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Technology and Nursing Education in Europe

A Literature Review

DEGREE PROGRAMME IN NURSING
2020

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	Number of pages 70	Language of publication English
Technology and Nursing Education in Europe		
A Literature Review		
Abstract Nowadays society exploits the applied sciences as an answer to the multitudes of needs that individuals may experience during their life. The bond between humanity and technology is today undeniable and does not restrict to any field. This study aims to obtain a clear idea of the technology employed within the delicate setting of nursing bachelor education. More thoroughly, this research is carried on the geographical level of Europe and maintains a record of the involved material but exempt itself from comparison since its scope is to analyze and not to confront. This study also provides a detailed definition of the requirements for nursing education, to identify the needs of European societies and illustrate the possible outcomes for the future. This study is conducted in the form of a narrative review of the already published scientific material, to address the integration of technology that nursing education has faced within the last years. The Semi-Systematic review includes forty-eight scientific articles from four reliable academic databases (ScienceDirect, Theseus, PubMed, and Google Scholar). It follows the critical evaluation as in accordance with the principles of qualitative research, which is carried with the Joanna Briggs Institute Critical Appraisal tools and by inductive critical analysis of the content. The findings of this study imply that the integration of technology within nursing education has been mostly restricted to the simulation-based scenarios that were already adopted in the pursuit of better clinical preparation for future healthcare workers. Still, technology can enhance the learning experience if there is enough background preparation for educators to fill the role. In addition, technology can be used as an answer to fill the vacancies of nursing jobs, since it is highly appreciated by the nowadays students, so, the right implementation within the nursing curricula could possibly allure more students to join the profession. The role of the nurse has evolved from its origins and it is the responsibility of the educators to address this change in the right way, by the alignment of the educative program with the latest trends. If this will happen, nurses will have a chance to remain in the evolutive technological epicenter that European healthcare is facing, and this will contribute to define their role even better in the future.		
Nursing Education, Technology, Literature Review, European Student Nurses		

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1 INTRODUCTION

In history, both nursing and medical fields have been always faced with the urge to produce competent personnel capable of giving safe patient care. In the past 60 years, a new typology of training has been introduced within healthcare education. Such would include the use of specific scenarios in the attempt to recreate such environments that would otherwise result in difficult to imagine (Sterten & Ogorodnyk 2016, 41). This has always been concluded in the attempt to reach for a higher degree of preparation for the future healthcare workers, especially since the situations involved are often related to stress, safety, and multiple task management (Fischer 2016).

Education can be pursued in many ways, thus, this can lead to questioning the nature behind the exigency of producing healthcare specialists that can be capable of being professionally self-aware, whilst preserving the old "vocational" positive aspects of earlier formation. The latter educational standards have changed many times within the years. Since the creation of the first specialists of care, which has occurred around the mid-19th century thanks to Florence Nightingale, the pioneer of the role the image of the nurse has improved in the attempt to adapt every time better to the requirements of a rapidly and ever-changing society (Website of Encyclopedia Britannica 2019).

The European societies have developed their welfare to standards, which our ancestors, would have probably never even dreamed about. Today, we are capable to address the complex health-related issues by also the feature of specific technologies, cloud-connected informatics systems, virtual realities, and other innumerable discoveries that science, within its applied use, has brought to us (Yoo 2013, 244). Whether these recent elements are involved within the direct application of a cure, or in the development of a more structured solution that includes the collaboration within more professional figures, or that may simply start from the basic training and

education of such figures, the individuals and their technological competence need to be assessed (Dunkel 2016, 13).

Because of the importance of the integration of technology within this era, the author addresses the delicate connection between the elements of modernity and education, whilst restricts its field of search to those articles that are strictly related to his native continent. More in detail, the author has chosen to concentrate part of this research in the technological implementation within simulative efforts, since it has seemed evident from the retrieved material, that the purpose of the latter is remarkably entwined with what this study tries to directly address. Finally, the author, as a final year bachelor student of nursing, has chosen to specifically address his future field of competence, in the attempt to define even further the already multi-faceted professional role of the nurses, in the hope that one day, their image will become even more clear.

2 PURPOSE AND OBJECTIVE

Nowadays, in our society, the use of applied science for addressing multitudes of needs is undeniable and does not restrict to almost any field. Whilst aiming to obtain a clear idea of what is currently implemented, this research strives to address the delicate topic of education and its “recent” relationship with technology. In addition, this research keeps track of the found evidence by specifying the provenience for the cited articles.

To this extent, the official purpose of this research is to gain knowledge of the existing scientific literature concerning the actual level of technology implemented within nursing education, in Europe.

Meanwhile, the main and sole objective is the realization of a literature review that can provide an efficient overview of the gathered sources. The study features the conduction of an attentive analysis of the applied science, involved, in bachelor nurses’ education with a specific focus on the technological aspect, in the attempt to promote possibly further empirical developments in the future.

The overall task has been pursued as in accordance with the research question: "How technologies are defined in Nursing Education in Europe?" which has acted as a reminder to the whole endeavor.

3 MEANING OF TECHNOLOGY

Despite the current era has conducted society through the more extensive and intuitive use of technology (Webster 2014, 3), its use within the healthcare field must be selectively classified, especially since the modern progress in science has led toward remarkable breakthroughs toward biomedical, clinical, and rehabilitative knowledge (Tambe 2019, 1). This chapter may help the reader to understand not just the meaning of it but also its use, implementation, and evolving application.

3.1 Definition and Implementation

The term "technology" is a compound word between the Greek expressions *technē* "art, craft" and *logos* "word, speech". Over time, different types of technologies have been involved in the evolution of humankind. Whether that happened through the first usage of utensils for improving the quality of living, such as cutting or skinning, until our century where thanks to the most advances machinery, the whole definition has been re-shaped toward any mean or activity by which mankind seeks to change or alter its environment to his own benefit (Website of Encyclopædia Britannica 2019)

Since the introduction in the market of the first personal computer during the year 1975 (Knight 2014), was at that time the possibilities of the application where otherwise limited by the actual hardware capabilities of the era. The actual need for commonality brought the introduction of the internet as the first step toward that desire of "connection" that is perhaps at the foundation of human nature (Yoo 2013, 244).

Today's students became natural adepts at using web technologies to interact, communicate, and produce content (Pinto et al. 2012, 850).

The role of constant connection had become a part of our existence. Today, cloud services guarantee the permanence of our digital material and almost disable the utility of data manipulation physical hardware. These modern discoveries opened a whole new set of possibilities toward education, business, healthcare, and every other imaginable field (Yoo, 2013; Tuhkala, Wagner, Iversen & Kärkkäinen 2019, 54-55).

By definition, a healthcare device is an instrument intended to prevent the illness or injury of a human being. It can also take the digital form of a software specifically designed for diagnosing, preventing, monitoring, treating different types of condition or even for physically studying or altering one's anatomy and physiology (Mäki-Koivisto 2018, 8).

Technology today is the tool from which we can shape our reality by almost any means. For its potential and involvement in daily living, the use-applied science has become a requirement for not just social interactions and entertainment, but also for work-related tasks and education, which can be either achieved by and through the meaning of scientific application (Sardi, Idri & Fernández-Alemán 2016, 32; Konrad & Böhle 2019, 105-106). It is esteemed that soon, the digitalization will affect most of the existing jobs, thus remarking the requirement of proper technical expertise and the adequate preparation pursued by the educational institutions, governments, stakeholders, and industry altogether (Dunkel 2016, 19).

3.2 Technologies' Role in Education

Integrating technology into educational programs can boost student's involvement in the learning process hence improve the quality of education on practice (Salovaara-Hiltunen 2018, 8). As an example, different tools can be exploited to introduce a practical reward system acted to justify the completion of learning assignments. This process is defined as "gamification" (Sardi, Idri & Fernández-Alemán 2016, 32), and

it has been inquired by the scientific community since its first introduction by Nick Pelling in 2002 (Marczewski 2013, 3).

Lack of training and familiarization with healthcare equipment takes time for patient work, meanwhile, also patient safety is either compromised if the caregiver is unable to use efficiently the devices. Health care equipment became more complex and the importance related to education is utterly emphasized by the latter findings (Dunkel 2016, 18). Such is the topic from which, as an example, the involvement of various game mechanics could potentially act as an anchor point for the users since it will manage to keep their concentration on the topic, help develop problem-solving skills and establish a goal-oriented mindset (Sardi, Idri & Fernández-Alemán 2016, 32; Salovaara-Hiltunen 2018, 19-20). To the latter extent, the almost recently introduced computer-based simulations renowned as “Serious Games” (SGs), attempt to incorporate the principles of entertainment with a positive experience of “gameplay”, whilst increasing student’s knowledge, skills, and confidence (Johnsen, et al. 2018, 2).

Specifically, these “realistic” simulation-based experiences can entitle the student with more realistic training, grow its sense of responsibility and most importantly give an imprint of what a real-life scenario could look and feel like, despite how harsh it could be in its wholeness (Berndtsson, Karlsson & Rejnö 2019, 7). Both simulations and games have shown to bear the potential to help students to increase their initiative, creative thought, and learning experience (Graham & Richardson 2008, 39-40; Alinier 2013, 212-213), as long as they are kept supplemental to the overall program and not used as the "corpus" of teaching (Johnsen, et al. 2018, 15). The whole concept of nurses' education should meet the expectations of the nowadays students, the ones of an interactive structure that largely differs from the old teaching model which, did not involve the direct participation of students within the lectures (Zarzycka 2016, 7).

Technology has influenced the world of education to the point of revolutionizing its mere conception (Tuhkala, Wagner, Iversen & Kärkkäinen 2019, 55). On the specific field of nursing, the old-fashioned teaching concept of formal lecture has been reshaped in more interactive learning programs (Zarzycka 2016, 4), where the students have the chance to interact and act as first-hand nurses entitled to make decisions, research questions and make use of their technological education (Graham &

Richardson 2008, 44; Dunkel 2016, 19; Fawaz, Hamdan-Mansour & Tassi 2018, 106). Thus, the “future learning environment” will not limit just to the field of nursing, its features will keep revolutionizing the concept of teaching by proposing more centered learning that takes into account individuals’ needs and interests, whilst promoting autonomy within a customizable tuition scenario that features teachers not anymore as “gurus”, but rather “facilitators” (Pinto et al. 2012, 852).

4 NURSING EDUCATION

Since the European Union agreement of 1999, known as the Bologna Process, the common requirements for the future of nursing education was established (Salminen, et al. 2010, 5; Kajander-Unkuri 2015, 12). The attentive planning of nurses’ curriculum by each of the main European countries had led to the implementation of Evidence-Based Practice methodology, cultural awareness, increased research, development of the international educators’ program, major investment in simulation laboratories, therefore, technological education (Salminen et al. 2010, 5; Stratoberdha Bardhi 2019, 7).

To earn a bachelor level degree in nursing, the candidate must complete its studies within a minimum of 3 years and on a full-time basis. This could be synthesized in 4600 hours, or 180 “European Credit Transfer System” (ECTS) of both theoretical and clinical training. A single ECTS corresponds to an average of 26,7 hours of study. Specifically, the duration of the theoretical part should be of at least one-third of the whole course, whilst the clinical practice should cover not less than half of it (Directive of the European Parliament and of the Council 2013/55, L 354/151-L 354-134).

The clinical training of a nurse consists of an extended experience where the trainee is entitled to learn the tasks and interventions related to its future role. Whereas this takes place in a teamwork environment, but also but being in contact directly with the sick and by organizing, dispensing, and evaluating the whole nursing care, based on the knowledge and skills that have been priory acquired within the theoretical setting. The

student nurse is also empowered to learn the concepts of leadership, which includes the direct organization of the general nursing care, and health promotion activities within the individual members of the community or small groups (Directive of the European Parliament and of the Council 2013/55, L 354/151).

The Finnish nursing education consists of 210 ECTS for Registered Nurses (Jalloh & Gichangi 2016, 4), therefore, it is 30 credits wider than the EU directive requires (Eriksson, Korhonen, Merasto & Moisio 2015, 73; Korhonen 2020). Its areas of study consist of basic, professional and elective studies, clinical practice, a thesis and a maturity test (Eriksson, Korhonen, Merasto & Moisio 2015, 13). Additionally, nurses could further their specialization as Public Health Nurses or Paramedics by achieving 240 ECTS and Midwives on 270 ECTS (Jalloh & Gichangi 2016, 4).

According to educational qualification requirements for nurses, issued by the Ministry of Education in Finland in 2006, a fully qualified registered nurse is a “specialist” of nursing care” (Numminen 2010, 37). 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; Lakanmaa 2012, 23; Kajander-Unkuri 2015, 12).

Today, the areas of nursing competence have been defined even more clearly, thanks to a more technological or yet “futuristic” approach by the institutions. The nowadays areas are: 1) Professionalism and ethics, 2) Client-centered care, 3) Communication and multi-professionalism, 4) Health promotion, 5) Leadership and professional cooperation skills of the employee, 6) Information technology and documentation , 7) Guidance and education competence and supporting self-care, 8) Clinical nursing, 9) Evidence-based practice, utilization of research knowledge and decision-making, 10) Entrepreneurship and development , 11) Quality management, 12) Service system of health care and social welfare services, 13) Patient and client safety (Korhonen 2020). Here, for the first time, we can witness the official introduction of Information Technology within the nursing curricula which has finally, and potentially, led to the answer to address the development of IT skills within the formation of future

healthcare personnel. Ragneskog & Gardner (2006, 131) did identify the latter need already back in the earlier stages of technological development.

Registered nurses represent, by any mean, the largest group of healthcare workers in the world (Nilsson et al. 2016, 2) and, regardless of that, it is likely that in the future their role will adapt constantly to the upcoming technologies and the related need for technical competence (Dunkel 2016, 20; Anderberg, Björling, Stjernberg & Bohman 2019, 2). Thus, by mastering their competences and perhaps by adhering to the new hypothetical standards of education, this new concept of technological “adept” nurse will lead them closer to the other collaborating figures who hold a higher level of education such as doctors and pharmacists (Dunkel 2016, 20).

If the nursing faculties will contribute to further the nurses’ technological education, it will be consequential that the professional gap between nurses and physicians shall narrow. This opportunity will offer the chance to the nurses to become, for the first time in history, full partners with doctors, pharmacists, and all the other major healthcare figures. This event could potentially be the biggest change in the European healthcare system, and, the nurses would be in its epicenter. As a consequence, their added technological responsibilities will further even exponentially their usefulness within the sector, thus, they will not be limited any longer to the nursing care but they will also acquire those essential technical skills that other figures may lack (Dunkel 2016, 20-21).

5 TECHNOLOGY AND NURSING EDUCATION

New technologies are constantly developed (Website of United Nations Conference on Trade and Development 2019), since this, the need for furthering teachers’ education has been proceeding as according to the requirements of a more specialized market (Dunkel 2016, 19; Risling 2016, 91; Nordic Welfare Centre 2018, 10). The latter inquiries about its workers’ actual capabilities of understanding and implementing technologies daily. Since such relationship has been proved to be

difficult especially for the nurses who have achieved their qualification in the less developed countries (Rea Cuan & Fagami 2018, 17), the importance of introducing a new and more technological education has been furtherly remarked (Dunkel 2016, 19).

Since the healthcare sector constantly changed and improved, the requirements for a corresponded enhancement of nursing education programs could be furthered by many means (Dunkel 2016, 17). The technology-enhanced simulation could be one of the possible solutions to help students to manage clinical issues (Georg & Zary 2014, 16).

Web-based courses and simulations are examples of how technology could be introduced and adapted for pedagogical purposes. Also, the requirements for proper Evidence-Based Practice implies the correct use of research terminals and databases. The acquirement of this precious skill can potentially improve students' critical thinking, decision making, therefore, lead to a better comprehension of the whole nursing process (Finotto et al 2013, 464).

The introduction of technological devices within society has led to the idea of adopting them for furthering assistance toward those who may need it most. This idea has been resumed within the concept of "welfare technology", beheld to pursue the outcomes of rehabilitation and healthcare support, whilst heterogeneously addressing the same issues spanning from substance abuse treatment to elderly care assistance. This "generic" term could be also briefly exemplified with the direct application of science in the attempt of supporting the healthcare environment, customers, and/or its workers (Rantanen & Toikko 2017, 132-133). Its importance has increased in both popularity and demand and not just based on the many technological advancements that society has achieved, but also in the reduced funding from public finances and the consequential urge to increase productivity and quality of service in both social and healthcare fields (Rantanen & Toikko 2017, 2; Kanervo 2018, 7)

The introduction of welfare technologies within the healthcare field has insolubly led to many changes in the working patterns of the employees, (Rantanen & Toikko 2017, 3). Since that, technology has also been the major driver for innovation in finding new meanings of education (Dunkel 2016, 19; Risling 2016, 89). Its responsibility also lies within the future chances of economic growth within the society (Dunkel 2016, 20).

Potentially, the right introduction of welfare technologies could lead to by cut the costs of less effective solutions, hence improve the quality of the services provided by healthcare workers. Remarkably, this process will also contribute to constantly introduce new meanings of development and tools within the healthcare sector (Dunkel 2016, 20; Kanervo 2018, 6). Alas, its potential will require the active support by the educators, which, must guarantee the right start for the further development of technological healthcare (Salminen et al. 2010, 5; Terzioglu et al. 2013, 40; Dunkel 2016, 19; Risling 2016, 91).

The healthcare field is not new to the concept of learning by experience; on the other hand, this has been regarded as non-ethically acceptable anymore whether concluded on living patients (Garrow 2015, 20). This typology of learning approach is regarded as “experiential, and it is constantly addressed by the many required clinical practices that nursing students have to experience before final graduation” (Bamidis, Antoniou & Sidiropoulos 2014, 120). Possibly, the continuous development of learning software, serious games, and augmented/virtual realities, will increase the technological confidence within either students or teachers, whilst reducing the potential learning barriers (McCutcheon, O’Halloran & Lohan 2018, 37).

In the end, the issue of resolving the complexity of the upcoming healthcare devices could be even furtherly hindered by the lack of training or familiarization with the new equipment. Overall, this may compromise the safety of the patients, especially if the user proves non-competent or rather uncertain within the attempt at assistance. This hypothetical scenario does but emphasizes, perhaps, the importance to guarantee the future nurses’ an effective and up-to-date education (Dunkel 2016, 19; Kanervo 2018, 12; Mäki-Koivisto 2018, 48).

6 TECHNOLOGICAL IMPLEMENTATION

This chapter addresses the direct implementations of technology within nursing education. Its focus is on simulation since it has been determined to be the most

relevant topic inherent to the search criteria. As a teaching method, simulation is also the most antique form of training that has been pursued within the healthcare professions, therefore, its augmentation with technology is to be analyzed for all the potential that it may hold.

As for the definitions, a “simulator” is regarded as a physical representation of an object related to either full or partial task that needs to be replicated, meanwhile, a “simulation” is the direct application of one or more simulators for the purpose of education or practical training (Sterten & Ogorodnyk 2016, 41). The use of simulators in healthcare has grown significantly in recent years (Georg & Zary 2014, 2) and along with simulations, they have been renowned to increase healthcare personnel professionalism and through that, patient’s safety (Terzioglu et al. 2013, 35; Karlsson 2014, 3-5; Chemutai & Jepkemei Kirui 2017, 5).

Simulation, as a learning approach, requires the utilization of active participation by its members, thus, it is widely known that nurses are more prone to learn practical skills by direct application rather than passive observation. To this extent, the simulation does not contribute to introduce anything that was not already included in nurses’ education (Garrow 2015, 16). Diverse typologies of simulations can be furthered to extend the students’ knowledge without little to no restriction on which method or "hardware" to include. A simulation, within its very form, can be enacted by simply written role-playing scenarios featuring live actors, or either more complex human patient mannequins, computerized simulations, and/or digital games (Virtanen 2015, 21).

Table 1. Overview of the simulation continuum (Garrow 2015, 18).

Simulation Types	Resources	Activities
Low Fidelity	Models, basic mannequins, and devices or tools intended for generically one sole purpose.	Preparing a nebulizer, medication administration, blood pressure measurement, CPR, etc.
Medium Fidelity	Mannequins with additional features and equipment.	Ward scenario simulation and role-play involvement.
High Fidelity	Human Patient Simulator, realistic settings, and service user involvement.	Specific role-played scenarios that involve also decision-making, communication and correct interventions.

As from Table 1, simulations can be classified on the principle of fidelity, through which they attempt to reenact diverse functions in a more or less realistic demeanor. As such, the level of fidelity is directly affected by the overall complexity of the simulation, which is associated with the equipment, environment, and type of activity. All types of simulations, regardless of the complexity, should be facilitated and monitored constantly by the nurse educators (Garrow 2015, 18).

Scientific evidence has specifically demonstrated that the introduction of high-end fidelity simulations within nursing faculties can support students' learning (Alinier 2013, 212). Still, it is recommended that additional research will be conducted on the aforementioned diverse typologies of simulations, possibly, in the form of a qualitative multi-site study that could selectively assess the validity based on the level of fidelity involved (Garrow 2015, 241-242). Regardless of any actual robust evidence (Garrow 2015, 241), the simulation learning approach enables the future nurses to train their clinical skills away from the caregiving area, safe from the additional stress of dangerous mistakes, whilst being constantly monitored and evaluated in their progress (Bamidis, Antoniou & Sidiropoulos 2014, 120).

Patient safety concerns the minimization of patient's exposition to "hazards", which involves the reduction of risks related to healthcare procedures, toward an acceptable level. Hazards are agents, actions or circumstances that bear the potential of harm to the patient and their reduction could only be furthered by increasing the emphasis on students' education, which will be furthered in this case from a technological point of view (Tella et al. 2013, 7). Simulation environment can be furthered to explore situations that would be either time-consuming, dangerous, or too rare to be experienced ordinarily in real-life (Terzioglu et al. 2013, 35; Garrow 2015, 20-22; Jalloh & Gichangi 2016, 29; Partanen 2016, 6; Chemutai & Jepkemei Kirui 2017, 5). For synthesizing the overall teaching, a correct simulation offers the chance for the students to integrate the knowledge acquired from other meanings of training such as clinical experiences, problem-based learning, educational events, etc. (Dunkel 2016, 19; Chemutai & Jepkemei Kirui 2017, 5).

A full-simulation training, despite its level of immersion, it still diverges from clinical skill training and its experience should substitute, by no extent the one with real patients. The simulation should be furthered as a bridge for the trainees to tests their skills, knowledge, and level of understanding. Within its complexity, it should be carefully designed around the exact level of competence denoted by its users, to avoid the risk of overwhelming the students and hamper their learning process and future predisposition to participate in a similar scenario (Alinier 2013, 37). Exceedingly, the benefits of using controlled simulations are remarked by enabling the "Learning From Errors" teaching method for its participants. Students are so capable of testing their limits and learn by identifying, reporting, and analyzing the mistakes that have occurred during the session, without furtherly concur in any serious consequence for the "unfortunate" patient (Tella et al. 2013, 10-11; Chemutai & Jepkemei Kirui 2017, 8).

The meanings for an accurate simulation can be generally provided by the combination of the first-hand experience with technical expertise (Sterten & Ogorodnyk 2016, 41). Its overall quality is always directly affected by the realism from which the scenario is pursued, along with the sensation of "on-going" that must be perceived and kept by the participants all the time (Graham & E. Richardson 2008, 40). Nevertheless, educators should be adequately prepared to support the learning environment, by

planning carefully the whole scenario so that it will match the students' level of preparation, thus acting as facilitators for the completely learning experience (Alinier 2013, 213). By considering these factors, it will be possible to increase the students' confidence within patient-care decisions and so expand the nurses' undergraduate curriculum (Terzioglu et al. 2013, 37).

6.1 Ambulance

International research shows that nursing students are not optimally prepared for managing emergencies, especially when those are involved in more complex scenarios that include multiple elements affecting each other, such as serious events or disasters (Nilsson et al. 2016, 2). Working as a paramedic, in the northern regions of Europe, involves tending to a patient while the working environment is constantly moving and shaky because of the icy mountain roads, which are typical of the scenario. Meanwhile, it is mandatory handling constant communication with the other medical personnel either through the radio or within the small chassis of the vehicle (Sterten & Ogorodnyk 2016, 43)

The ambulance simulator of the Norwegian University of Science and Technology represents the direct use of applied science toward the purpose of “preparing” the future healthcare workers to operate in a stress-related scenario, and it could furthered as a possible answer for the demand of a better emergency preparation (Sterten & Ogorodnyk 2016, 43). Today, the simulator is used for specific training those students who aspire to work as ambulance personnel during their future career, whether this may guarantee them a better understanding of the feelings and difficulties related to the job thanks to the “learn by doing” technique (Sterten & Ogorodnyk 2016, 45). The latter may also prove compatible with the arisen needs of furthering nursing students' disaster handling procedures and their overall preparation (Nilsson et al. 2016, 6).

6.2 Empowering Discourse

Patient empowerment resides at the very core of all the high-quality healthcare interventions. Its use includes supporting the patients over gaining back control over their decisions and actions, especially when actions are concerning one's own health. It has been demonstrated that its correct use does not limit to just the theoretical benefits, but it also extends to more practical reasons since, nowadays, access to information is more available than it has ever been which, unfortunately, may not apply as well to the reliability of the information that patients could access autonomously, leaving an open window for nurses to enact "guidance" and make sure that the information is used correctly (Virtanen 2015, 11).

Despite how simple and empowerment discourse may seem, there is evidence to support the contrary. Discrepancies, as an example, could arise between factors such as knowledge and values, whether also the subject of the empowerment could feel "paternalized" if the nurse is not capable enough of enforcing the right tone, or the patient may as well not feel successfully involved due to the circumstances or because the nurse does not have a satisfactory level of competence in sharing power with its subjects (Virtanen 2015, 20). The importance of learning how to perform an effective empowering discourse is so utterly remarked by the many aforementioned factors that could if not properly considered, affect the whole effort in a detrimental way. To aid such process, a study in Finland has found that a computer simulation could be rightly programmed, to help the nursing students to comprehend the principles of a correct empowering discourse and prepare them better for the real-life scenario (Virtanen 2015, 20-21).

Students are so "empowered" of learning the proper ways of conducting the discourse, since the simulation puts them in control of setting their own learning objectives, to keep track of their record and decide the progression pace. Despite being the computer also regarded as a low-fidelity simulation, its use has been recognized as suitable for the learning purpose of understanding the application of a specific method within a sole context that does not require further "immersion" within the setting (Virtanen 2015, 21).

6.3 Electronic Documentation

Patient documentation is a common procedure for nurses all over the world as they are responsible for writing down all the concerning details from admission to discharge. More than often, freshly graduated nurses' electronic documentation skills have been judged non-satisfactory by the more experienced colleagues (Elo 2017, 6), thus leading to extra effort by the experienced nurses to train the new ones in the workplace (Elo 2017, 13). Unfortunately, the documentation software availability is either restricted to hospital personnel or changing constantly. In Finland, this has led to the creation of a prototype "academic" version of such software, which follows the documentation criteria of Finnish Care Classification (FINCC) (Elo 2017, 15).

Prior to this, nurses students have been taught how document properly by the use of paper reproductions of those databases that are used in the healthcare (Elo 2017, 13), thus this may be in contrast with what are the directives both Finland and European Union about how nurses should implement more technology into their education (Elo 2017, 9). According to the eHealth strategy 2015-2020 from the Finnish Nurses Association, digitalization in nursing enhances the role of nurses in developing and introducing eHealth services (Elo 2017, 9-10).

The nursing students must further improve their electronic documentation skills since of its importance within the healthcare field (Elo 2017, 14). This type of training could also contribute to improving their generic technological competence; therefore it shall help them also to familiarize themselves with those elements related to nursing care that will one day become part of their professionalism (Elo 2017, 45).

6.4 Multiculturalism

The integration of foreign cultural norms and customs within western societies has been one of the main issues of modern healthcare, especially from the nursing holistic point of view, which requires the acknowledgment of the multiple human spheres within the individual, but without any sort of discernment (Chemutai & Jepkemei Kirui 2017, 1-2; Graham & Richardson 2008, 37-38). In Finland, simulations have been

conducted in the attempt of guaranteeing a better preparation for the nursing students on how to handle scenarios that could potentially generate contrast between what would be better for the patient, and what the patient could tolerate on the base of his cultural and religious norms (Chemutai & Jepkemei Kirui 2017, 9-10).

Scientific evidence has denoted that the students' nurses who are graduating with an already advanced understanding of cultural differences will, nonetheless, contribute to decrease the already existing health disparities among minor communities and, therefore, improve the quality and overall safety of the care (Tambe 2019, 42). To that extent, a role-playing simulation has taken place at the University of Lahti. With the support of the available technological equipment, such as: "Partial task trainers" for training specific duties, "Integrated human body simulators" for practicing medication dosage, and "Complex task trainers" as virtual-reality scenarios (Chemutai & Jepkemei Kirui 2017, 6), it was possible to successfully increase the knowledge of the simulation participants toward the complex topic of multicultural awareness (Chemutai & Jepkemei Kirui 2017, 23).

6.5 Palliative Care

Another scenario that has been monitored to show benefits in student's nurses' education is the palliative care. Often regarded as frightening, the concept of death is among the most "dodged" topic between students until first-hand real experience with taking care of a dying person is otherwise witnessed (Berndtsson, Karlsson & Rejnö 2019, 1). The end of life is generally a scenario from which achieving a high level of mental preparation could require a certain degree of experience, especially when the witness is aroused by feelings such as inadequacy, uncertainty, and helplessness. The challenge of having to cope with these intense feelings, meanwhile providing care to the dying person, could result in difficult to whoever has not faced such reality before (Berndtsson, Karlsson & Rejnö 2019, 2).

In Sweden, engaging students in simulation scenarios for the treatment of life-ending conditions has shown to improve their overall acceptance of the topic (Berndtsson, Karlsson & Rejnö 2019, 2). Even when, the more specific cancer case from which the

students are shown to be more fearful, has been simulated, their attitudes have shown a greater improvement after the simulation, reducing the negative feelings and leading toward a more generic acceptance toward the case (Berndtsson, Karlsson & Rejnö 2019, 5).

If the material and the lectures provided within the course for the preparation of palliative-care can be adequate, the use of the simulation scenario has proven to be the best if not the only factor that could significantly contribute to educate both already educated nurses and nurses students toward the care of dying (Berndtsson, Karlsson & Rejnö 2019, 7).

6.6 Telenursing

Simulations can happen also in the attempt to recreate virtual scenarios such as telenursing (Reierson, Solli & Bjørk 2015, 244). Human societies are facing the struggle of a constant growing elderly population (Bamidis, Antoniou & Sidiropoulos 2014, 119; Kanervo 2018, 6-7). Europe specifically, in the past decades, has witnessed inflation of the average life expectancy of its elderlies. Such has been documented in the first data collection in 2002, meanwhile, in 2013 the mean increased by almost three years and it is still predicted a future increment (Zarzycka 2016, 8).

In the Scandinavian regions, where people are often strayed within the country's surface, the shortage of skilled healthcare workers and the increasing healthcare needs from these patients, they have led to the attempt of using information and communications technology for trying to solve the problem (Reierson, Solli & Bjørk 2015, 244). The concept of home care has been developed as according from the needs of the healthcare market which, due to be proved insufficient in providing constant care due to the geographical features and population's density of the regions involved, it has been reshaped toward the needs of the society, thus leading to remote assistance (Pekkarinen & Melkas 2019, 252).

The nurses have concluded home assistance physically, which has involved traveling and all the expenses connected to the time and resources connected to that. Whether

physical assistance for difficult tasks must not be denied, still there could be a more time-efficient way to perform those more regular operations that usually require no more than just supervision. Telenursing has been a new answer to this problem, which with communication appliances such tablets, phones, or computers, may connect the family directly to the nurse involved in their care (Bendzelova 2014, 15-16).

The importance of teaching telenursing skills has been remarked by its future applications. It is also important to remind that since its multiple nature of providing either practical or theoretical remote guidance, Telenursing can make the most out of the right simulation environment (Reierson, Solli & Bjørk 2015, 248).

6.7 Virtual Patient

Virtual patients' simulators have been used extensively by healthcare students to enhance their professional competences before getting their hands-on real patients, thus increasing their confidence and familiarity with those scenarios that they will meet once they are adequately prepared (Georg & Zary 2014, 2; Karlsson 2014, 3-5; Partanen 2016, 6). By their use, virtually simulated patients present the challenge of a safe activity that can boost students learning capacity by both integrating theory and practice, whilst granting a chance at developing clinical reasoning skills. VPs can be shaped to fit different types of practice with the help of presentations, styles, and settings. (Georg & Zary 2014, 2).

Their design is usually only dependent on the technical affordance of the hardware, meanwhile, their features can include medical background, physical examinations, imaging, and all the meanings for suggesting proper diagnoses and treatments (Georg & Zary 2014, 3). There are many diverse descriptions of virtual patients, which often lack a precise definition of the latter. Perhaps, the most resuming concept would be the one of a digitally generated simulation of a clinically realistic scenario, for the scope of achieving a higher degree of technical preparation by the health-care personnel or students (Georg & Zary 2014, 3).

The most common example is that of patient monitors, tools used specifically for checking patient's physiological parameters meanwhile performing various medical tests such as heart rate and rhythm, arterial blood pressure, blood oxygen saturation, and respiratory rate. Their use is at the routine of any healthcare establishment and sometimes they can even be installed remotely at a patient's home (Partanen 2016, 5). Among all the possible features available, the one that resides at the very essence of any VP, is the interactive interface (Georg & Zary 2014, 3). VPs can be programmed through the use of tools such as the Virtual Interactive Case (VIC), a web-based software built on Adobe Flash that lets the users navigate between the algorithms of questions, medical history and specific details that every case must present (Georg & Zary 2014, 4).

In Greece, an attempt has been conducted to reinforce the whole experience of VP, through the implementation of additional technologies that were addressed to raise the excitement of overcoming the physical limitations of training. Such is the case of the introduction of a Virtual Reality environment within nursing education, where not just the case of the patient was virtualized but also the scenario with computer-based simulation software (Bamidis, Antoniou, & Sidiropoulos 2014, 119-120).

The first used software is named "Discover4Carers", and it has been introduced as an extension to the already existing academic learning platform widely known as "Moodle", where the educational material has been selectively organized into different courses. Here, the learners are entitled to demonstrate their knowledge by taking part into the Virtual Patients instances, carefully tailored to fit the needs of different medical thematic, from dementia to diabetes, but all within the specific field of elderly care (Bamidis, Antoniou, & Sidiropoulos 2014, 120-122).

The virtual patients' details were set up by the attentive planning of educators/tutors' based on working experience, so that they may feature realistic features concerning symptoms, diagnosis, and treatment. The first simulator ran on a web interface that attempted to recreate the environment by images, whilst giving the user the feature to interact by both point-and-click interface and multiple-choice menus. The second simulator ran on the wide renowned Second Life videogame simulation, which

featured the creation of a specific care character, thus its task was to attend diverse patients within specific scenarios (Bamidis, Antoniou, & Sidiropoulos 2014, 121-122)

Regardless the use of Second Life virtual patients' scenarios has been regarded as non-innovative, due to feasibility of the approach, its specific purpose for addressing the care of the elderlies could still be considered groundbreaking since no prior evidence has been found regarding the use of the same level of technology for addressing this setting (Bamidis, Antoniou, & Sidiropoulos 2014, 123).

In Finland, these types of simulators are still nowadays developed and improved to the extent of giving the most realistic simulation possible, whether that be given by a more accurate user interface (Partanen 2016, 1-2) or by including more options about the type of case-patient to simulate (Partanen 2016, 33).

In Sweden, whilst healthcare students have used virtual patients extensively for years, their benefits in nursing education has been inquired. Were if adapted to the nursing holistic concepts of care, at the same time carefully designed to fit the theoretical models of nursing interventions and be constructively assessed by learning models, VPs could indeed support the development of clinical reasoning skills while providing a cost-effective and safe alternative to learning on the work field (Georg & Zary 2014, 3-9).

6.8 Virtual Reality

Achieving immersion through materialistic factors can result in a difficult effort for the structures who are attempting to support nurses' education, especially when this comes to the attempt of recreating difficult scenarios such as the live operation of a patient. Nowadays, virtual reality accessories have become more affordable than what they used to be ten years ago, the technology has improved under every circumstance and can even actually be enacted with very cheap solutions (Ojanen 2019, 11).

In Finland, the use of virtual reality for an educational purpose has been mostly restricted to surgeons (Ojanen 2019, 7) therefore, its hypothetical use has been also

extended to nurses students who could actually anticipate their orientations to the wards by having received this type of preparation ahead (Ojanen 2019, 46).

Whether simulations have proved to show their educational benefits by helping the development of decision-making and collaboration skills (Salovaara-Hiltunen 2018, 11-12) their extensive use by the meaning of the nowadays high-end technology could further the demanded modernization of healthcare education (Elo 2017, 9). Scenarios should include difficult situations within credible settings such as the basics of resuscitation, post-reanimation treatment, rehabilitation, acute illness, or emergency care (Salovaara-Hiltunen 2018, 10-12).

Virtual reality is still a new brand in education and there is not yet much evidence in Europe about its use. A formal introduction in the academic environment needs to be furthered a backed up by more research (Salovaara-Hiltunen 2018, 49). According to the first positive feedbacks of the prototype software done by the University of Turku, the future student nurses will surely benefit from this new type of learning as long as the product will meet the standard requirements (Salovaara-Hiltunen 2018, 56-57).

7 METHODOLOGY AND DATA

The essence of scientific research is within the construction of theories or facts based on already existing knowledge and regardless of the discipline. Literature reviews have so the precious task of connecting and summarizing the many kinds of research that this era, is witnessing due to the increasing production of scientific material. Through synthesis, they can provide different overviews of the areas where the already existing literature may be contrasting and multidisciplinary. A literature review can detect which areas need more research thus that is the fundamental component of forging new theoretical frameworks and conceptual models (Snyder 2019, 333).

7.1 Literature Review

A literature review is a comprehensive summary of the previous research within a specific topic. As a qualitative research method, it enables the writer to survey scientific articles, books, and reports with little regard to the size of search if the selected topic is correctly addressed. The writer's attempt should be to describe, summarize, and evaluate, the precedent research, whilst producing newer material that could be furtherly reviewed by other researchers as well. Its base should always be supported by a strong theoretical background since that would not only affect the validity of the work but, it would also help the author determine the characteristics of the research. A literature review always acknowledges the work of previous researchers. It must adopt proper citation and avoid writer's personal opinions since that could also lead to further bias within the text. As in this thesis, a literature review can be aimed to address new topics that require further exploration (Snyder 2019, 333-339).

Different typologies of literature reviews can be pursued in accordance with the required methodology that can fit the researcher's specific goal. These approaches can either be qualitative, quantitative, or hybrid design and, it would be a mistake to selectively classify all the literature review methods since the combination of the multiple elements that compose it and, the diverse research approaches, could lead to a too wide spectrum of results. More thoroughly, a literature review should be capable of being adapted to the specific needs of the research while maintaining its basic structure, and not the opposite (Snyder 2019, 333-334).

A possible sample of different types of literature reviews could be of systematic reviews, *semi-systematic reviews*, and integrative reviews. The first is commonly used within the medical and healthcare field as the best method to synthesize other research and findings by critically identify and appraise the relevant data. The second, also known as the *narrative literature review*, has the specific purpose to address diverse topics and methodologies within more than one discipline. The third attempts to assess, critique, and synthesize the already existing literature of a certain topic, while using

an approach that can enable the development of further theoretical frameworks. (Snyder 2019, 334-335).

The topic of this thesis includes both the concept of nursing, education, and technology since that, the *narrative literature review* has been found as the most compatible approach to try to integrate the scientific material within these two fields. Otherwise, a systematic review would have been non-optimal also by the fact that a sole a person has carried out this research, and one of the main requirements for the quality of such a method is the presence of two or more researchers (Joanna Briggs Institute 2017, 3). The narrative approach instead, guarantees the chance to identify and understand all the potential relevant research material available within the thesis' areas of interest, whilst the author has kept trace of his work and by that adhered to the guidelines of transparency that any review of this kind should follow. Finally, a *semi-systematic review* could also be furthered to map the field of research (Snyder 2019, 335), which in this case has been done by the localization of the many gathered studies and successive synthesis of the latter finding within the discussion area.

7.2 Study Selection

For a literature review, the part of planning which data to gather requires the establishment of well-defined criteria. Whether those may have varied during the different phases of the thesis, therein will be listed the elements that have been guaranteeing the quality of the research and defined its spectrum. Most importantly, the criteria served the purpose of answering the research questions within its limitation and acted as a reminder for the authors during the research process.

Table 2. Inclusion and exclusion criteria.

INCLUSION	EXCLUSION
Material written in English & Finnish languages	Material written in other languages
No time restriction	Non-dated material
Material from academic databases	Material from non-academic databases
Material available in full text	Material not available in full text
Material that addressed the topic	Material that did not address the topic

The inclusion and exclusion criteria presented in Table 2 were set down for assisting the data selection. The articles related to the topic, which have been considered only if available in full text, included terms technologies in nursing education, welfare technologies, educational technologies, e-learning, simulation, gamification, were selected for the study. The research data has been retrieved from reliable academic databases, such are: ScienceDirect, Theseus, PubMed, and Google Scholar. Thus, the selected articles were in English and Finnish language. There was not used time restriction concerning publications during selecting articles due to the newness of the topic and limitation of data.

7.3 Search Strategy

The initial phase of the thesis was conducted in a non-documented manner, which has served the purpose of just instructing the author to further the development of the topic. Consecutively, few articles who have been featured in the text do not possess trace of search documentation. It is the author responsibility to remark that those references were gathered only during the initial phase of the thesis and were successively used "just" as a lesser citation, whether they served the purpose of reinforcing precedent quotes, answer minor topics, or eventually help to explain the overall concept without being considered in the main discussion. These articles are anyway exempt from possible further critical evaluation; thus, they will be excluded from the final discussion but still will be mentioned here for preventing any bias in the external quality evaluation of the research.

Despite the planning effort, the first search on PubMed did not retrieve enough exhaustive material on e-learning education for nurses, thus, this served as further experience for the author and lead him to choose another database from which to carry on. New specific searches lead to an increased understanding of the topic, whereas also the articles were useful to produce the first developments of the thesis. All the searches on ScienceDirect were based on the complete availability of the articles, so the “open access” option was used within the search engine.

Furtherly a search about “Welfare technology” on ScienceDirect did not show enough compelling results to the topic, whether that be caused by the absence of inherent material and by non-free access to the potentially inherent articles. Successively, it became possible to understand that "Welfare technology" is an umbrella term for generic applied sciences adopted within "just" Nordic Europe, this was understood thanks to the fact that even the few mentioned articles within the international databases were exclusively coming from the Nordic countries.

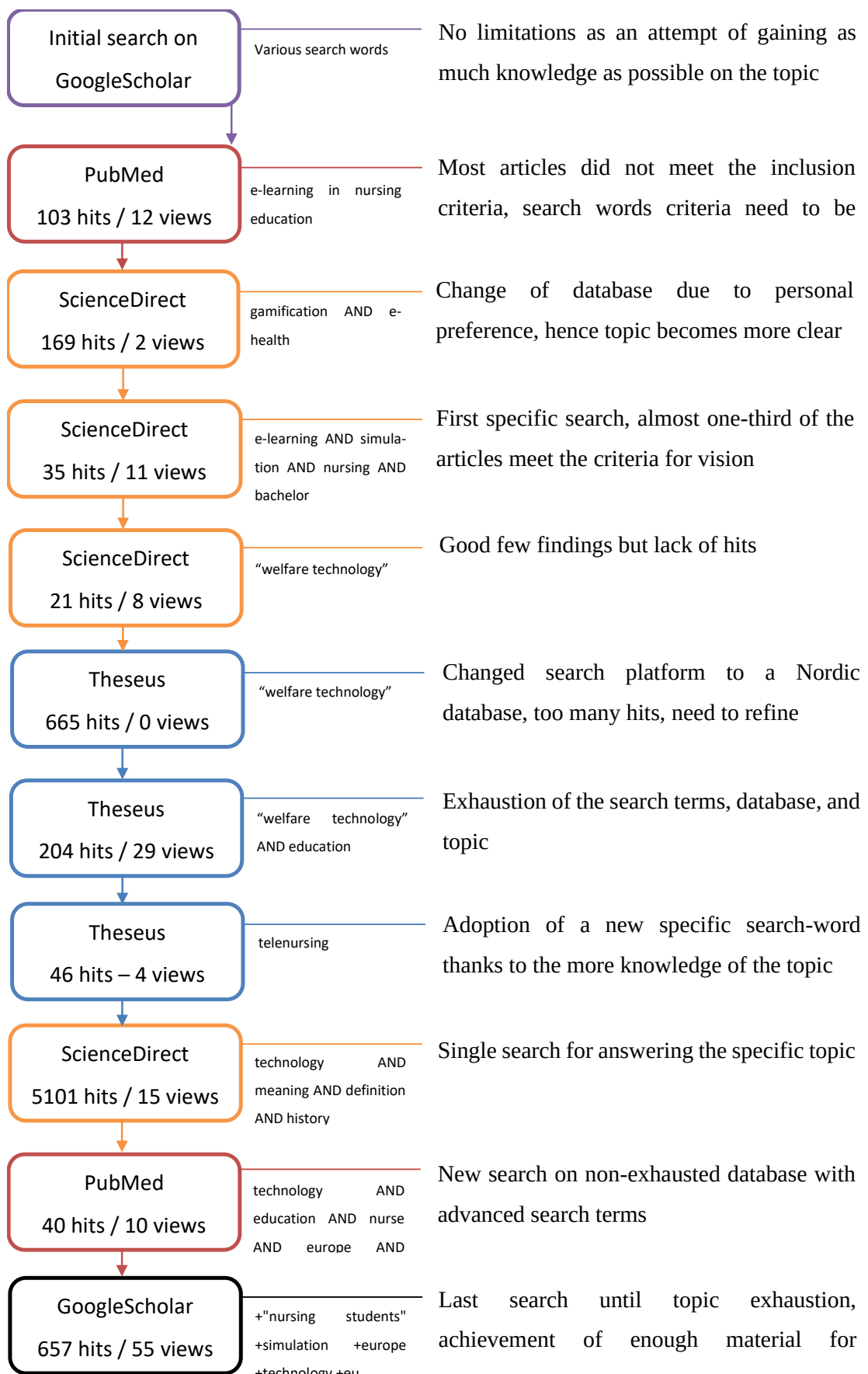
That brought to lead the search on Theseus, a Finnish national research database, which gave results that are more inherent. In the attempt to narrow the search, the term “Education” has been furtherly added. Once the results were exhausted, a small single search has been conducted on Theseus in the attempt of finding more about the newly discovered evidence about distance healthcare, which is regarded in Northern Europe as "telenursing". Furtherly another search was conducted on ScienceDirect, with the aspiration of enabling the technological background to be more exhaustive and qualitative in its presentative role of the thesis.

Another search was conducted on PubMed in the attempt of using as many databases as possible to have results that are more “diverse”. This time, the search was performed with different types of criteria since the large availability of the found material, and along with the lack of geographical restrictions of the new database, which imposed more carefulness. Only free articles that did directly relate to studies, about humans and not animals, were considered in the search. As the knowledge of the topic came finally clear, an additional research was carried on the "bigger" Google Scholar, but this time with very specific restrictions that lead regardless to 657 hits. After

considering 55 articles, 19 met the inclusion requirements and the thesis had enough material for publication.

Regardless, the pre-fixed search time greatly overextended on the initial planning phase, due mostly to the unexpected abandonment of the project by one of the two initial authors, which has led the remaining one to cover the missing effort. Any eventual contribution to the topic by the former co-author has been carefully removed as in adherence to the ethical principles of plagiarism and misappropriation of scientific material. To follow, the explanatory figure (Figure 1) of the research process.

Figure 1. The process of the literature's data selection

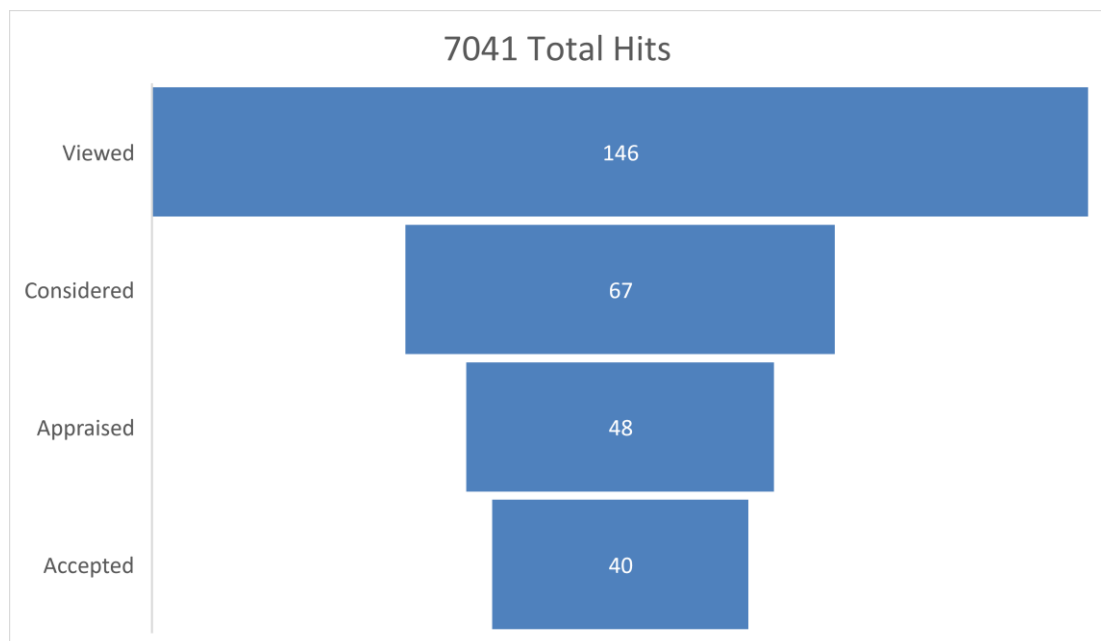


7.4 Critical Appraisal

The Joanna Briggs Institute “Critical Appraisal tools” were used for the evaluative process of the found material. The Institute (JBI) is an international, membership-based research and development organization, located within the Faculty of Health Sciences at the University of Adelaide. Thanks to these appraisal tools, a researcher can guarantee, that and if, the methodological quality of a study has been maintained within its integrity. Despite these “advanced” tools that were formerly designed to address systematic reviews, they can be adapted to evaluate also studies and texts of a less complicated nature (Joanna Briggs Institute 2017, 4).

Of 7041 hits, the initial sampling included 146 viewed articles. These were analyzed by at least the abstract and the possible details of inference within the further text, whether this gave hints on interest for the thesis’ development. Of the latter, 67 were formerly considered for the review, of which 48 proved eligible for the critical appraisal (respectively 42 in English & 6 in Finnish language). Within this last sample, eight did not qualify positively for the final discussion.

Figure 2. Summary of the selection process.



The Finnish written articles were originally excluded from the critical appraisal since the author did not feel enough “confident” to give a judgment that respected the

baselines of validity. It should always be a researcher's responsibility to give his critical opinion exempt from any misunderstanding, especially if, the latter may be penalized by the partial comprehension of the text. Specifically, the above-average complexity of the Finnish grammatical structure has imposed, on the author's, more carefulness in the evaluative process. Nevertheless, the final decision has been to comply with the evaluative standards of qualitative research, due mainly, to the important contribution that the Finnish written material has brought to the overall research.

The tables for critical evaluation, complete search, and description of the literature are available for consultation within the appendixes. The descriptive tables have been furtherly sub-divided on the base of the written language. Therein lastly attached the research agreement signed by both client and former researcher(s).

Figure 3. Appendixes detailed index.

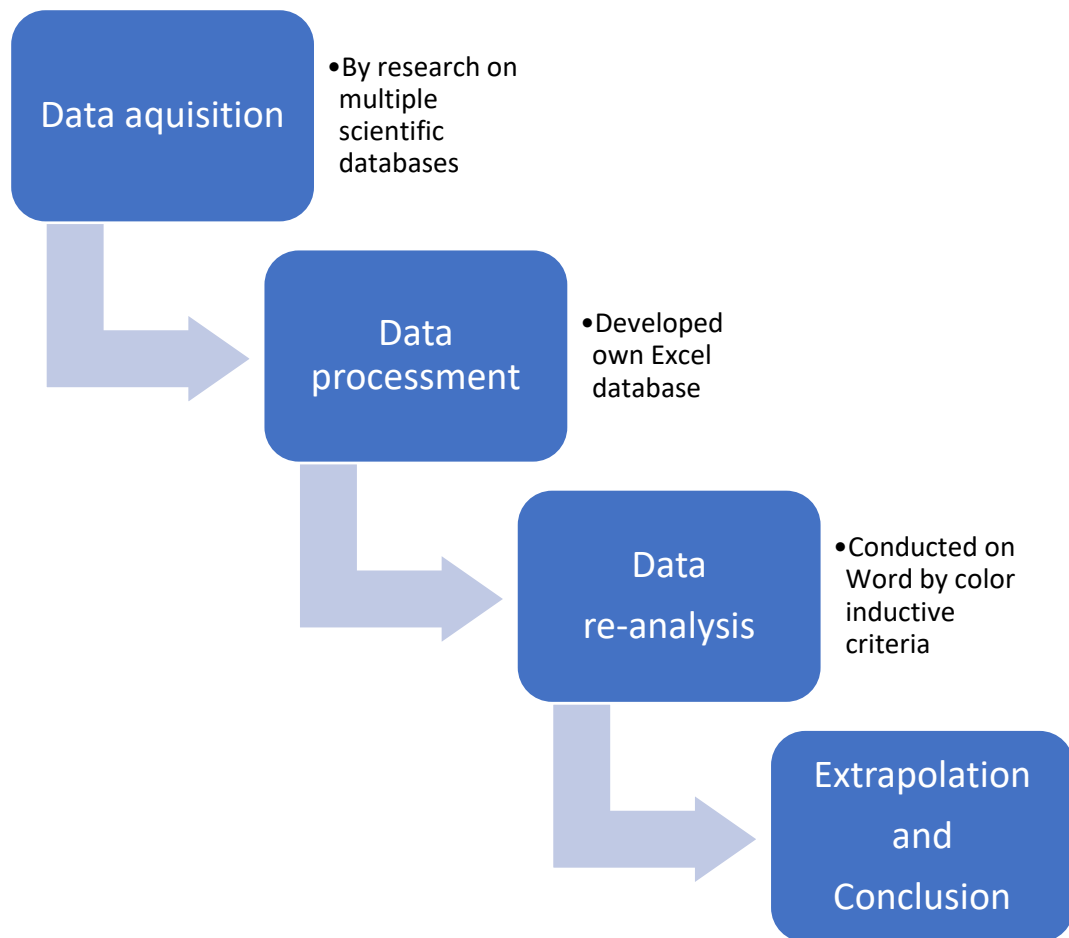
p.53	• APPENDIX 1 • The complete search table
p.58	• APPENDIX 2 • The descriptive table of the English written literature material
p.66	• APPENDIX 3 • The descriptive table of the Finnish written literature material
p.67	• APPENDIX 4 • The summary table
p.69	• APPENDIX 5 • The agreement on the preparation of a Thesis

7.5 Content Analysis

The content analysis consists of a survey of the cited articles to answer the question of the research. As a class of methods used within empirical social science, the latter can be performed in both qualitative and quantitative ways, to address the common issue of non-transparency from which literature reviews are too often negatively remarked. Generally, this form of investigation can be carried out within two sequential levels of analysis, where the first approach the text by statistical meaning, and the second harvests through the interpretation of the textual concepts that are inherent to the objective of the research. Most importantly, it is to mention that the validity of the analysis is usually also directly affected by the number of researchers who have been involved in the process since, otherwise, the judgment from only one person could be alleged with bias and be therefore contestable. (Seuring 2012, 546-547). Unfortunately, to the extent of reliability, this study has been affected by a shortage of researchers. Thus, the ethical adherence of the single author, later specifically addressed, may compensate in a partial way.

Specifically, within this research twenty articles have been found to contribute generally to the research question. The survey has been conducted via software Excel and Word, where the first has been used as a database of all the records and number related details, and the second was employed for the resumption of the quotes that were directly related to this thesis' topic. The citations have been highlighted with three different colors: *green* for those elements that directly helped to define the use of technology within European nursing education, *yellow* for the elements who were connected with feedback related to the use of such technology and *neutral* for anything that was related to the topic but without being specifically inherent in its details. To follow, the explanatory figure process of the data survey.

Figure 4. Content analysis' process.



Within the sample, fifteen articles were directly able to contribute to the definition of educational technology that this study tries to address within Europe. More specifically this has been pursued in the attempt to optimize the concepts that were already confirmed within nurses' education, such as the simulation environment and its enhancement via technological meanings, conducted by the use of interactive mannequins, partial task trainers, full task trainers, and the recreation of clinical scenarios from the inside of an ambulance to the hospital ward. Other technological solutions have been employed in a less practical way, which is the case of computer ran simulations that can potentially overcome the physical boundaries of those faculties that, may not have access to either space or the funds necessary to raise possible simulation environments.

The learning experience has been furthered by specifically programmed Software, which tried to expose the user to several diverse clinical scenarios. The objective was

to ensure that the learner can witness the same stressors that he will encounter in a real-life scenario. Additionally, even more sophisticated virtual reality environments have been implemented into trial. The latter are capable to submerge the trainee into supplementary complicated situations such as the progress of a surgical operation. All of this is pursued in the attempt to achieve a better level of fidelity within the mere attempt to offer the best technical preparation to the healthcare workers to be. The level of fidelity has been identified as one of the main elements that can enhance the learning experience of the students within a simulative experience, consecutively, it has been determined that technology plays a fundamental role in the latter.

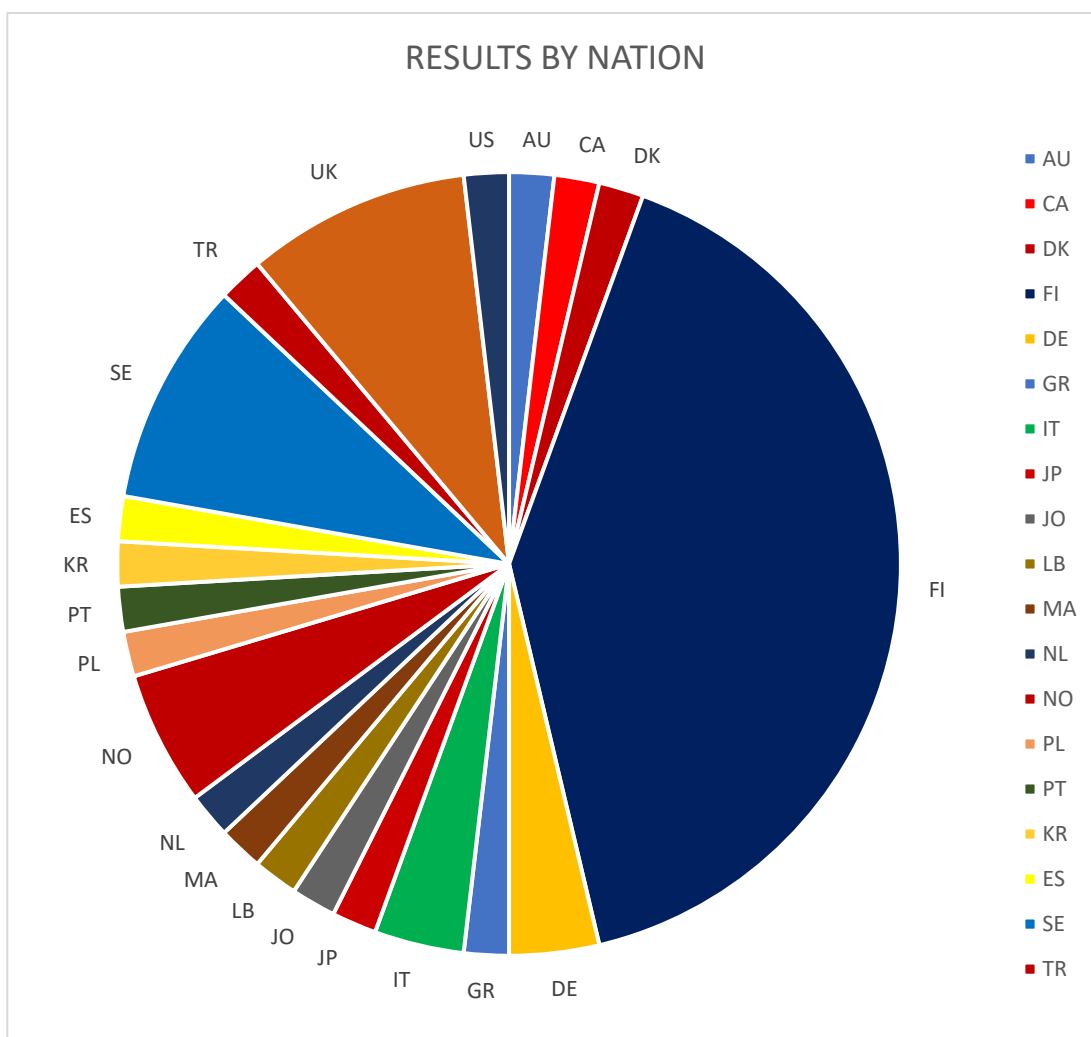
It is important to specify that technological education be not pursued only in the “simulative” effort, but also in the attempt to offer different perspectives of learning such as the blended approach, that includes both contact and online lectures. In addition, electronic clinical documentation is an essential skill to master, especially since nowadays, European hospitals are not prone to use paper documentation any longer, therefore, student nurses are intended to meet this requirement. Finally, even the renowned Evidence-Based Practice implies the user to be capable to conduct research within databases, confront, analyze and diffuse the found knowledge, and all of this would be technically impossible without the technological support that only the constantly internet-connected computers can nowadays offer.

Additionally, the feedbacks from the technologically enhanced teaching are extremely positive on the side of the students, and the few exceptions were usually implied in the lack of care within the preparation of the environment or use of the tools, therefore, educators have been confirmed to play a fundamental role in the whole effort. Unfortunately, all the studies inquired also the necessity to conduct more specific research about the potential positive extents of this learning approach.

8 DISCUSSION OF THE RESULTS

The articles that have been selected for this thesis have shown a great origin prevalence from Nordic countries. In detail, Finland holds the highest amount of research material with a total of twenty-two articles that are directly related to the thesis' topic. This high prevalence is justifiable by the adoption of the Finnish national academic database "Theseus" as one of the main meanings of the search. The United Kingdom and Sweden together withhold the second place. With a respective count of five articles each, of which the UK has one inter-academic project with Turkey and Italy, and Sweden holds two inter-academic projects, one with Norway and Japan, and one with the USA. Norway follows for the third place with three total articles of which one, as just mentioned, concluded in cooperation with Sweden. The other European countries that are featured in the articles are ten of which: Denmark (1), Germany (2), Greece (1), Italy (2), Netherlands (1), Poland (1), Portugal (1) and Spain (1). To follow, the exemplificative pivot chart of studies by prevalence.

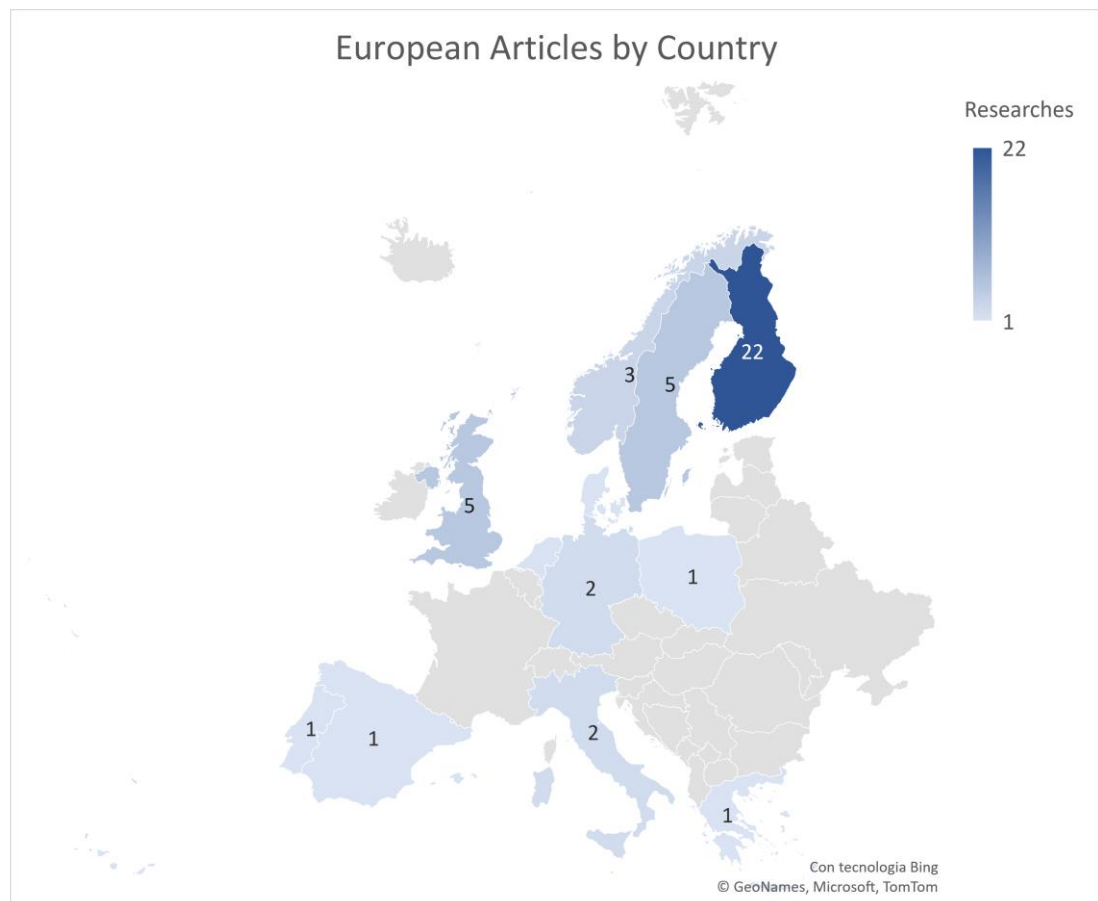
Figure 3. The pivot chart of the results by nations.



Additionally, despite this study has been conducted in the attempt to define the application of science within nursing education in Europe, it has been useful also to evaluate and include those articles that, even though they were not realized by nations within the European continent, still were connected to the topic. In detail, one Australian study analyzed the gamification techniques and teaching methods within nursing. One Canadian study wanted to identify the new trends in nursing education within the future perspective of ten years from the time of publication. A Jordan/Lebanese research has been analyzing the market trends and challenges of the modern nursing education, on both a local and global spectrum, thus, the remarks found by this study are entwined with the ones in the European continent, so it has been used as support for the already existing notions. An article from South Korea has been integrated within the literature, as support for the pure technological notions that were mentioned within the introductive part of the theoretical background. Other

respective studies coming from either Morocco, USA, Turkey, and Japan were considered due to their cooperative participation with other European universities. Regardless of the exceptions, forty-five European articles have been gathered within the whole research endeavor.

Figure 4. The European chart by number of publications.



Totally, forty-eight articles have been evaluated and forty-four were gathered in accordance with the exact search criteria that were priory declared. There are five exceptions to the research criteria, which were respectively made for Fischer (2016), Yoo (2013), the website of Encyclopædia Britannica (2019), Knight (2014), Rea Cuan & Fagami, (2018) and Korhonen (2020). All these sources have been used merely for presenting the introductive historical-technological background of the research or reinforcing already existing concepts, thus only two (Rea Cuan & Fagami, 2018 and Yoo 2013) qualified for the critical appraisal since the tools that have been used were strictly forged for assessing only medical-related research. Still, the non-evaluated articles have been assessed through inductive critical analysis.

Eight of the complete evaluated articles did not receive a positive verdict and therefore, have been either removed from the research or maintained as a reinforcement for other sources. Regardless, these articles have also been excluded from the final discussion. Respectively, the research conducted by Anderberg, Björling, Stjernberg, and Bohman, (2019) was not updated with the results yet, thus, this has made the study unreliable for the purpose of this thesis. The study concluded by Fawaz, Hamdan-Mansour & Tassi (2018) has also been excluded due to the geographical restrictions by which this thesis is affected. The Finnish research of Partanen (2016) is non-complete within the retrieved papers and the first version of the simulation software is yet to be realized, thus it is impossible to make a concrete evaluation of the study without the feedback of the latter. The research of Pinto et al (2016) did not pass the quality check due to the lack of clear search criteria, nor critical evaluation, and neither the search table was attached within the appendix. The purpose of the study of Rea Cuan & Fagami, (2018) did not directly relate to the topic of the Thesis. The Finnish research of Tambe (2019) has been conducted in a non-clear nor effective manner, thus, also the open-ended questionnaire has led to incongruence within the results, and the participants' sample was not wide enough to guarantee the reliability of the study. The intercontinental research of Terzioglu et al (2013) is considered still in progress, so it has been mentioned just to reinforce other sources. The Finnish study of Wang, Wang, Ren & Wang (2018) has been completely removed from the thesis, due to the non-adherence to the quality standards and by the perception of bias inherent with the results.

Within the sample of articles that have passed the evaluation process, eleven references were used for the definition of the whole simulation learning technique. Additionally, other ten sources were also directly used to describe several diverse methods of simulation. These references can be categorized as by the nation of provenience: Finland (5), Norway (2), Sweden (2), and Greece (1). More specifically, there were eight different typologies of simulation analyzed and reviewed within this thesis. These were the Norwegian ambulance simulator, the Finnish empowering discourse software, the Finnish electronic documentation software, the Finnish multiculturalism role-played simulation, the Swedish palliative care simulation, the Norwegian telenursing simulation, the Greek and the Swedish virtual patient software, and the Finnish surgery and emergency virtual reality environment. All the other sources used

within this study have been employed to explore the relationship between nursing education and nowadays-technological enhancements. Few of these sources were not originally from medical academic databases, thus, these exceptions had to be made for the explanation of laws, regulations and historical facts that were tied directly to the topic of this research.

8.1 Limitations

This thesis has been initially planned as a pair work but had witnessed the abandonment of the project by one of the former participants. Since that, the amount of workload that it was first intended to withhold, has been carried by the sole remaining researcher to the best of its abilities. The realization of a thesis is a demanding task, especially for those who are unaware of the various techniques and skills that are required for the composition of the latter. In this case, the author, as a first-time university student, did not have any prior experience on how to conduct a literature review, thus, this may have affected as well the developmental quality of the work. To exemplify this specific limitation, the initial phase was conducted through an autonomous and non-documented multiple research that led the author to a better comprehension of not just the topic, but also of how to realize research in the first place.

The author is not a native speaker of the chosen language of communication, English. Despite being an international student who has carried all his studies in foreign countries (Finland, Scotland, and Spain), his comprehension and compositive skills within the latter language, are still distant from the standards that only a native speaker could probably ever reach. It had been also, the decision of the author, to evaluate and include studies who were conducted in the native language of the client of this thesis (SAMK), Finnish. Thus, his competence within the latter tongue is even less developed compared to what he has been to achieve so far with his English linguistical skillset. Despite that, it has been in the main interest of the author to preserve the integrity of this work, by the application of major carefulness in the evaluation and comprehension of the Finnish research.

A more technical restriction of this work has been the coercion within database usage. Many pieces of research had to be excluded due to the non-opensource availability, which collided with one of the main criteria of this study. In addition, one of the main sources for the articles retrieval has been Theseus, the Finnish national database, which has obviously meant that most of the retrieved material would be of local origin. Time had also been a component of the restrictions involved in this research. Lastly, this thesis covers only marginally the concepts of electronic learning. Although, a better analysis of the latter could have potentially broadened the answer to the research question.

8.2 Ethical viewpoints

This review has been conducted following the ethical principles of research; therefore, the author has attempted to avoid any form of bias, misappropriation, plagiarism, and discrimination within the text. A possible source of bias within this research could be in the form from which the author has tried to lead the conclusion of his thesis in the direction where he wanted. The author is remarkably supportive of new methods and passionate about technology, still, his professional position within society, nursing, imposed him to consider mainly the promotion of the well-being of the relevant population, rather than just his area of interest.

Another possible form of bias could have been interpreted from the decision to include the great majority of the articles within the review, from Finnish sources. Still, the author hereby declares no wish in the promotion of one country or society above the others, especially since he is not native of Finland. Although, this could bring the same issue to the nation where the author origins, but also Italian studies have been kept marginal in the numbers. As aforementioned, the purpose of this thesis has been to define concepts and not to establish comparisons between countries.

It should be also ethically clarified that the analysis conducted by this thesis has been localized on the geographical concept of Europe and not the European Union, so, away from any political influence in the definition of its borders. This choice has been carried also by the fact that already since the planning phase, the occurrence of Brexit

was imminent, therefore, this would have led to the removal of the many important British articles that are featured within this thesis. It was not in the author's interest to re-define the political decisions of the mentioned nation, but it is important to remind that science should follow no borders, and active research should be equally spread around the world with little regard to the political decisions.

Particular attention has been considered in the avoidance of plagiarism and misappropriation of material, especially since the abandonment of the project from one of the former participants. The author has taken all the possible efforts in the removal of the text and references that were not produced and gathered by his person.

The client, Satakunta University of Applied Sciences, had also guaranteed the permit for the realization of this research. SAMK is a modern industrial university that puts emphasis on innovation, expertise, and workforce capability. As one of the four universities within the Satakunta region of Finland, SAMK has its own ethics committee for human research purposes, which has been founded in 2010 (Website of Samk 2010). It is the right of the committee to guarantee the permission of the research, but it is up to the researcher to adhere to the ethical principles so that the image of the guarantor will not be compromised.

9 CONCLUSION

Within all the examined articles, there is evidence that the field of nursing is currently in expansion. As Dunkel stated (2016, 20), the newly discovered technologies are responsible for this change since, their introduction in the healthcare has created a window of opportunity for the nurses to learn, adapt to the new discoveries and, so to increase the quality of treatment, therefore, the safety of the patients. These conclusions are remarked by the findings of all the studies that have been conducted in the pursuit of the evaluation of the simulation environment. The only few discordant opinions are held by the idea of the non-enough research available, which furtherly supports that the technologically enhanced education within nursing faculties, is still a

fresh concept in Europe. These findings furtherly remark the need for the creation of this study and promote the development of more research within the field. In the meantime, technology is both a necessity, a challenge, and an opportunity that needs to be pursued.

This study can also support the validity of simulation-based teaching method if the latter is used as a supplement for nursing training and regardless of the technology involved. Although, there is not any evidence to support simulations of being enough formative to cover every area of learning. Also, as Garrow suggested (2015, 243), simulation does not guarantee a safe learning environment for all types of student. This statement arises from concept that every person is unique, therefore, some students' may be more prone to learn by theory rather than by practice. Also, some students' may be afraid of judgment whilst their performance is observed and evaluated by their course mates, thus, it is fundamental for the educators to psychologically support the effort of their students, so that they will maximize the learning experience.

Educators play indeed a fundamental part in the preparation of the simulation scenario, but they are also responsible for the integration of the technologies within their courses. It is required of the teachers to pursue technological progress unanimously, so that any negative effect derived from the non-familiarity with the nowadays instruments of teaching, will not hinder the learning process. As stated by Risling (2015, 92), educators should actively seek new meanings of teaching based on the potential evolution of nursing, thus they must not limit themselves with the current templates so that they could finally match the pace with the latest technology trends. In accordance with Zarzycka (2016, 8), the nursing teaching system of the last century does not meet the requirements of the nowadays healthcare system. If the European educational system does not continue to adapt to the most recent standards of teaching, there is the risk that even fewer people will choose to pursue the nursing career due to finding it not enough attractive.

The European continent has partially standardized the requirements for the basic education of the nurses on a technological level, since it implied that the curricula must include IT skills and technical preparation to adhere to the diverse tasks that nurses can pursue along their career. The way from which each university decides to prepare

their students is left independent. From what arose from this research, often the use of technology is just left implied within the latter education, and what is more advertised within the research, are the experimental methods from which technology can be furthered to new meanings. Since this experimental approach, it also seems natural that all the articles inquire about the need for additional development of the field, which also this thesis addresses since it was impossible, for the author, to find any other similar research.

As a direct answer to the research question, the definition of the technology adopted in nursing education within Europe is the one of a current development that tries to keep the pace with the modern scientific advancements, and against the old vocational concepts that nurses seem still not too eager to leave. This leads to the conclusion that it is impossible to homogenize the definition along the whole continent, but the further development in the field that will hopefully be brought by the pioneers of technological advancements will perhaps lead to a more uniformed adoption of applied science within the many nursing faculties of the European countries.

The integration of new technologies within healthcare will continue to happen since of the increased benefits that derives from its application. It is only up to the nurses to follow the progress of this sector, to fulfill the requirements of an evolving society that adapts its findings for the greater good, and evolve along from the old vocational concept from which they arose. Unlikely this change will happen by itself, so it will be the responsibility of the universities and their educators, to provide updated learning programs and an attractive yet competitive teaching method. If this will happen, the urge to provide more specialized and competent healthcare workers may be finally answered. Perhaps, also the number of people who would find interest in the pursuit of the nursing career will increase, since this effort will contribute to define even better the role of the nurses, who will stand in the midst of the change and that, hopefully, will manage to reconcile the “*conditio humana*” with the technology.

10 FURTHER DEVELOPMENT

As already mentioned, the limited availability of the literature did not make it possible to quantify exactly the utility of the simulation as a teaching method. Further research is suggested in the form of qualitative research so that it will be possible to determine the specific benefits of diverse typologies of simulation and the detailed impact of technology within the scenario.

In addition, a systematic review could also help to determine more precisely the bond between technology and nursing education especially since, this study, had been conducted by only one inexperienced researcher who used freely available material, which mostly originated from the same national sources of his university. Perhaps, the hypothetical systematic review could be conducted within a collaboration of three researchers, each of them from one of the three countries that scored the highest number of the scientific material inherent topic (Finland, Sweden, United Kingdom), so that there will be a further guarantee for the accuracy of the retrieved material. Estimably, the number of articles written in each local language will be higher than the ones written just in English, and by the involvement of local researchers which will have respectively access to each national database, it will be likely possible to furtherly confirm or even dissent from the findings of this limited research.

Finally, as already mentioned, the author of this study is a non-experienced researcher. The development of a thesis is indeed a learning process, but despite how much the researcher may have strived to absorb new notions and matured his professionalism, the limits of this product are still visible to a more experienced eye. The author is completely conscient of this fact, therefore, he could suggest the repetition of this study with the consideration of the latter findings.

REFERENCES

- Alinier, G., 2013. Effectiveness of the use of simulation training in healthcare education. University of Hertfordshire. Referred 04.05.2020.
<https://doi.org/10.18745/th.10746>
- Anderberg, P., Björling, G., Stjernberg, L. & Bohman, D., 2019. Analyzing Nursing Students' Relation to Electronic Health and Technology as Individuals and Students and in Their Future Career (the eNursEd Study): Protocol for a Longitudinal Study. JMIR Research Protocols, 8(10), p.e14643. Referred 29.04.2020.
<http://doi:10.2196/14643>
- Bamidis, P.D., Antoniou, P. & Sidiropoulos, E.A., 2014, May. Using simulations and experiential learning approaches to train careers of seniors. In 2014 IEEE 27th International Symposium on Computer-Based Medical Systems (pp. 119-124). IEEE. Referred 06.05.2020. <https://www.dhi.ac.uk/san/waysofbeing/data/health-jones-bamidis-2014.pdf>
- Bendzelova, V. 2014. Applying telehealth interventions for depression in nursing care, Literature review. Yrkeshögskolan Arcada. Referred 03.04.2020.
<https://www.theseus.fi/handle/10024/138600>
- Berndtsson, I. E. K., Karlsson, M. G. & Rejnö, Å. C. U. 2019. Nursing students' attitudes toward care of dying patients: A pre- and post-palliative course study. Heliyon, Volume 5, Issue 10, 2019, Referred 01.04.2020.
<https://doi.org/10.1016/j.heliyon.2019.e02578>
- Chemutai, N. & Jepkemei Kirui, F., 2017. Multicultural Simulation Scenarios for Nursing Education. Referred 30.04.2020.
<https://www.theseus.fi/handle/10024/132565>
- Directive 2013/55/EU of the European Parliament and of the Council of 20 November 2013. <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:354:0132:0170:en:PDF>
- Dunkel, T. 2019. Emerging Skill Needs in Health Care and the Future of Nursing. Professional Education and Training through Knowledge, Technology and Innovation, p.13. Referred 28.04.2020. https://dspace.ub.uni-siegen.de/bitstream/ubsi/1057/1/Professional_education_and_training.pdf#page=20
- Elo, A. 2017. Designing A Nursing Care Plan Application for Nursing Education In Finland. Thesis. Pori: Satakunta University of Applied Sciences. Referred 08.04.2020. <https://www.theseus.fi/handle/10024/132754>

Eriksson, E., Korhonen, T., Merasto, M. & Moisio, E-L., 2015. Sairaanhoitajan ammatillinen osaaminen –Sairaanhoitajakoulutuksen tulevaisuus –hanke. Ammattikorkeakoulujen terveysalan verkosto ja Suomen sairaanhoitajaliitto ry. Referred 14.04.2020.

<https://www.epressi.com/media/userfiles/15014/1442254031/loppuraportti-sairaanhoitajan-ammattillinen-osaaminen.pdf>

Fawaz, M. A., Hamdan-Mansour, A. M. & Tassi, A. 2018 Challenges facing nursing education in the advanced healthcare environment, International Journal of Africa Nursing Sciences, Volume 9, 2018, Pages 105-110. Referred 01.04.2020

<https://doi.org/10.1016/j.ijans.2018.10.005>

Finotto, S., Carpanoni, M., Casadei Turrone, E., Camellini, R. & Mecugni, D. 2013. Teaching evidence-based practice: Developing a curriculum model to foster evidence-based practice in undergraduate student nurses. University of Modena and Reggio Emilia. Nurse Education in Practice 13 (2013) 459-465. Referred 15.11.2019.

<https://www.sciencedirect.com/science/article/abs/pii/S1471595313000814?via%3Dihub>

Fischer, K. 2016. Nurses: Overworked and Understaffed on the Front Lines. In: Healthline. Referred 14.02.2020. <https://www.healthline.com/health-news/nurses-overworked-understaffed-070714#5>

Garrow, A.L., 2015. The Use of Simulation in Pre-Registration Nurse Education (Doctoral dissertation, The University of Manchester (United Kingdom)). Referred 06.05.2020.

https://www.research.manchester.ac.uk/portal/files/54564063/FULL_TEXT.PDF

Georg, C. & Zary, N. 2014. Web-Based Virtual Patients in Nursing Education: Development and Validation of Theory-Anchored Design and Activity Models. J Med Internet Res 2014;16(4): e105. Referred 14.04.2020.

<https://doi.org/10.2196/jmir.2556>

Graham, I. & Richardson, E., 2008. Experiential gaming to facilitate cultural awareness: its implication for developing emotional caring in nursing. Learning in Health and Social Care, 7(1), pp.37-45. Referred 30.04.2020.

<https://doi.org/10.1111/j.1473-6861.2008.00168.x>

Jalloh, A. & Gichangi W.G. 2016. Developing core skill of international nursing students through simulation in Finland. A literature review. Lahden ammattikorkeakoulu. Referred 28.04.2020.

https://www.theseus.fi/bitstream/handle/10024/126068/Gichangi_Grace.pdf?sequence=2

Joanna Briggs Institute. 2017. Critical Appraisal Checklist for Qualitative Research. <https://joannabriggs.org/research/critical-appraisal-tools.html>

Joanna Briggs Institute. 2017. Critical Appraisal Checklist for Systematic Reviews and Research Syntheses. <https://joannabriggs.org/research/critical-appraisal-tools.html>

Johnsen, H.M., Fossum, M., Vivekananda-Schmidt, P., Fruhling, A. & Slettebø, Å. 2018. Nursing students' perceptions of a video-based serious game's educational value: A pilot study. The University of Sheffield. Referred 10.04.2020
http://eprints.whiterose.ac.uk/125991/1/Nursing_students_perceptions_of_a_video-based_serious_game.pdf

Kajander-Unkuri, S. 2015. Nurse competence of graduating nursing students. Turun yliopisto. Referred 28.04.2020.
<https://www.utupub.fi/bitstream/handle/10024/103403/AnnalesD1158Kajander-Unkuri.pdf>

Kanervo, S. 2018. Tulevaisuuden apuvälinepalvelut. Satakunnan ammattikorkeakoulu. Referred 10.04.2020.
<https://www.theseus.fi/handle/10024/150571>

Karlsson, N. 2014. Endoskopiasimulaattorin käytettävyystudkimus. Jyväskylän ammattikorkeakoulu. Referred 09.04.2020.
<https://www.theseus.fi/handle/10024/80870>

Knight, D. 2014. Personal Computer History Index: 1975-84. 26.04.2014 Referred 30.03.2020 <https://lowendmac.com/2014/personal-computer-history-the-first-25-years/>

Konrad, K. & Böhle, K. 2019 Socio-technical futures and the governance of innovation processes—An introduction to the special issue, Futures, Volume 109, 2019, Pages 101-107. Referred 07.04.2020.
<https://doi.org/10.1016/j.futures.2019.03.003>

Korhonen, T. 2020. Competence requirements and contents (180 ECTS credits) for general nurse education. Blogit Savonia. 15.01.2020. Referred 07.05.2020.
<https://blogi.savonia.fi/ylesharviointi/2020/01/15/competence-requirements-and-contents-180-ects-credits-for-general-nurse-education/>

Lakanmaa, R.L., 2012. Competence in intensive and critical care nursing. In Annales Universitatis Turkuensis D (Vol. 1014). Referred 30.04.2020.
<https://www.utupub.fi/bitstream/handle/10024/76824/Annales%20D%201014%20Lakanmaa%20DISS.pdf?sequence=1>

Mäki-Koivisto, H. 2018. Hoitajien laiteosaamisen prosessin kehittäminen Tampereen yliopistollisen sairaalan lasten päivystysyksikössä. Tampereen ammattikorkeakoulu. Referred 10.04.2020. <https://www.theseus.fi/handle/10024/151511>

Marczewski, A. 2013 Gamification: A Simple Introduction. Referred as 31.03.2020

McCutcheon, K., O'Halloran, P. & Lohan, M. 2018. Online learning versus blended learning of clinical supervisee skills with pre-registration nursing students: A randomised controlled trial. International Journal of Nursing Studies. Volume 82, Pages 30-39. Referred 29.04.2020.
<https://www.sciencedirect.com/science/article/pii/S0020748918300488via%3Dihub>

Nilsson, J., Johansson, E., Carlsson, M., Florin, J., Leksell, J., Lepp, M., Lindholm, C., Nordström, G., Theander, K., Wilde-Larsson, B. & Gardulf, A., 2016. Disaster nursing: Self-reported competence of nursing students and registered nurses, with focus on their readiness to manage violence, serious events and disasters. *Nurse education in practice*, 17, pp.102-108. Referred 29.04.2020.

<https://doi.org/10.1016/j.nepr.2015.09.012>

Nordic Welfare Centre. 2018. Nordic Think Tank for Welfare Technology. Referred 8.11.2019. <https://nordicwelfare.org/en/publikationer/nordic-think-tank-for-welfare-technology/>

Numminen, O., 2010. Nursing ethics education in Finland from the perspective of codes of ethics. University of Turku.

<https://www.utupub.fi/bitstream/handle/10024/63587/AnnalesD912Numminen.pdf?sequence=1&isAllowed=y>

Ojanen, M. 2019. Virtuaalitodellisuuden soveltuvuus leikkaussaliperehdytykseen. Tampereen ammattikorkeakoulu. Referred 09.04.2020.

<https://www.theseus.fi/handle/10024/227813>

Partanen, S. 2016. User Requirements and User Interface Design for Virtual Patient Simulator. Helsinki Metropolia University of Applied Sciences. Referred 10.04.2020.

<https://www.theseus.fi/handle/10024/119206>

Pekkarinen, S. & Melkas, H. 2019 Welfare state transition in the making: Focus on the niche-regime interaction in Finnish elderly care services, *Technological Forecasting and Social Change*, Volume 145, 2019, Pages 240-253. Referred 07.04.2020.

<https://doi.org/10.1016/j.techfore.2018.09.015>

Pinto, M., Souza, F., Nogueira, F., Balula, A., Pedro, L., Pombo, L., Ramos, F. & Moreira, A., 2012. Tracing the use of communication technology in higher education: a literature review. In *Proceedings of INTED 2012–International Technology, Education and Development Conference* (pp. 850-859). Referred 05.05.2020.

<https://pdfs.semanticscholar.org/cf9e/a30ff5fe6db60416f1a4afe07ff9eef9c6e8.pdf>

Ragneskog, H. & Gerdner, L., 2006. Competence in nursing informatics among nursing students and staff at a nursing institute in Sweden. *Health Information and Libraries Journal*, 23, pp.126–132. Referred 16.04.2020.

<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1471-1842.2006.00643.x>

Rantanen T. & Toikko T. 2017. Employees' attitudes towards welfare technology in substance abuse treatment in Finland, Nordic Welfare Centre. Referred 02.04.2020.

<https://doi:10.1177/1455072517691060>

Rea Cuan, A. & Fagami, S. 2018. Patient Satisfaction with The Nursing Care Given by Foreign Nurses: A Literature Review. Centria University Of Applied Sciences. Referred 21.11.2019

<https://www.theseus.fi/handle/10024/155396>

Reiersen, I. Å., Solli, H. & Bjørk, I. T. 2015 Nursing Students' Perspectives on Telenursing in Patient Care After Simulation, *Clinical Simulation in Nursing*, Volume 11, Issue 4, 2015, Pages 244-250. Referred 03.04.2020.
<https://doi.org/10.1016/j.ecns.2015.02.003>

Risling, T. 2015. Educating the nurses of 2025: Technology trends of the next decade, *Nurse Education in Practice*, Volume 22, 2017, Pages 89-92,
<http://www.ufjf.br/pgenfermagem/files/2018/04/Educating-the-nurses-of-2025-Technology-trends-of-the-next-decade.pdf>

Salminen, L., Stolt, M., Saarikoski, M., Suikkala, A., Vaartio, H. & Leino-Kilpi, H. 2010. Future challenges for nursing education – A European perspective, *Nurse Education Today*, Volume 30, Issue 3, 2010, Pages 233-238. Referred 27.04.2020.
<https://doi.org/10.1016/j.nedt.2009.11.004>

Salovaara-Hiltunen, M. 2018. Käyttäjäkokeemus ja oppiminen virtuaalitodellisuudessa : simulaatiopelin ja skenaarioiden kehittäminen terveydenhuollon ammattilaisille. Turun ammattikorkeakoulu. Referred 09.04.2020.
<https://www.theseus.fi/handle/10024/142895>

Sardi, L., Idri, A. & Fernández-Alemán, J.L. 2017. A systematic review of gamification in e-Health. *Journal of Biomedical Informatics*. Volume 71, July 2017, Pages 31-48. Referred 30.03.2020. <https://doi.org/10.1016/j.jbi.2017.05.011>

Seuring, S. & Gold, S. (2012). Conducting content-analysis based literature reviews in supply chain management, *Supply Chain Management*, Vol. 17 No. 5, pp. 544-555. <https://doi.org/10.1108/13598541211258609>

Snyder, H. 2019. Literature review as a research methodology: An overview and guidelines, *Journal of Business Research*, Volume 104, 2019, Pages 333-339, Referred 07.04.2020. <https://doi.org/10.1016/j.jbusres.2019.07.039>

Sterten, J. & Ogorodnyk, O. 2016. Application of Modern Educational Methods through Implementation of the Ambulance Simulator at a Clinic Laboratory (NTNU Gjøvik), *Procedia CIRP*, Volume 54, 2016, Pages 41-46. Referred 02.04.2020
<https://doi.org/10.1016/j.procir.2016.05.065>

Stratoberdha Bardhi, I., 2019. Nursing students' learning experiences through academic mobility in Finland and Spain. Laurea University of Applied Sciences. Referred 05.05.2020. <https://www.theseus.fi/handle/10024/186003>

Tambe, D.T. 2019. The Process of Becoming Culturally Competent in Nursing: A Qualitative Study Among Swedish Nursing Students in Novia. Referred 05.05.2020.
<https://www.theseus.fi/handle/10024/263638>

Tella, S., Liukka, M., Jamookeeah, D., Smith, N.J., Partanen, P. & Turunen, H. 2013. What Do Nursing Students Learn About Patient Safety? An Integrative Literature Review. *Journal of Nursing Education* • Vol. 53, No. 1, 2014. Referred 27.04.2020.
<https://doi.org/10.3928/01484834-20131209-04>

Terzioglu, F., Tuna, Z., Duygulu, S., Boztepe, H., Kapucu, S., Ozdemir, L., Akdemir, N., Kocoglu, D., Alinier, G. & Festini, F. 2013. Use of Simulation in Nursing Education: Initial Experiences on a European Union Lifelong Learning Programme - Leonardo da Vinci Project. Journal of Curriculum and Teaching, Vol. 2, No. 1; 2013. Referred 27.04.2020. <https://doi.org/10.5430/jct.v2n1p34>

Tuhkala, A., Wagner, M-L., Iversen, O.S. & Kärkkäinen, T. 2019 Technology Comprehension — Combining computing, design, and societal reflection as a national subject, International Journal of Child-Computer Interaction, Volume 20, 2019, Pages 54-63. Referred 07.04.2020. <https://doi.org/10.1016/j.ijcci.2019.03.004>

Virtanen, H., 2015. Nursing students' learning about an empowering discourse in patient education. Turun yliopisto. Referred 29.04.2020. <https://www.utupub.fi/bitstream/handle/10024/117673/AnnalesD1207VirtanenDISS.pdf?sequence=2&isAllowed=y>

Website of Encyclopædia Britannica. Buchanan, R.A. 2019. History of technology. Referred as 12.03.2020. <https://www.britannica.com/>

Website of Samk, 2020. Referred on 19.05.2020. <https://www.samk.fi/>

Website of United Nations Conference on Trade and Development. The need for an honest discussion on technology and development. Referred 12.03.2020. <https://unctad.org/en/>

Webster, F. 2014. Theories of the information society. Routledge. Referred 30.03.2020

Yoo JH. 2013. The Meaning of Information Technology (IT) Mobile Devices to Me, the Infectious Disease Physician. Infect Chemother. 2013 Jun;45(2):244-251. Referred 30.03.2020 <https://doi.org/10.3947/ic.2013.45.2.244>

Zarzycka, D., 2016. Current Trends in Vocational Training of Nurses and Health Needs of the Society. Zdrowie Publiczne i Zarządzanie, 14(1), pp.3-10. Referred 05.05.2020. <https://www.ceeol.com/search/article-detail?id=515928>

APPENDIX 1

The complete search table.

Search Terms	Database	Hits	View	Selected Articles
e-learning in nursing education	Pubmed	103	12	-Nursing students' perceptions of a video-based serious game's educational value: A pilot study. -Web-based virtual patients in nursing education: development and validation of theory-anchored design and activity models.
gamification AND e-health	ScienceDirect	169	2	-A systematic review of gamification in e-Health.
e-learning AND simulation AND nursing AND bachelor	ScienceDirect	35	11	-Nursing students' attitudes toward care of dying patients: A pre- and post-palliative course study. -Nursing Students' Perspectives on Telenursing in Patient Care After Simulation
“welfare technology”	ScienceDirect	21	8	-Application of Modern Educational Methods through Implementation of the Ambulance Simulator at a Clinic Laboratory. -Welfare state transition in the making: Focus on the niche-regime interaction in Finnish elderly care services.

				-Socio-technical futures and the governance of innovation processes—An introduction to the special issue.
“welfare technology”	Theseus	665		
"welfare technology" AND education	Theseus	204	29	-Employees' attitudes towards welfare technology in substance abuse treatment in Finland. -Designing a nursing care plan application for nursing education in Finland. -Virtuaalitodellisuuden soveltuvuus leikkaussaliperehdytykseen. -Käyttäjäkokemus ja oppiminen virtuaalitodellisuudessa: simulaatiopelin ja skenaarioiden kehittäminen terveydenhuollon ammattilaisille. -Endoskopiasimulaattorin käytettävyystudkimus. -User requirements and user interface design for virtual patient simulator. -Hoitajien laiteosaamisen prosessin Kehittäminen tampereen yliopistollisen sairaalan lasten päivystyksyksikössä. -Tulevaisuuden apuvälinepalvelut.

				-Peruselintoimintojen häiriöt ja hoitoelvytys: koulutussuunnitelma.
“telenursing”	Theseus	46	4	-Applying telehealth interventions for depression in nursing care Literature review
technology AND meaning AND definition AND history	ScienceDirect	5101	15	-Technology Comprehension — Combining computing, design, and societal reflection as a national subject.
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 students: A randomised controlled trial. - Audience response technology: Engaging and empowering non-medical prescribing students in pharmacology learning.
+ "nursing students" +simulation +europe +technology +eu	GoogleScholar	657	55	-Future challenges for nursing education — A European perspective. -Use of Simulation in Nursing Education: Initial Experiences on a European Union Lifelong

				Learning Programme - Leonardo da Vinci Project. -What Do Nursing Students Learn About Patient Safety? An Integrative Literature Review. -Nurse competence of graduating nursing students. -Developing core skill of international nursing students through simulation in Finland. A literature review. -Emerging Skill Needs in Health Care and the Future of Nursing. -Analyzing Nursing Students' Relation to Electronic Health and Technology as Individuals and Students and in Their Future Career (the eNursEd Study): Protocol for a Longitudinal Study. -Nursing Students' Learning about an Empowering Discourse In Patient Education. -Disaster nursing: Self-reported competence of nursing students and registered nurses, with focus on their readiness to manage violence, serious events and disasters. -Multicultural Simulation scenarios for nursing education. -Experiential gaming to facilitate cultural awareness: its implication
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				for developing emotional caring in nursing. -Changes in Nursing Education in the European Union. -Effectiveness of the use of simulation training in healthcare education. -Nursing students' learning experiences through academic mobility in Finland and Spain. -The Process of Becoming Culturally Competent in Nursing: A Qualitative Study Among Swedish Nursing Students in Novia. -Current Trends in Vocational Training of Nurses and Health Needs of the Society. -Tracing the use of communication technology in Higher education: a literature review. -Using simulations and experiential learning approaches to train careers of seniors. -The Use of Simulation in Pre-Registration Nurse Education.
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APPENDIX 2

The descriptive table of the English written literature material.

Author(s), Year & Country	Purpose & Aim	Data collection & analysis method	Main findings
Alinier 2013 United Kingdom	To evaluate the effectiveness of simulation within healthcare education and develop a pilot programme to facilitate the use of realistic scenario-based simulation training.	Questionnaires were used for different aspects of the work, namely, to collect demographic information, to find out the randomized participants thoughts and anticipations about specific aspects of the OSCE based sessions, but also as an assessment strategy.	Realistic scenario-based simulations can improve students' psychomotor and cognitive skills. Uni-professional training should be administered before facing highly realistic or high fidelity interprofessional simulation sessions.
Anderberg, Björling, Stjernberg & Bohman 2019 Sweden	To explore students' knowledge related to technology and eHealth.	The study consists of two parts: a longitudinal study and a qualitative sub study. Questionnaire were distributed to all the undergraduate nursing students of two universities. The data collection will be repeated every year; at the start of the semester, each fall, for as long as the project is active, but at least for the minimum duration of 7 years.	The first results were expected to be published in 2019.
Bamidis, Antoniou & Sidiropoulos 2014 Greece	To build a tutoring virtual environment that can provide information and knowledge on a variety of healthcare education topics.	Usability and impact questionnaires regarding their initial impression from the DISCOVER approach. The additional data analysis was expected to be published on March 2014.	Combining different technologies with pedagogical approaches can be beneficial.
Bendzelova, 2014 Finland	To explore Telehealth interventions for depression treatment.	Qualitative literature review. 12 articles were chosen with inductive content analysis. No critical appraisal tools have been used.	Telehealth interventions can be effective in depression treatment.
Berndtsson, Karlsson & Rejnö 2019 Sweden	To examine nursing students' attitudes towards care of dying patients before and after a supplemental course in palliative care.	A descriptive study with a pre and post design. Data from 73 participants were collected before and after a palliative care course using FATCOD and qualitative open-ended questions. Data processed by descriptive and analytical statistics. The open-ended questions	A course in palliative care can help to change nursing students' attitudes towards dying patients and their relatives, in a positive direction.

		analysed by qualitative content analysis.	
Chemutai & Jepkemei Kirui 2017 Finland	To document the experience of the nursing students in a multicultural environment and enhance the nursing students' cultural competence skills.	Development was done by collecting nursing student's experiences about multicultural issues using questionnaires and by developing two simulation scenarios for simulation education. Data collection method used was qualitative analysis.	Culturally based simulation scenarios in nursing education can enhance the cultural competence of the students.
Dunkel 2019 Germany	To analyse the current nursing tasks, nursing knowledge and the relation between them. Also, to determine the future perspectives of European nursing.	The book consists of the papers which were peer reviewed and presented at the symposium.	The role of the nurses in Europe is changing as in accordance with the latest technological developments.
Elo 2017 Finland	To determine the requirements for an electronic nursing care plan application for students.	Qualitative literature review was used for overviewing the theoretical background. Software development and further prototyping of the latter followed.	The use of electronic documentation is fundamental for nowadays nurses, therefore their preparation must be adequate. The software can be implemented within nursing faculties.
Fawaz, Hamdan-Mansour & Tassi 2018 Lebanon / Jordan	To align nursing education with the modern technological practice environment and market demands.	Literature was collected on the base of inference to the addressed issues without any specified restriction. Article is a development project, not a research.	Nursing education is facing various challenges locally and globally, as well as it is exhibiting multiple facets of reformation.
Finotto, Carpanoni, Casadei Turrone, Camellini & Mecugni 2013 Italy	To describe the perception of newly graduated nurses concerning Evidence Base Practice.	A descriptive study with a sample of 300 newly graduated nurses. The data collection instrument was an anonymous questionnaire. It was possible to answer through a 10 Likert scale.	EBP competence is one of the core skills that all health professionals should develop and maintain throughout their career.
Garrow 2015 United Kingdom	To comprehend better different experiences and the related perceptions of simulation from the students' point of view.	A narrative review which articles have been evaluated with the CASP tools carried along with a qualitative case study that involved participants observation, recording, and interview. Four different models of simulation were involved.	Simulation may not be the optimum learning and teaching approach for all students and lacks national guidelines. The authenticity of the simulation may affect students' engagement and learning.

Georg & Zary 2014 Sweden	To develop and evaluate a virtual patient model for learning outcomes.	Review of the theoretical frameworks reported in the literature and used by practitioners when designing learning and assessment activities featuring the Outcome-Present State Test for the evaluation. Questionnaires were administered to the participants and the results analysed through descriptive statistics.	Virtual patients that are adapted to the nursing paradigm can support nursing students' development of clinical reasoning skills.
Graham & Richardson 2008 Australia	To further cultural awareness using games and simulations within nursing education.	A 3-year project where 24 exchange students from each side of the Atlantic (UK/USA) had placements on the opposite continent where they continued to record experiences in their reflective journal and, on their return, wrote an analysis of a critical incident involving a cultural encounter. Two specific games were used on-site for furthering the research.	Games and simulations can help students understand the discipline of nursing in a way that the usual methods of teaching do not.
Jalloh & Gichangi 2016 Finland	To improve the level of communication, critical thinking, and development of self-efficacy for international nursing students in Finland.	A literature review composed of 10 articles judged on the base of inductive content analysis. No critical appraisal tools used.	The students favour simulation experiences as they can prepare them better to face real scenarios.
Johnsen, Fossum, Vivekananda- Schmidt, Fruhlingc & Slettebøa 2018 United Kingdom	To assess nursing students' perceptions of a video-based serious game.	A pilot study was conducted concerning the implementation of a Serious Game prototype within two simulation courses in nursing education: one for home health care and one for hospital medical-surgical wards. A total of 249 second year nursing students participated. A paper-based survey was used to assess students' perceptions of the SG's educational value.	Serious games can be educationally valuable and potentially useful within nursing education.
Kajander- Unkuri 2015 Finland	To analyse the level of competence of graduating nursing students and the factors related to their preparation.	The study is divided in two phases: descriptive and evaluative. In the descriptive phase, a literature review was conducted in two sequential parts divided by time frames (1999-2012 & 2012-2014). In the evaluation phase the data were collected within 11 months and by online	Nurses need to develop self-assessment skills to ensure current and safe practice especially in the ever-changing health care. This skill must be developed during their education.

		questionnaire, all based on a cross-sectional survey design. The sampling was conducted on 302 graduating nursing students practising in their final clinical placement within 4 university hospitals.	
Konrad & Böhle 2019 Netherlands / Germany	To survey the socio-technical features of the innovation processes and their governance.	The article assembles twelve contributions that draw on several lines of research mobilizing concepts developed in science and technology studies.	When analysing the principles of innovation the most technical hypothesis must be also accounted for. The performativity of socio-technical imaginaries needs to be considered when studying the governance of innovation and transformation processes.
Lakanmaa 2012 Finland	To define the competence requirements in intensive and critical care nursing and develop the related assessment scale.	A wide range of materials and methods were used in the study: previously developed scales (BKAT-5 and 7, Toth 2012) and qualitative Delphi method; in addition, the scale was developed and tested. A literature review was also conducted for the basic exploration of competence. 45 empirical studies were analysed.	Intensive and critical care nursing competence is holistic and multidimensional.
McCutcheon, O'Halloran & Lohan 2018 United Kingdom	To analyse the effectiveness of a blended learning approach for undergraduate student nurses.	A post-test-only randomised controlled trial. Participants were a total of 122 pre-registration nurses enrolled at one United Kingdom university, randomly assigned to the online learning control group (n = 60) or the blended learning intervention group (n = 62).	Blended learning can be more beneficial than just online learning.
Nilsson, Johansson, Carlsson, Florin, Leksell, Lepp, Lindholm, Nordström, Theander, Wilde-Larson & Gardulf 2016	To measure the self-reported disaster nursing competence among nursing students and compare it with the one measured in the registered nurses.	A cross-sectional study was conducted of 569 NSs and 227 RNs. All respondents completed the 88-item Nurse Professional Competence Scale, including three items assessing DNC.	Workplace experience can effectively increase the readiness of registered nurses to handle critical scenarios.

Sweden / Norway / Japan			
Numminen 2010 Finland	To analyse nursing ethics education in accordance to the regulations of Finnish polytechnics.	The data collection was targeted to all polytechnics in Finland providing basic nursing education. A total of 183 educators and 214 students from 24 polytechnics participated. The data was collected using a structured questionnaire with four open-ended questions designed for this study, later it was analysed by SPSS (14.0) and the open-ended questions by inductive content analysis.	Ethical codes are an important element in nursing education; therefore their teaching needs development and further research is advised.
Partanen 2016 Finland	To define the user requirements and propose the basic design for the user interface of a virtual patient simulator.	Usability study and focus group interviews were used to find out the end users' preferences and desires. In total, only five possible end users participated in the research. The end users are clinicians with backgrounds in nursing. Further, focus groups were used for more thorough investigation on what the clinicians truly wanted in the software and what features would ease their work the most.	The user requirements and the user interface design have been respectively established.
Pekkarinen & Melkas 2019 Finland	To study the ongoing changes in elderly care within Finland.	Data acquisition was triangulated by administering interviews, questionnaires, focus groups, and observation.	Both customers and care workers may find it problematic to trust the technology or may have problems using it.
Pinto, Souza, Nogueira, Balula, Pedro, Pombo, Ramos & Moreira 2012. Portugal	To develop an online information visualization tool for the use of communication technologies	A literature review has been conducted but without any critical appraisal nor table of research. Search criteria are not clear.	Communication technologies are not exclusive to only one methodology but rather intertwined.
Ragneskog & Gerdner	To ascertain nursing students' and nursing	Data survey administration to 247 nursing students (45 of whom were registered nurses who	Nursing students must reinforce their IT skills.

2006 Sweden / USA	educators' self-reported attitudes, skills and experiences using IT.	participated in extension courses) and 52 staff members from the nursing faculty at a university in Sweden.	
Rantanen & Toikko 2017 Finland	To examine the healthcare workers' readiness to introduce technologies in substance abuse treatment and their attitudes towards its use.	The theoretical framework of this study is based on Ajzen's (1991, 2001) theory of planned behaviour, and the ongoing discussion about the adoption of new technology in healthcare. 129 questionnaires were administered within Finland.	Previous positive experiences with welfare technologies can help to introduce new technologies within the workplace.
Rea Cuan & Fagami 2018 Finland	To inquire about patient satisfaction with nursing care given by international Nurses, in Finland.	Data used in this study were collected from qualitative literature review to answer the research questions during the data collection process. The research materials were taken from scientific nursing journals where the authors have free access. No critical appraisal tools have been used.	Local patients are not as equally satisfied by foreign nurses as they could be from local ones.
Reierson, Solli & Bjørk 2015 Norway	To analyse the perspectives of undergraduate nursing students on telenursing after simulative effort.	An exploratory design using focus group interviews was performed; data were analysed using qualitative content analysis.	Delivering telenursing care is an important yet complex activity. Telenursing simulation should be integrated into undergraduate nursing education.
Risling 2015 Canada	To identify the future technological trends of nursing education.	Literature was collected on the base of inference to the addressed issues without any specified restriction. Article is a development project, not a research.	Much of the preparation for the next decade of nursing practice must be conducted as an investment and without the benefit of certainty for the results.
Salminen, Stolt, Saarikoski, Suikkala, Vaartio & Leino- Kilpi 2010 Finland	To identify selected future challenges for nursing education in Europe.	The article describes some main policy papers in the field of nursing education.	Multicultural collaboration, a better clinical learning environment, and teacher education will play a fundamental role in the future nursing education.
Sardi, Idri	To summarize the current knowledge regarding gamified e-	Of 562 initially gathered articles, 46 studies from multiple sources were	There is need for further empirical research to produce a valid evaluation.

& Fernández-Alemán 2017 Morocco / Spain	Health applications and their respective teaching strategies.	included in the systematic literature review.	
Snyder 2019 Norway	To provide an overview and guidelines on how to conduct a literature review.	The article discusses literature review as a methodology for conducting research and offers an overview of different types of reviews.	Literature reviews play an important role as the foundation for all types of research since they can serve as a basis for knowledge development.
Sterten & Ogorodnyk 2016 Norway	To evaluate the effects of the ambulance simulator, use for educational purposes, whilst also considering the cultural aspects.	The article describes development of a novel ambulance simulator implemented at the Nursing department at NTNU Gjøvik.	The implementation of the simulator can increase the practical knowledge and confidence of the future ambulance staff.
Stratoberdha Bardhi 2019 Finland	To explore the experiences of undergraduate nursing students before and during international academic mobility between Finland and Spain.	This study used the qualitative research method and was conducted in Finland and Spain. Eight participants are involved in the study.	More effective communication and agreements between universities can bring better learning outcomes, especially when this can be furthered to tear language barriers.
Tambe 2019 Finland	To analyse the process of becoming culturally competent in nursing among the Swedish speaking students in Finland.	The administration of an open-ended questionnaire within a sample of 20 participants among the 3 rd year nursing group of one university was selected for the study. A literature review was also conducted to support the theoretical part, but the research is exempt of a table and material has not been critically appraised.	To adapt to the needs of modern society nurses need to improve their cultural knowledge.
Tella, Liukka, Jamookeeah, Smith, Partanen & Turunen 2013 Finland	To critically analyse peer-reviewed studies focusing on patient safety in nursing education and to synthesize the findings.	An integrative literature review was conducted using the Whittemore's and Knaf's (2005) five stages as a framework for data collection. 44 articles were selected by the abstract, of which 20 qualified for critical evaluation.	Patient safety in the nursing curriculum requires a broad yet comprehensive approach and attention to its development.
Terzioglu, Tuna, Duygulu, Boztepe,	To share the insights about the European Union Lifelong Learning Programme Leonardo Da Vinci Transfer of Innovation	The project is divided into 7 work packages. Only the first 3 work packages have been assessed in the retrieved publication. Respectively, the three	Learning from experience is a fundamental part of nursing education, therefore simulations can pursued to further nurses education in a safe way.

Kapucu, Ozdemir Akdemir, Kocoglu, Alinier & Festini 2013 Turkey / UK / Italy	Project related to the use of simulation-based learning with nursing students from Turkey.	phases are: WP 1: Dissemination of the project results, Regulation of project management and, Identification of the needs of the target group. The third phase was conducted as a pilot study for testing the prepared simulation scenarios and data sheets for assessment.	
Tuhkala, Wagner, Iversen & Kärkkäinen 2019 Finland / Denmark	To consider the implementation of the new learning subject "Technology Comprehension" into lower secondary schools in Denmark.	Interviews, surveys, and questionnaires were administered to the educational staff of the 13 schools that agreed to join the project by answering the initial online survey.	The teaching of Technological Comprehension brings up both challenges and opportunities for the educational system.
Virtanen 2015 Finland	To strengthen the knowledge on empowering discourses and to develop a software simulation of the latter.	The theoretical knowledge was gathered through a systematic literature review with a meta-summary technique (n=15). The software was created based the description in 2006–2007. A descriptive comparative design was used to evaluate students' (n=69) process of learning empowering discourse using the computer simulation program and a pre-test–post-test design without a control group was used to evaluate students' (n=43) outcomes of learning.	An empowering discourse can be effective to increase patient education. The use of the computer simulation software can increase the students' knowledge on the topic.
Yoo 2013 South Korea	To address development of the technological outbreaks and how they have revolutionized our quality and way of life, especially within the healthcare field.	An open-access article, not a research.	Society has changed as according to the recent technological advancements, thus, also healthcare has joined this changed with positive remarks within the application of science for furthering its needs.
Zarzycka 2016 Poland	To indicate the directions of transformation in the training of nurses around the world, but with a specific focus for Poland.	The scientific article reviews the current training method of nurses concerning high-fidelity simulations.	The nowadays requirements set for the teaching system of nurses are constantly changing but high-fidelity simulations are an effective way of teaching.

APPENDIX 3

The descriptive table of the Finnish written literature material.

Author(s), Year	Purpose & Aim	Data collection & analysis method	Main findings
Eriksson, Korhonen, Merasto & Moisio 2015	To determine the EU minimum requirements for general care nurses, whilst defining its area of competence in the attempt of unifying local standards.	A literature review composed of 26 articles for the theoretical background, the administration of electronic 200 questionnaires and group focus evaluation. Feedback was provided by 31 area experts.	Universities of applied sciences are autonomous organizations and so can decide about the specific courses that nurses must further in their education, if this is conducted in harmony with the EU directives.
Kanervo 2018	To identify the issues in the field of assistive devices whilst providing further guidance for the future.	A qualitative Delphi study conducted by e-mail survey. 17 participants regarded as experts, with different professional backgrounds within the healthcare field.	The developments in assistive technology and new technological solutions require continuous competence development from experts.
Karlsson 2014	To find out the usability problems of the endoscopy simulator.	Three different testing methods: heuristic evaluation, usability testing as well as ergonomics research.	Despite the few encountered usability problems, the simulator user experience was still found to be very positive.
Mäki-Koivisto 2018	To investigate the nursing staff experience and competence within children hospital emergency room and overall expertise at using the related technological equipment.	The administration of electronic questionnaires and interviews to experts. 38 participants, response of 44,7%.	Nurses can use medical devices well, although, some of the devices require more training and instructions.
Ojanen 2019	To investigate the applicability of virtual reality simulation to current and future orientation processes at the Neurosurgical Unit of the HUS Töölö Hospital.	Semi-structured recorded interviews to 8 nurses (response rate 21%) and a virtual reality demonstration.	Virtual reality and other augmented Realities are eligible methods for increasing surgical theatre familiarization.
Salovaara-Hiltunen 2018	To produce an emergency scenario for a Virtual Reality simulation game and explore the user experience. Based on the gathered data, to promote the development of a simulation game.	13 subjects played the game 1-2 times in the presence of the researcher. The subjects were interviewed post user experience and the material processed by deductive content analysis.	Precedent gathered theoretical knowledge is supported by study results, but also new insights are gathered about virtual simulations.

APPENDIX 4

The summary table.

Includes description of the author(s), year, method, scale, and the verdict of the evaluation.

Legend: Yes (2), No (0) and Unclear (1).

Author(s) & Year	Method	Scale	Verdict
Alinier, 2013.	Qualitative Research	20/20	✓
Anderberg, Björling, Stjernberg, & Bohman, 2019.	Qualitative Research	14/20	✗
Bamidis, Antoniou, & Sidiropoulos, 2014.	Qualitative Research	16/20	✓
Bendzelova, 2014.	Qualitative Research	18/20	✓
Berndtsson, Karlsson & Rejnö, 2019.	Qualitative Research	20/20	✓
Chemutai & Jepkemei Kirui, 2017.	Qualitative Research	16/20	✓
Dunkel, 2019.	Text & Opinion	12/12	✓
Elo, 2017.	Qualitative Research	20/20	✓
Eriksson, Korhonen, Merasto & Moisio, 2015.	Qualitative Research	17/20	✓
Fawaz, Hamdan-Mansour & Tassi, 2018.	Text & Opinion	12/12	✗
Finotto, Carpanoni, Casadei Turrone, Camellini & Mecugni, 2013.	Qualitative Research	20/20	✓
Garrow, 2015.	Qualitative Research	20/20	✓
Georg & Zary, 2014.	Qualitative Research	18/20	✓
Graham & Richardson, 2008.	Qualitative Research	14/20	✓
Jalloh & Gichangi, 2016.	Qualitative Research	15/20	✓
Johnsen, Fossum, Vivekananda-Schmidt, Fruhlingc & Slettebøa, 2018.	Qualitative Research	16/20	✓
Kajander-Unkuri, 2015.	Qualitative Research	19/20	✓
Kanervo, 2018.	Qualitative Research	20/20	✓
Karlsson, 2014.	Qualitative Research	15/20	✓
Kihnula, 2017.	Qualitative Research	18/20	✓
Konrad & Böhle, 2019.	Text & Opinion	12/12	✓
Lakanmaa, 2012.	Qualitative Research	20/20	✓
Mäki-Koivisto, 2018.	Qualitative Research	20/20	✓
McCutcheon, O'Halloran & Lohan, 2018.	Randomized Controlled Trial	22/26	✓

Nilsson, Johansson, Carlsson, Florin, Leksell, Lepp, Lindholm, Nordström, Theander, Wilde-Larsson & Gardulf, 2016.	Analytical Cross Sectional Study	14/16	✓
Numminen, 2010.	Qualitative Research	16/20	✓
Ojanen, 2019.	Qualitative Research	20/20	✓
Partanen, 2016.	Qualitative Research	11/20	✗
Pekkarinen & Melkas, 2019.	Qualitative Research	20/20	✓
Pinto, Souza, Nogueira, Balula, Pedro, Pombo, Ramos, & Moreira, 2012.	Qualitative Research	10/20	✗
Ragneskog & Gerdner, 2006.	Qualitative Research	16/20	✓
Rantanen & Toikko, 2017.	Qualitative Research	18/20	✓
Rea Cuan & Fagami, 2018.	Qualitative Research	14/20	✗
Reiersen, Solli & Bjørk, 2015.	Qualitative Research	20/20	✓
Risling, 2015.	Text & Opinion	12/12	✓
Salminen, Stolt, Saarikoski, Suikkala, Vaartio, & Leino-Kilpi, 2010.	Text & Opinion	12/12	✓
Salovaara-Hiltunen, 2018.	Qualitative Research	20/20	✓
Sardi, Idri & Fernández-Alemán, 2017.	Systematic Review	22/22	✓
Snyder, 2019.	Text & Opinion	12/12	✓
Sterten & Ogorodnyk, 2016.	Text & Opinion	12/12	✓
Stratoberdha Bardhi, 2019.	Qualitative Research	17/20	✓
Tambe, 2019.	Qualitative Research	9/20	✗
Tella, Liukka, Jamookeeah, Smith, Partanen & Turunen, 2013.	Qualitative Research	20/20	✓
Terzioglu, Tuna, Duygulu, Boztepe, Kapucu, Ozdemir, Akdemir, Kocoglu, Alinier, & Festini, 2013.	Qualitative Research	15/20	✗
Tuhkala, Wagner, Iversen & Kärkkäinen, 2019.	Qualitative Research	20/20	✓
Virtanen, 2015.	Qualitative Research	20/20	✓
Wang, Wang, Ren & Wang, 2018.	Qualitative Research	13/20	✗
Yoo, 2013.	Text & Opinion	12/12	✓
Zarzycka, 2016.	Text & Opinion	12/12	✓

The agreement on the preparation of a Thesis.

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Author of thesis: Valerio Radicchi & Elizaveta Kempí	
Student number: 1702019	Group in which studies were started: NNU17SPB
Degree programme: Nursing	
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Client, name of contact person, email address, telephone number, address and Business ID : SAMK	
Title of thesis: LITERATURE REVIEW: TECHNOLOGIES IN NURSING EDUCATION IN EUROPE.	
Scheduled progress of thesis: Plan Approved	
The agreement is based on an approved research plan.	
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We have read the Terms (page 2) and accepted them.	
Date: 27/03/2020	
Signature of the client's representative, title and clarification of name: <i>Maurit Häyryne</i>	
Signature of Dean and clarification of name: <i>Taina Savola</i> Taina Savola (1. huhtikuuta 2020)	
Signature of the supervising teacher: <i>Anu Elo</i> Anu Elo (31. maaliskuuta 2020)	
Signature of the author: <i>Valerio Radicchi</i>  Elizaveta Kempí (30. maaliskuuta 2020)	

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