in simulations. (Majuri 2017, 8.) Simulations can be used to teach new ways of working or to practice situations that are very rare, but in which they need to be able to act correctly. Simulation-based teaching focuses on actions and specific events that are supported by theoretical knowledge on the subject. Whilst learning in practice, a student can easier identify own theoretical shortcomings and limitations in the studied subject. Simulation is visual and experiential learning that prepares a student for a real-life situation. (Liias, Lehtinen & Suvanen 2021, 10.)

Special interactive dolls are designed to imitate real patients which are actively used in a simulation environment. The dolls have audible vital signs such as heart and lung sounds. There is also a possibility to monitor electrocardiogram. Some of the dolls are designed to learn how to administer medications (cannulation, nasogastric tube etc). Simulation learning in nursing education means working with the interactive doll in special facilities or simulation which can also take place in a virtual environment using VR (virtual reality) glasses. In Finland, special simulation facilities have been built in Turku University of Applied Sciences and Savonia University of Applied Sciences. (Mörsky, Pitkänen & Poutiainen 2020, 14.). Satakunnan University of Applied Sciences (SAMK) has a simulation center for health and welfare for nursing and physiotherapy students. SAMK participates in an international Erasmus-funded iSPAD project (Innovative Simulation Pedagogy for Academic Development), which aims at finding innovations to nursing education by the means of simulation. (Website of Samk 2021).

In the future, students will be able to perform a virtual simulation independently, so case-based learning will not be time-bonded. However, this creates a problem with the proper usage of virtual simulations for teachers and students without major technical problems. One of the challenges is also the constant development of the virtual world and how to accelerate virtual simulations with developing technologies. (Liias, Lehtinen & Suvanen 2021, 5.)

Southeast Finland University of Applied Sciences has a "Workseed" program for paramedic students. The program serves as a diary of student’s internship and as a self-assessment tool of their practice. The internship supervisor and mentor of the internship also evaluate student's practice in the program. Ratings are saved in the program, and student can use theese grades in the future if it is needed. By the help of this web-based program university solves a problem with a distant counseling and evaluation of the student’s practise. Thus, teacher monitor the student’s progress during the internship because it can be chalenging for a supervisor to participate on face-to-face meeting with a student and mentor due to distantly alocated practise placements and large number of students to be supervised. (Karvonen, Nurmi, Sädekallio 2019, 31.)

5 RESEARCH METHODOLOGY

5.1 A literature review

A literature review is a systematic way of gathering and evaluating previous research in the chosen topic area. A well-conducted review composes a ground for future studies and the development of theories. The findings of a literature review provide an answer to the research question and identify gaps in research. A literature review shows evidence of findings on a meta-level and indicates areas with insufficient research. (Snyder 2019, 333.)

Types of review can be different: narrative or integrative, systematic reviews, and meta-analysis or integrative reviews. (Snyder 2019, 333.)
Systematic reviews comprise specific requirements for inclusion criteria in the review with a strict search strategy and selecting articles. They provide a summary of studies in a particular question and evidence of the theory.
A semi-systematic review approach is used in studies with broader topics with different concepts and within diverse disciplines.
An integrative review approach is more appropriate for studies when it is not essential to make a summary of all existing literature concerning the chosen topic but to combine perspectives to produce new theories. (Snyder 2019, 334.)

There are different approaches to conducting a literature review: qualitative, quantitative, or a mixed design. The appropriate type of review is chosen depending on the methodology needed to achieve a specific goal. (Snyder 2019, 334.)

A narrative literature review is a comprehensive summary of previous research on a topic. The literature review surveys scholarly articles, books, and other sources relevant to a specific area of research. The review should enumerate, describe, summarize, objectively evaluate, and clarify this previous research. It should supply a theoretical base for the research and help the author determine the character of the research. The literature review acknowledges the work of previous researchers. It is

assumed that by mentioning a previous work in the field of study, which the author has read, evaluated, and assimilated that work into the work at hand (Salminen 2011, 4.)

5.2 Study selection and search strategy

Inclusion and exclusion criteria (Table 1) were set down for assisting the data selection. Articles related to the topic published in full text, included terms technologies in nursing education, technology, e-learning, were selected for the study. Search terms were applied in different combinations to find articles related to the topic. All data was retrieved from reliable academic databases: ScienceDirect, Theseus, PubMed, Finna and Google Scholar. Selected for the study articles are written in English and Finnish language. There was no applied time restriction concerning publications during selecting articles due to the newness of the topic and limitation of data.

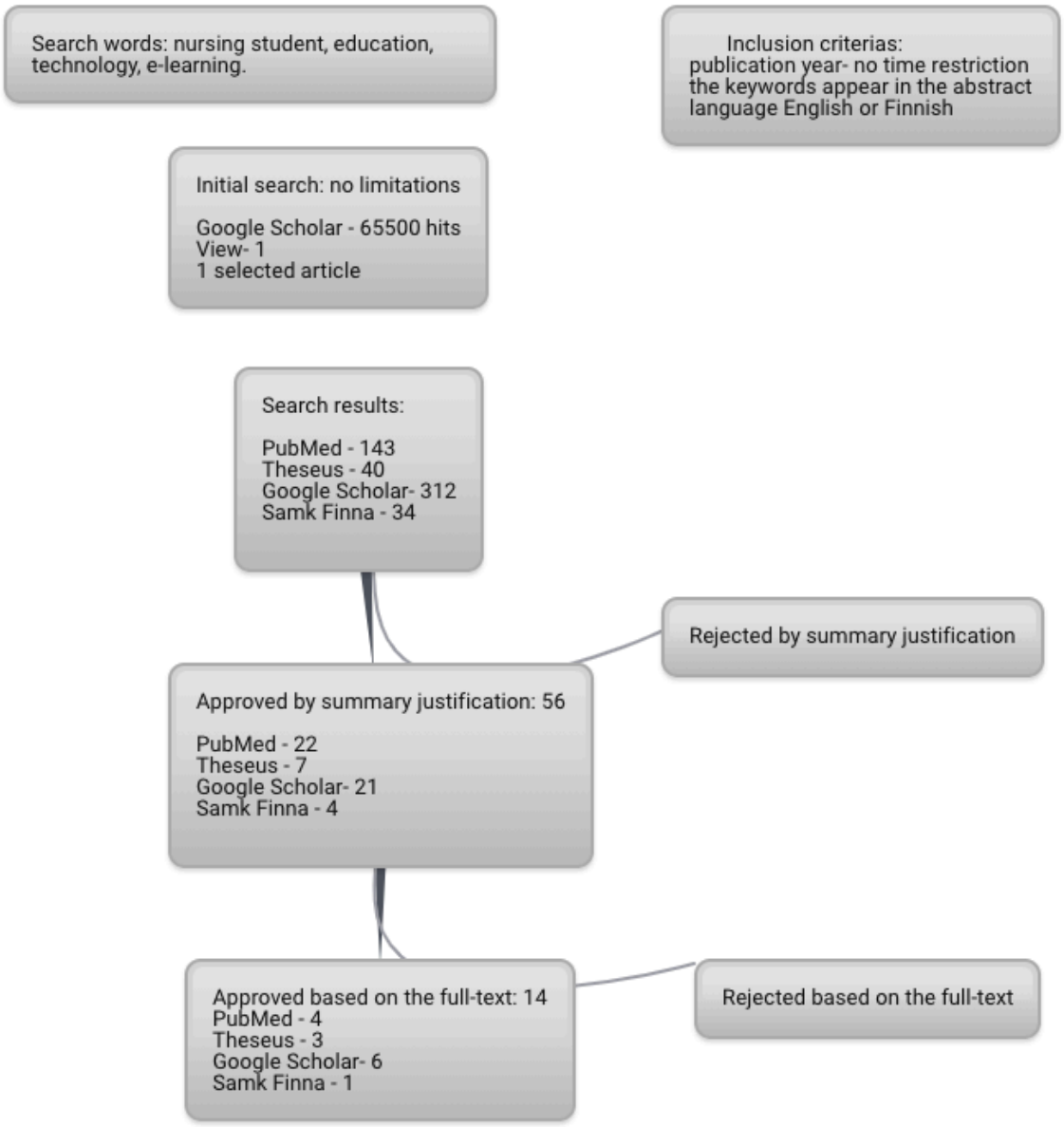
Table 1. Inclusion and exclusion criteria.

INCLUSION	EXCLUSION
Material written in English and Finnish language	Material written in language non-comprehensible by the author
No time restriction	Non-dated material
Material from academic data bases	Material from other non-academic data bases
Material available in full text	Material not available in full text
Material that answers the topic	Material that does not answer the topic

First of all, was defined the research question of the literature review, on which basis was selected keywords for further search. Search terms were: "technology + nursing education", "e-learning", "web-based learning", "online studies + nursing education", a "nursing student" and "verkko-oppiminen + sairaanhoitajan opiskelu". Reliable databases such as Google Scholar, PubMed, Science direct, Finna and Theseus were used in data search. Titles and abstracts were screened based on the inclusion and exclusion criteria. If title and abstract were not related to the topic it was rejected.

From this selection, the full-text articles were assessed accurately by the author against the inclusion and exclusion criteria. Duplicates were also excluded. The material search and selection process are described in (Figure 1). The search queries and search results are described in the data retrieval (Table 2) in Appendix 1. Studies for the literature review were selected according to the set-down criteria describing nursing education and the technology used in it.

FIGURE 1. Material search and selection



5.3 Critical appraisal

Critical Appraisal is the process of assessing and interpreting evidence, by systematically considering its validity, results and relevance to your own context. (Website of CASP UK, 2021). A research article table was done to highlight the main findings of each of the selected articles. This was done to reveal the applicability of each of the articles for this literature review (Appendix 2).

Data quality assessment was performed with the CASP (critical appraisal skills programme) checklists (APPEDNIX 3) for the selected articles (APPENDIX 4).

The quality of the articles was revised based on the evaluation criteria by following the checklists. The fulfilment of each criterion was assessed by a value of 1 and non-implementation by a value of 0. The overall scope determined the qualitative value of the study. Fourteen full articles (n=14) were selected after the critical appraisal.

5.4 Content Analysis

Content analysis is a process of organising and summarising collected data with the purpose to answer the main research question. (Nursing Plus Open 2016, 8-14).

Content analysis can be quantitative when collected data is more statistical and concise and can be analysed by counting and measuring, and it can be qualitative when data is non-statistical. Qualitative content analysis is focused on interpreting and understanding information. Applying both methods of analysing all retrieved data is categorised by common concepts or words are coded within the text and then the results are analysed. (Website of Scribbr, 2021.)

Qualitative content analysis can be written in an inductive or deductive way. Both methods have three main phases: preparation, organisation, and reporting of results.

The preparation phase - collecting suitable data for content analysis and selecting the studies for analysis.

The organisation phase - the inductive way of content analysis means the process of summarising collected data. Using deductive approach - means developing

categorisations where all the data reviewed for content and coded in the accordion to the categories.

The reporting phase - contains results that are described by the content of the categories. (Elo et al., 2014.)

In this bachelor theses was applied the inductive approach of qualitative content analysis. Fourteen (n 14) articles were selected for the literature review according to the chosen topic. All the articles were approved for the final work based on the critical appraisal tool.

The initial analysis phase of the thesis started from coding small topics within all the retreived data. Each article was analysed and coded with its own colour. Similar data was coded with the same colour. According to this arrangement, were formed six (n=6) categories, which were named according to the found data. After the generic categories were named, the main categories were created. The content analysis process is shown in Table 3.

Table 3 . Content Analysis Process

Reoccurring Themes	Generic Category	Main Category
Impact of e-learning Importance of e-learning and its advantages E-learning usage in clinical nursing Clinical skills training via a blended learning A professional identity for blended learning	impact and advantages of e-learning e-learning and clinical skills through blended-learning	e-learning
The competence requirements of digitalization for nurse Specialities of online nursing education IT skills and experiences using IT	professional competence specialities of online learning	technological competence pedagogical competence
Technologies usage in nursing education Digital tools system and its utilisation The usefulness of podcasts, as an extra learning tool Virtual reality is utilized in nursing education Virtual reality is utilized in a simulation Perceptions of simulation courses	technologies virtual reality	digitalization

6 RESULTS

The findings which are presented above in Table 3 based on the fourteen (14) analysed articles. Six (n=6) articles elucidate the use of technology in nursing education in Finland and answer the main research question. Eight (n=8) articles cover the chosen topic within Europe and provide a deeper understanding of the concept. The content analysis results comprise the four main questions: e-learning, technological competence, pedagogical competence, and digitalisation.

6.1 E-learning

According to İlkay & Zeynep (1286-1287, 2014), e-learning is an effective method of improving student's performance and can be used as an alternative way of learning in nursing education. E-learning should be used based on students' personal goals so providing access to needed knowledge. E-learning received good feedback from students and educators, however, new curriculum programs should be designed and ensure investments in technologies required for the development.

Feedback from nursing students highlighted the importance of online education. E-learning with its tools such as video materials for studying improves practical skills and enhances the efficiency of knowledge. Online learning materials enable personal learning without binding to place or time and supports lifelong learning. (Ilonen & Klami 2017, 33-35.)

According to the Kehus (21, 2014) research results, e-learning can improve the clinical skills of nursing students, but further research is still needed for the evaluation of long-term competence.
Nevertheless, the results of another research show the privilege of studying clinical skills by blended learning compared to the online one. (McCutcheon, O'Halloran & Lohan 2018, 39.) The study of Majuri (2017, 31) also emphasizes the importance of practising clinical training in blended learning for good degree expertise.

Network communication at the beginning of studies between students and educators raise a sense of belonging to the school community and the future professional identity. The presence of the same teacher-mentor throughout the studies allows creating better conditions for education and self-reflection. The most important futures of online learning were cohesion, self-motivation and a sense of responsibility. Blended learning allows choosing own study pace and gives students the possibility to combine work with study. (Majuri 2017, 31.)

6.2 Technological competence

The results of the Göös & Haapalainen (2021, 38-40) literature review showed that in nurse work having ICT and interactive online communication skills are very important. The European Commission, defined that information and communication technologies are used a lot in digital health services. Digitalisation provides better tools for professionals to accomplish their jobs, as new information systems automate work that is currently being done manually.

Technological competence is often learned only at the workplace and this issue should be addressed in social and healthcare education. Competence assessment must be done constantly to ensure efficient professionalism. Education must be able to anticipate and produce up-to-date skills for the labour market. (Göös & Haapalainen 2021, 29.)

6.3 Pedagogical competence

Findings of Ragneskog& Gerdnert (2006, 31-32) research elicit a deficit of IT skills from both students and educators. However, overall educator’s competency was higher than student's level. The study highlighted that nursing educators play the main role in providing IT skills to the students and must be equipped with the needed skills to fulfil them. New curriculum programs should include IT courses with all needed skills for future work. To promote a consistent level of IT literacy among

nursing students was recommended that nursing educators establish core IT competencies for each course.

Online courses platforms should have forums with open discussions concerning the content of the course and the opportunity for free interaction with a teacher and other participants. There are many misunderstanding can arise in e-learning because unclear issues can not be discussed quickly. Quick feedback from the teacher as well as an assessment of assignments and exams have a huge role in student learning and satisfaction. It is mostly hinged on pedagogical competence to confer a course right direction. (Karvonen, Nurmi & Sädekallio 2019, 42-43.) E-learning tends to increase teacher workload compared to traditional classroom teaching. Thus, implementing a new way of studying should contain careful care and planning to minimize side effects and negative experiences. E-learning is cost-effective and gives a possibility to take in a larger number of students for the course, though the quality of learning outcomes must not decline. (Karvonen, Nurmi & Sädekallio 2019, 49-50.)

6.4 Digitalisation

Usage of pharmacology podcast proved the usefulness of this extra learning tool from both objective and subjective point of view. This virtual approach gave constant access to the lecture's content thus improved the study outcome. (Meade, Bowskill & Lymn 2009, 9-11.) Serious games as a part of the simulation course also showed positive feedback from nursing students but evidence suggests that interactive online courses should be used as a supplemental tool.(Johnsen, Fossum & Vivekananda-Schmidt 2017,13.)

According to Seppälä (2020, 33) technology is used in nursing education very diversely: phones, tablets, 360º cameras, smart glasses, and various virtual reality tools. Technology implementation had clear positive effects on the performance of teaching and learning. Virtual reality creates a presence and immersion a feeling that engages students and improves learning outcomes. Virtual reality is implemented through learning games or simulation classes.

Virtual learning is being researched and developed all the time so that it can be utilized more in nursing education. The resuscitation course using special dolls with vitals as a part of the simulation courses got good feedback from nursing students. (Liias, Lehtinen & Suvanen 2021, 21). Virtuality allows students to make mistakes without hurting anyone, allow errors and the possibility to realise made mistake and get feedback through discussion. Feedback increases student's motivation for improving personal skills and develops professional competence. (Liias, Lehtinen & Suvanen 2021, 21.; Mörsky, Pitkänen, & Poutiainen 2020,22.)

The world of virtual reality is diverse: 3D virtual environments such as Second Life, 360 videos in trauma treatment, virtual glasses for monitoring the patient's lungs, a virtual patient simulator where the patient can be monitored and treated, and virtual games where students act as a nurse treating COPD patient. Through these virtual simulations, students practise critical thinking, independent decision making and work, care assessment and implementation, and communication. Utilising virtual reality can replace the expensive equipment needed in the traditional simulation and provide an opportunity for more students to participate at a time. (Mörsky, Pitkänen, & Poutiainen 2020, 28.)

7 ETHICS, RELIABILITY AND VALIDITY

According to the Finnish Advisory Board on Research Integrity (TENK), for research to be ethically acceptable and reliable and for its results to be credible, the research must be conducted according to the responsible conduct of research. (TENK 2012, 30).

Conducting research and presenting results were done according to research community rules, which include integrity, meticulousness and accuracy. The data acquisition was done according to scientific criteria and using reliable databases. The research was written honestly and respectfully to other researchers by citing appropriately their publications. The research adheres to the standards of scientific knowledge on all phases of designing the review. The research permit has been guaranteed by SAMK (Satakunta University of Applied Science). There are no sources of financing or conflicts of interest relevant to the conduct of research. (TENK 2012, 32.)

There was no human factor in the research that would compromise the ethical criteria of the study. The concepts of the research were defined clearly. The validity of research questions and sources used in acquiring information was unbiased that helped to create a reliable study. The credibility of the study may be impaired by the low author's experience in conducting a literature review. This literature review has been done by only one author, which may impair the reliability of the study. The reliability also can be affected by the fact that the author is not a native speaker of Finnish or English languages and also the number of researches on the chosen topic was relatively small.

8 CONCLUSION

Although there are not enough academic researches concerning e-learning and technologies usage in nursing education in Finland. The author of this literature review has found some information regarding it. According to the results of this review, technology is used in Finnish polytechnic universities quite extensive. Digital learning environment, such as Moodle, Adobe Connect, Microsoft Office 365, Optima and Mooce (Sivula &Sonninen 2019, 14) are in use all around Finland. Also simulation environments are in wide use: classes and interactive dolls in Turku and Savonia Universities of Applied science (Mörsky, Pitkänen & Poutiainen 2020, 14), simulation centre in Satakunta University of applied science. (Website of Samk 2021). Southeast University of Applied science has invented a "Workseed" program - a diary for student's practice with self and teacher assessment. I assume that every university in Finland has simulation classes for nursing students and many other different programs for studying. Unfortunately, there are not so many researches concerning this topic.

The competence requirements for a nurse include the ability to know how to use medical technology equipment needed for patient care and various technology-assisted tools in processing and reporting information. This includes, for example, possible equipment's work failures and the ability to recognise or fix them. The professional must be able to combine clinical experience and be confident in work with the telemedicine field needed for decent communication. (Website of Savonia 2020.) In addition to these, is very important the ability to communicate electronically and interact with patients and coworkers applying online etiquette and implementing ethical considerations of patient's data privacy. (Göös & Haapalainen 2021, 40.) These competencies must be taken into account while designing curricula because the base of ICT knowledge must be laid during the study period and then just get improved at the workplace.

As the importance of digitalisation will continue to grow in the social and health sectors, the challenge is to develop and maintain new types of knowledge and skills. Digital learning environments and the trend of continuous learning will inevitably change the requirements of professional competence. (Sivula & Sonninen 2019, 38.)

Technology usage in nursing education can be implemented in numerous ways such as mobile technology, computer-based hardware, virtual reality, simulation environment and telehealth. The studies included in this review highlighted the improvement of learning outcomes by using technology and demonstrated a positive attitude towards usage. It requires further research and development basing on already gained knowledge.

9 PROPOSALS FOR FURTHER RESEARCH

The technology comprises a very broad spectrum of concepts. Digitalisation in the health care sector has a big implementation. Nowadays the constant development of digitalisation paces new possibilities of utilising technology which accordingly requires corresponding competencies. One of the proposals for future research is nurse's technological competencies and curriculum programs. Also, this literature review demonstrated that studies concerning technology implementation in nursing education in Finland are very few. Further research can be carried out on these topics.

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APPENDICES

APPENDIX 1

Table 2

Search terms	Database	Hits	View	Selected articles
E-learning in nursing education	Google Scholar	65500	1	-Impacts of E-learning in Nursing Education: In the Light of Recent Studies.
E-learning in nursing education	Pubmed	103	12	-Nursing students' perceptions of a video-based serious game's educational value: A pilot study.
Technology AND education AND nurse AND Europe AND student	PubMed	40	10	- Competence in nursing informatics among nursing students and staff at a nursing institute in Sweden. - Online learning versus blended learning of clinical supervisee skills with pre-registration nursing stu-dents: A randomised controlled trial. - Pharmacology as a foreign lan-guage: A preliminary evaluation of podcasting as a supplementary learning tool for non-medical pre-scribing students.

Search terms	Database	Hits	View	Selected articles
Technology and education and nurse	Theseus	40	7	- Miten virtuaaliympäristöä voidaan hyödyntää sairaanhoitajakoulutuksessa Kirjallisuuskatsaus - Sairaanhoitajan digitaaliset osaamisvaatimukset hoitotyössä - Teknologiset ratkaisut sairaanhoitajien koulutuksessa – kartoittava kirjallisuuskatsaus
Verkko-oppiminen sairaanhoitajan opiskelussa	Google Scholar	312	21	- Verkko-opinnot sairaanhoitajaopiskelijoiden kliinisen hoitotyön osaamisen kehittymisessä - Digitaalisten osaamismerkkien nykytila Systemaattinen kirjallisuuskatsaus - Sairaanhoitajan ammatti-identiteetin muodostuminen monimuotokoulutuksessa - Verkko-opetuksen erityispiirteet hoitotyön koulutusohjelmissa - Kirjallisuuskatsaus - Digitalisoituminen ja verkkovideot hoitotyön koulutuksessa
Technology in nursing education in Finland	Samk Finna	34	4	- Virtuaalitodellisuus simulaatioympäristössä sairaanhoitajakoulutuksessa: kuvaileva kirjallisuuskatsaus.

APPENDIX 2

RESEARCH ARTICLE CHART

AUTHOR, TITLE AND YEAR	PURPOSE	DATA COLLECTION AND ANALYSIS	MAIN RESULTS
İlkay & Zeynep, 2014. Impacts of E-learning in Nursing Education: In the Light of Recent Studies.	To review the impact of e-learning on nurses' and nursing student's knowledge and skills.	A systematic review and meta-analysis of 11 randomized controlled trials. Quality assessment was done by a tool developed for Cochrane reviews.	Four studies showed some improvement associated with e-learning compared to traditional techniques on knowledge. One study reported a slight impact of e-learning on skills.
Johnsen, Fossum, Vivekananda-Schmidt, Fruhlingc, & Slettebøa, 2018. Nursing students' perceptions of a video-based serious game's educational value: A pilot study.	To evaluate nursing students' perceptions of video-based serious games from simulation courses.	A paper-based survey. Data were analysed using the Statistical Package for Social Sciences (SPSS) for Windows.	Students perceived the SG as educationally valuable and easy to use. Video-based SGs should be developed more and used in nursing education.
Ragneskog & Gerdner, 2006. Competence in nursing informatics among nursing students and staff at a nursing institute in Sweden.	To explore nursing students' and nursing educators' skills and experiences using IT.	A written survey completed by 247 nursing students. The questionnaire responses were tabulated and percentages calculated.	71% of the students identified their IT skills as being sufficient for future work. Nurse educators reported that only 29% of nursing students had sufficient IT skills.
McCutcheon, O'Halloran & Lohan, 2018. Online-learning versus blended learning of clinical supervisee skills with pre-registration nursing stu-dents: A randomised controlled trial.	To compare nursing students clinical skills training via a blended learning approach compared to an online-only teaching approach	A post-test-only randomised controlled trial. Qualitative data analysis. Statistical analysis was performed using independent t-tests and thematic analysis was used to analyse responses to open-ended questions.	Participants via the blended learning approach scored higher in terms of motivation, attitudes and knowledge compared to the online group.
Meade, Bowskill & Lymn, 2009. Pharmacology as a foreign language: A preliminary evaluation of podcasting as a supplementary learning tool for non-medical prescribing students.	To evaluate the usefulness of podcasts of pharmacology lectures which were provided as an extra learning tool for nursing students.	Survey data were collected from 44 students. Exam results were compared with those of two historical cohorts who did not have access to podcasts.	The majority of students found the podcasts helpful for revision and in promoting their understanding of the subject. Evaluation of the grades has shown improved knowledge in students with access to podcasts.

AUTHOR, TITLE AND YEAR	PURPOSE	DATA COLLECTION AND ANALYSIS	MAIN RESULTS
Lehtinen, Liias & Suvanen, 2021. Miten virtuaaliympäristöä voidaan hyödyntää sairaanhoitajakoulutuksessa Kirjallisuuskatsaus.	To discover how virtual reality is utilized in nursing education	8 articles were selected for inclusion in the review. Inductive content analysis were used for analysis.	Virtual simulation is a safe way to learn clinical skills. It increases students' self-confidence and can promote learning. Negative experiences concerned the inoperability of technology and the scariness of v.s.
Göös & Haapalainen, 2021. Sairaanhoitajan digitaaliset osaamisvaatimukset hoitotyössä.	To find out the competence requirements of digitalization in the work of a nurse.	The literature review included 19 scientific researches and the thematic design was used to analyze the results.	Digitalization requires new competence from health care professionals and the strengthening of current knowledge.
Seppälä, 2020. Teknologiset ratkaisut sairaanhoitajien koulutuksessa – kartoittava kirjallisuuskatsaus.	To survey how technologies are utilized in nursing education and what implications they have.	6 original studies were selected for the final work. A scoping review was chosen as a method.	Technology can be used regardless of time and place while saving on costs. Technology can be utilized as an adjunct to teaching, to support independent learning and to distance learning.
Kehus, 2016. Verkko-opinnot sairaanhoitajaopiskelijoiden kliinisen hoitotyön osaamisen kehittymisessä.	To describe how e-learning applied in the teaching of clinical nursing to nursing students and its learning outcomes.	Descriptive analysis.8 scientific articles were selected for the final analysis.	The knowledge and competence of nursing students in clinical nursing can be improved with online studies.
Sivula & Sonninen, 2019. Digitaalisten osaamismerkkien nykytila Systemaattinen kirjallisuuskatsaus.	To describe the digital tools system and its utilisation as a continuing education tool.	Inductive content analysis.10 original studies were accepted for the final systematic literature review.	Digital tools enable an individual learning path, create a balance between theoretical knowledge and practical skills and enable the identification and recognition of competence.
Majuri, 2017. Sairaanhoitajan ammatti-identiteetin muodostuminen monimuotokoulutuksessa.	To describe the formation of nurses' professional identity in blended learning.	Qualitative research. Data was collected by interviewing 4 students. The results were analysed by interpreting the data based on the theoretical background.	The most important factors in the growth of professional identity were identified and can be utilized in the development of blended learning.
Karvonen, Nurmi & Sädekallio, 2019. Verkko-opetuksen erityispiirteet hoitotyön koulutusohjelmissa	To find out what the specialties of online nursing education are.	26 articles were selected for the final review.	Nursing theoretical knowledge and clinical skills can be developed by online learning with the development of technology.
Ilonen & Klami, 2017. Digitalisoituminen ja verkkovideot hoitotyön koulutuksessa.	To demonstrate the growing importance of E-learning and its advantages.	Written survey. The Google Forms feedback form for Google documentary solutions was used to evaluate the results.	Using technology is strengthening competence and theoretical knowledge. E-learning and mobile applications show good cognitive effects.

AUTHOR, TITLE AND YEAR	PURPOSE	DATA COLLECTION AND ANALYSIS	MAIN RESULTS
Mörsky, Pitkänen & Poutiainen, 2020. Virtuaalitodellisuus simulaatioympäristössä sairaanhoitajakoulutuksessa: kuvaileva kirjallisuuskatsaus.	To find out how virtual reality is utilized in a simulation environment in nursing education, and student's experiences concerning it.	Descriptive literature review, 12 articles were included. The data was analyzed by using inductive content analysis.	VR in nursing education has been utilized by using a 3D virtual environment, 360-video, virtual headset, virtual patient simulator and virtual game. Nursing student's experiences of using VR were positive. It promotes learning and increases interest in the learning topic.

APPENDIX 3

CRITICAL APPRAISAL CHECKLIST

CASP Systematic Review Checklist

Section A: Are the results of the review valid?

1. Did the review address a clearly focused question?
2. Did the authors look for the right type of papers?
3. Do you think all the important, relevant studies were included?
4. Did the review's authors do enough to assess quality of the included studies?
5. If the results of the review have been combined, was it reasonable to do so?

Section B: What are the results?

6. What are the overall results of the review?
7. How precise are the results?

Section C: Will the results help locally?

8. Can the results be applied to the local population?
9. Were all important outcomes considered?
10. Are the benefits worth the harms and costs?

CASP Qualitative Studies Checklist

Section A: Are the results valid?

1. Was there a clear statement of the aims of the research?
2. Is a qualitative methodology appropriate?
3. Was the research design appropriate to address the aims of the research?
4. Was the recruitment strategy appropriate to the aims of the research?
5. Was the data collected in a way that addressed the research issue?
6. Has the relationship between researcher and participants been adequately considered?

Section B: What are the results?

7. Have ethical issues been taken into consideration?

8. Was the data analysis sufficiently rigorous?

9. Is there a clear statement of findings?

10. How valuable is the research?

CASP Randomised Controlled Trial Standard Checklist

Section A: Is the basic study design valid for a randomised controlled trial?

1. Did the study address a clearly focused research question?

2. Was the assignment of participants to interventions randomised?

3. Were all participants who entered the study accounted for at its conclusion?

Section B: Was the study methodologically sound?

4. • Were the participants 'blind' to intervention they were given?
   • Were the investigators 'blind' to the intervention they were giving to participants?
   • Were the people assessing/analysing outcome/s 'blinded'?

5. Were the study groups similar at the start of the randomised controlled trial?

6. Apart from the experimental intervention, did each study group receive the same level of care (that is, were they treated equally)?

Section C: What are the results?

7. Were the effects of intervention reported comprehensively?

8. Was the precision of the estimate of the intervention or treatment effect reported?

9. Do the benefits of the experimental intervention outweigh the harms and costs?

Section D: Will the results help locally?

10. Can the results be applied to your local population/in your context?

11. Would the experimental intervention provide greater value to the people in your care than any of the existing interventions? (Website of CASP UK, 2021).

APPENDIX 4

CRITICAL APPRAISAL TABLE

REVIEWED RESEARCH LITERATURE	METHOD AND SCALE GIVEN THROUGH CRITICAL APPRAISAL CHECKLIST
İlkay & Zeynep, 2014.	Systematic review. Scale 10/10. Approved for the literature review.
Johnsen, Fossum, Vivekananda-Schmidt, Fruhlingc, & Slettebøa, 2018.	Qualitative Research. Scale 7/10 Approved for the literature review.
Ragneskog & Gerdner, 2006.	Qualitative Research. Scale 8/10 Approved for the literature review.
McCutcheon, O'Halloran & Lohan, 2018.	Randomised controlled trial. Scale 7/11 Approved for the literature review.
Meade, Bowskill & Lymn, 2009.	Qualitative Research. Scale 9/10 Approved for the literature review.
Lehtinen, Liias & Suvanen, 2021.	Systematic review. Scale 7/10 Approved for the literature review.
Göös & Haapalainen, 2021.	Systematic review. Scale 9/10 Approved for the literature review.
Seppälä, 2020.	Systematic review. Scale 7/10 Approved for the literature review.
Kehus, 2016.	Systematic review. Scale 7/10 Approved for the literature review.
Sivula & Sonninen, 2019.	Systematic review. Scale 10/10 Approved for the literature review.
Majuri, 2017.	Qualitative Research. Scale 7/10 Approved for the literature review.
Karvonen, Nurmi & Sädekallio, 2019.	Systematic review. Scale 8/10 Approved for the literature review.
Ilonen & Klami, 2017.	Qualitative Research. Scale 9/10 Approved for the literature review.
Mörsky, Pitkänen & Poutiainen, 2020.	Systematic review. Scale 9/10 Approved for the literature review.