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YLIOPISTO**
UNIVERSITY
OF TURKU

THE PERCEPTION OF THE NURSING PROFESSION AMONG NURSING APPLICANTS

Assessment and promotion of the perception
using a 360° virtual learning environment

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The originality of this publication has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

ISBN 978-951-29-9981-1 (PRINT)
ISBN 978-951-29-9982-8 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
Painosalama, Turku, Finland 2024

“Älä ajattele, että elämä on lyhyt. Ajattele: Miten erikoinen kokemus. Kun siinä ei ole kysymys pituudesta lainkaan, vaan että on ylipäättänsä saanut kokea tämän.”
(Eeva Kilpi, 1982)

UNIVERSITY OF TURKU

Faculty of Medicine

Department of Nursing Science

Nursing Science

NIINA GLERAN: The perception of the nursing profession among nursing applicants – Assessment and promotion of the perception using 360° virtual learning environment

Doctoral Dissertation, 178 pp.

Doctoral Programme in Nursing Science

November 2024

ABSTRACT

Perception of the nursing profession influence the career choice in nursing profession. The purpose of the study was I) to develop a theoretical base for the perception of the nursing profession, II) to develop and psychometrically test the Perception of Nursing Profession Instrument to measure the perception of the nursing profession among nursing applicants in an entrance examination setting, and to develop a 360° virtual learning environment to provide correct information about the nursing profession to nursing applicants, and III) to evaluate the effectiveness of the 360° virtual learning environment on nursing applicants' perception of the nursing profession and evaluate the usability of the 360° virtual learning environment.

In phase I), an integrative literature review (n = 8), three focus group interviews with nursing applicants (n = 18) and a content analysis of the national documents regulating nursing education (n = 6) were conducted. Finally, a synthesis of the sub-phases' results was carried out to describe the perception of the nursing profession. In phase II), the Perception of Nursing Instrument was developed. The psychometric properties of the instrument were tested in a cross-sectional study among (n = 1115) nursing applicants. In addition, the 360° virtual learning environment was developed. In phase III), a quasi-experimental study design was used as a part of national entrance examination to nursing education to investigate the effect of the use of 360° virtual learning environment on the nursing applicants' perception of the nursing profession.

The perception of the nursing profession consisted of the content of nursing work, the nature of the nursing work, career in nursing, and characteristics of a nurse. The Perception of Nursing Profession Instrument demonstrated preliminary validity and reliability, although, the difficulty level of the items must be enhanced to improve the measurement accuracy. The use of a 360° virtual learning environment had an effect on nursing applicants' correct perception of the nursing profession and the usability of the 360° virtual learning environment was evaluated as good. The results of this study can be used to promote the career choices in nursing profession. Further intervention studies are needed to find effective strategies for influencing nursing applicants' perception of the nursing profession.

KEYWORDS: 360°, a nurse, nursing education, nursing profession, perception, intervention study, student selection, test development

TURUN YLIOPISTO

Lääketieteellinen tiedekunta

Hoitotieteen laitos

Hoitotiede

NIINA GLEREAAN: Sairaanhoidajaksi pyrkivien käsitys sairaanhoidajan ammatista – Käsityksen arviointi ja edistäminen 360° virtuaalisen oppimisympäristön avulla

Väitöskirja, 178 s.

Hoitotieteen tohtoriohjelma

Marraskuu 2024

TIIVISTELMÄ

Käsitys sairaanhoidajan ammatista vaikuttaa uravalintaan sairaanhoidajaksi. Tämän tutkimuksen tarkoituksena oli I) kehittää teoreettinen viitekehys käsitykselle sairaanhoidajan ammatista, II) kehittää ja psykometrisesti testata mittari, joka mittaa sairaanhoidajakoulutukseen pyrkivien käsitystä sairaanhoidajan ammatista osana sairaanhoidajakoulutuksen valintakoetta sekä kehittää 360°virtuaalinen oppimisympäristö, joka antaa oikeaa tietoa sairaanhoidajan ammatista sekä III) arvioida 360° virtuaalisen oppimisympäristön käytön vaikutusta sairaanhoidajakoulutukseen pyrkivien käsitykseen sairaanhoidajan ammatista sekä arvioida oppimisympäristön käytettävyyttä.

Ensimmäisessä vaiheessa toteutettiin integroiva kirjallisuuskatsaus ($n = 8$), kolme fokusryhmähaastattelua ($n=18$) sekä sisällönanalyysi sairaanhoidajakoulutusta säätelevistä kansallisista dokumenteista ($n = 6$). Osatutkimusten tuloksista tehtiin synteesi, joka on teoreettinen viitekehys käsitykselle sairaanhoidajan ammatista. Toisessa vaiheessa kehitettiin Käsitys sairaanhoidajan ammatista -mittari. Mittarin psykometrisiä ominaisuuksia tarkasteltiin poikkileikkaustutkimuksessa, johon osallistui 1115 sairaanhoidajakoulutukseen pyrkivää. Tämän lisäksi kehitettiin 360° virtuaalinen oppimisympäristö. Kolmannessa vaiheessa tutkittiin kvasikokeellisella tutkimusasetelmalla 360°virtuaalisen oppimisympäristön käytön vaikutusta sairaanhoidajakoulutukseen pyrkijöiden ($n = 1115$) käsityksiin sairaanhoidajan ammatista sekä arvioitiin 360°virtuaalisen oppimisympäristön käytettävyyttä.

Käsitys sairaanhoidajan ammatista koostui sairaanhoidajan työn sisällöstä, sairaanhoidajan työn luonteesta, sairaanhoidajan urasta sekä sairaanhoidajan ominaisuuksista. Käsitys sairaanhoidajan ammatista -mittari osoitti alustavaa luotettavuutta, mutta väittämien vaikeustasoa tulee jatkossa kehittää. 360° virtuaalisen oppimisympäristön käyttö vaikutti sairaanhoidajakoulutukseen pyrkivien oikeaan käsitykseen sairaanhoidajan ammatista ja sen käytettävyyden arviointiin hyväksi. Tutkimuksen tuloksia voidaan hyödyntää uravalintojen tukemisessa. Jatkossa tarvitaan lisää interventiotutkimuksia, jotta löydetään tehokkaita keinoja vaikuttaa sairaanhoidajakoulutukseen pyrkivien käsityksiin sairaanhoidajan ammatista.

AVAINSANAT: 360°, sairaanhoidaja, sairaanhoidajakoulutus, sairaanhoidajan ammatti, käsitys, interventiotutkimus, opiskelijavalinta, testin kehittäminen

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Abbreviations

AACN	American Association of Colleges of Nurses
ANA	American Nurses Association
ECTS	European Credit Transfer and Accumulation System
EFN	European Federation of Nurses
EHEA	European Higher Education Area
EU	European Union
GPA	Grade Point Average
HEI	Higher Education Institution
HDM	Head-Mounted Display
ICN	International Council of Nursing
IRT	Item Response Theory
I-CVI	Item level Content Validity Index
JBI	Joanna Briggs Institute
OECD	Organisation for Economic Co-operation and Development
PCM	Partial Credit Model
PNPI ₁	Perception of Nursing Profession Instrument – the first version
PNPI ₂	Perception of Nursing Profession Instrument – the second version
P-SUS	Positive System Usability Scale
RCN	Royal College of Nurses
ReSSNE	Reforming Student Selection in Nursing Education Project
SUS	System Usability Scale
TEAS	Test of Essential Academic Skills
UAS	University of Applied Science
VLE	Virtual Learning Environment
VR	Virtual Reality
WHO	World Health Organisation

List of Original Publications

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals:

- I Glerean, N., Hupli, M., Talman, K., & Haavisto, E. Young peoples' perceptions of the nursing profession: An integrative review. *Nurse Education Today*, 2017, 57, 95–102.
- II Glerean, N., Hupli, M., Talman, K., & Haavisto, E. Perception of nursing profession – focus group interview among applicants to nursing education. *Scandinavian journal of caring sciences*, 2019, 33(2), 390–399.
- III Glerean, N., Talman, K., Glerean, E., Hupli, M., & Haavisto, E. Development and psychometric testing of the perception of nursing profession instrument. *Journal of advanced nursing*, 2023, 79(10), 4074–4087.
- IV Glerean, N., Talman, K., Glerean, E., Hupli, M., & Haavisto, E. Promotion of correct perception of the nursing profession via a 360° virtual learning environment: Quasi-experimental intervention study. Manuscript.

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1 Introduction

Nurses form more than a half of the health professionals. Nurses are the backbone of the healthcare systems; they provide evidence-based care, and they have an essential role in maintaining and improving population health, and they contribute to health policy (World Health Organisation WHO, 2020). Nurses enhance patient safety in healthcare (Amiri et al., 2019) and prevent and control infections (Burnett, 2018). Nurses improve the access to health care, and they have a key role in health promotion, preventing and treating illnesses and in guidance of patients with chronic diseases such as diabetes, cardiovascular diseases, and cancer (Norful et al., 2017). Nurses support patients in their health behaviour and work as a patient's advocator (Gomez Del Pulgar et al., 2022). Nurses work in emergency situations, epidemic outbreaks, disasters, and humanitarian crises. They are integral part of security of supply in public emergency conditions as seen during the Covid-19 outbreak and currently in warzones in Ukraine and in Gaza. (Fink, 2023; Reynolds, 2022;)

Global nursing workforce consists of 27,9 million nurses, and from which 69% 19,3 million are professional registered nurses. Most of the nurses are females (89%), and the workforce is relatively young (38% are less than 35 years, 17% are 55 years or over). Most of the nurses (81 %) work in Americas, Europe and in Western Pacific, and there is variation in the number of nurses between the countries and regions. (WHO, 2020.) For example, in Turkey, there are approximately three nurses per 1000 persons, while in Finland and in Norway, the number of nurses is over 18 per 1000 persons (Organisation for Economic Co-operation and Development OECD, 2023). In Europe, there are 4.45 million nurses, and the number of nurses has been increasing in most of the European countries in the past years (Eurostat, 2020). The increase is mostly due to increased number or nursing education enrolments, investments in increasing the number of nursing associate professionals, who have lower qualification than registered nurses, and recruitment of foreign trained nurses (OECD, 2023). In Finland, registered nurses constitute the second largest group of health professionals, following practical nurses, who are the largest group with 79, 776 individuals in practice (Keva, 2023). Nursing workforce consists of 63, 750 registered nurses. Most of the nurses are women (91 %) and the biggest age group in 2021 was nurses who were 36–55 years old. Nurses work as registered

nurses (85%, including paramedics), public health nurses (12%) and as midwives (3%). Nurses work in different areas including primary care, special medical care, community care, and telehealth services/telemedicine. The number of foreign nurses is low (4% in 2021) (Finnish Nurses Association, 2023).

Shortage of nurses is a global health emergency, which threatens the health and wellbeing of the societies (Buchan et al., 2022). Before the Covid-19 pandemic, the shortage of nurses was estimated at 5.9 million by the year 2030 (WHO, 2020) and the shortage of nurses has increased rapidly due to the pandemic (Buchan et al., 2022). In Finland, estimates of the nursing shortage vary. In 2023, Keva reported that the shortage of nurses is 16, 657 nurses. In 2024, the Ministry of Social Affairs and Health made a new estimate, in which, the shortage was 5,336 nurses. Both estimates underline that the shortage of nurses has worsened rapidly in recent years (Ministry of Social Affairs and Health, 2023).

As a one solution to the shortage of nurses, countries should invest in making the nursing profession more attractive to young people (WHO, 2020). Young people's interest in nursing is important, because it influences the nations' supply of nurses (AACN, 2024). Unfortunately, the attractiveness of the nursing profession among 15 years old young people has decreased (OECD, 2024). Similarly, the amount of the nursing applicants has gone down in many countries, and dropout rates have been an international concern (Canzan et al., 2022; Chan et al., 2019). For example, in United States the number of nursing applicants went down 1,4% in 2021-2022 (American Association of Colleges of Nurses AACN, 2023), and in UK the drop was 26 % in 2023 (RCN, 2024). In Finland, the number of primary nursing applicants has gone down as well. In 2016, there were 17, 779 nursing applicants to Finnish nursing education, and in 2023, there was only 14, 361 nursing applicants (Vipunen Education Statics, 2023). In addition, the dropout rate in nursing education is estimated as 9% (Kukkonen, 2016). As a response to the nursing shortage, the Finnish Governments have increased the funding to selected Universities of Applied Sciences' (UAS) to educate more nurses (e.g., Ministry of Education and Culture, 2024; Ministry of Education and Culture, 2022) which has led to UASs selecting more nursing applicants, from a smaller pool of nursing applicants. While increasing the number of the nursing students is a temporary solution to the shortage of nurses (Finnish Nurses Association, 2023), understanding the current perception of the nursing profession among young people is crucial for effective recruitment and retention.

Perception can be defined as a mental notion or idea of something, or the knowledge acquired through the process of coming to know something, the way how something is understood (Merriam-Webster, 2024). Perception of the nursing profession is connected to selecting the career in nursing (Başkale and Serçekuş, 2015; Prosen, 2022). Correct perception of the profession is also connected to the

satisfaction towards the career choice. (Sand-Jecklin, 2006.) Misperception of the profession might lead to wrong career choices, and attrition from the studies (Smith-Wacholz et al. 2019) or from the nursing field (O'Donnell, 2011). Misperceptions of nursing does not attract people to apply to nursing (Grainger and Bolan, 2006; Liaw, 2016). Moreover, misperception of the nursing profession narrows the pool of nursing applicants while the aim is to increase the diversity and the number of practising nurses in the profession (WHO, 2020).

Correct perception of the profession prevents nursing student's attrition from the nursing education. Mismatch between the idea of the nursing profession, and the reality can lead to drop out from nursing education (Canzan et al., 2022). The difference between the perception and reality can contribute to the high attrition rates (Smith-Wacholz et al., 2019). In addition, misperceptions of the nursing profession have been also connected to transition shock, (Duchscher, 2018), primarily called as reality shock (Kramer, 1974), in which, the newly graduated nurses are challenged with their expectations, and the reality of the nurses' role in the practice (Graf et al., 2020).

Reforming Student Selection in Nursing Education (ReSSNE, 2015–2021) was a national project, which aimed to harmonise the student selection in nursing education. The project aimed to develop student selection methods, which are, valid, objective, cost effective and evidence-based. The project suggested incorporating the measurement of nursing applicants' perception of the nursing profession at the entrance examination to select nursing applicants with correct perception of the profession. ReSSNE project suggested that assessing the perception at the application stage could lead to better retention in nursing education and in nursing profession. In the ReSSNE project, content, and structure for entrance examination for nursing education was developed and it was conducted in UAS participating the ReSSNE project. The entrance exam assessed applicant learning skills (mathematical skills, language skills and reasoning skills), emotional intelligence and the certainty of the career choice (desire to work as a nurse, perception of nursing profession) (Haavisto et al., 2019).

This study was conducted in collaboration with the ReSSNE project. In this study the perception of young people and nursing applicants was investigated. Based on the findings, this study provided the Perception of Nursing Profession Instrument (PNPI₂) to measure nursing applicants' perception of the nursing profession in the entrance examination setting. In addition, this study provided a 360° virtual learning environment (360°VLE) to promote correct information about nursing profession to nursing applicants. The purpose of this three-phase study was to develop a theoretical base for the perception of the nursing profession, to develop and psychometrically test the PNPI₂ instrument to measure the perception of nursing profession in the entrance exam setting, and to develop the 360°VLE intervention to share correct

information about nursing profession to nursing applicants, and finally, to evaluate the effect of the 360°VLE of the nursing applicants' perception of the nursing profession and to evaluate the usability of the 360°VLE.

2 Review of the Literature

This chapter describes the theoretical background of the study to provide an overview of the phenomena, and to introduce the concepts related to the study. The theoretical background consists of three parts. The first part describes the nursing profession, nursing education and student selection in nursing education based on the existing literature. The second part describes the concept of perception and presents how the perception of nursing profession has been assessed and promoted according to the past literature. The last part describes the virtual learning environment.

2.1 Nursing profession and nursing education

2.1.1 A nurse and nursing profession

A nurse is a person whose work is to care for ill or injured people, especially in hospital environment (Merriam-Webster, 2024; Oxford Dictionary, 2024). A nurse is a licensed and registered health care professional who promotes and maintains health and who practices independently or under the supervision of physician (Merriam-Webster, 2023). The International Council of Nurses (ICN) defines a nurse as a person who has a nurse qualification and is authorised by a regulatory body to practice nursing. Furthermore, a registered nurse is a person, who fulfils the legal, educational, and administrative requirements to work as a nurse and has been authorised to practice nursing in their country (ICN, 1987; WHO, 2020).

Globally, there are multiple pathways becoming a registered nurse. In United States (US), for example, a person must have a diploma in nursing (two to three years of training in hospital-based nursing schools), associate degree in nursing (ADL, two-year degree) or a bachelor's degree in nursing (BSN, four-year degree in college or university), pass the National Council Licensure Examination for Registered Nurses (NCLEX) and obtain a nursing licence from the state (American Nurses Association (ANA), 2024).

In Europe, a registered nurse most commonly refers to a person, who has completed minimum of three years of nursing studies approved by a nursing board

or council, has passed the required assessment, and is qualified and authorised to work as a nurse in their own country (European Federation of Nurses EFN, 2015). In addition, European union directives 2013/55/EU and 2005/36/EU (The European Parliament and the Council of the European Union, 2005, 2013) sets standards for registered nurses' education in the European context.

In the Finnish context, a nurse is *hoitaja*, and the word refers to the person who provides nursing care (Kielitoimiston sanakirja, 2022). A registered nurse is "sairaanhoitaja" and it refers to a person, who has a bachelor level nursing education (three and a half years), and who has been licensed by the Valvira National Supervisory Authority for Welfare and Health and registered to the Central Register to Health Care Professionals. Finland follows the European Union directives 2013/55/EU and 2005/36/EU (The European Parliament and the council of the European Union, 2005, 2013). Nationally, nursing is also regulated in the guidelines of Ministry of Education's and Culture and in national legislation (e.g., the Act on Health Care Professionals (559/1994) and the Decree on Health Care Professionals). A Registered nurse is a protected professional title, and only licensed persons with a nursing qualification and adequate language skills may work as a registered nurse in Finland. The licensure is granted by Valvira the National Supervisory Authority for Welfare and Health.

Nursing refers to the duties of nurses, or to the nursing profession (Merriam-Webster, 2023). Historically, nursing theorists have defined nursing through the duties of nurses. According to the Florence Nightingale, nurse's duty was "put the patient in the best condition for a nature to act upon them" (Nightingale, 1860). In addition, Virginia Henderson's (1964) defined nursing as "assisting individuals, sick or well, to perform of those activities which they would perform unaided if they had the strength, will or knowledge, and to do this in such a way to achieve independence as rapidly as possible". Over the years, the definitions of nursing have changed and expanded as nursing has changed (Mottian et al., 2022). More recent definitions are those of the professional organisations such as ICN's definition of nursing. ICN defines nursing as the collaborative care of individuals in all ages, groups, and communities in a variety of settings. Nursing includes health promotion, disease prevention and the care of the sick, disabled and dying people at all ages and in all care settings. Nursing is the autonomous work of nursing professionals. Nursing professionals work as patients' advocates, and they are responsible for promoting a safe care environment. Nursing professionals work in multi-professional teams and they are responsible for health care teaching. Nurses guide and support other nurses and other health professionals, and they are involved in research, healthcare system management and health policy (ICN, 1987, 2002).

National professional nursing organisations follow the ICN's definition of nursing. The American Association of Colleges of Nursing (AACN) defines nursing

as protection, promotion and optimisation of health and functioning; the prevention of illness and injury; the alleviation of suffering through the diagnosis and treatment of human response; and advocacy in the care of individuals, families and communities, and populations. In the UK, the Royal College of Nursing (RCN) recently updated its definition of nursing to describe the complex demands of modern nursing. According to the RCN's definition "nursing is a safety critical profession based on four pillar: clinical practice, education, research, and leadership. Evidence-based knowledge and clinical judgement are used to assess, plan, implement and evaluate high quality, person-centred nursing care" (RCN, 2023). In addition, also ICN (2024) has announced that ICN's new modernised definition for nursing will be ratified and published in ICN's council meeting in Helsinki in 2025.

Profession refers to work that requires special type of skill, training, and a high level of education, usually involving mental rather than manual work (Cambridge Dictionary, 2024b). The member of the profession is called as professional, which refers to expertise, ethics, trust (Australian Council of Professions, 2023). There are several criteria for a profession in the literature, although there is no complete consensus of the exact definition and attributes of the profession (Liaschenko and Peter, 2004). For example Bixler and Bixler (1945) defines the criteria for the profession as follows: The profession uses special body of knowledge, the knowledge is disseminated through education and developed by scientific methods, education is provided at a higher level in institutions of higher education, the knowledge is applied for practical human and social welfare issues, the profession functions as an autonomously and formulates professional policy and controls the professional activity, attracts intellectual individuals who place service above personal gain, offers members opportunities for professional growth and economic security.

In the nursing science, the profession can be defined using Kelly's (1981) criteria. According to the criteria, the service of the profession is vital to society, the profession has a special body of knowledge, the profession requires intellectual activities, the profession is autonomous, the members are committed to the profession, ethical guidelines guide the decisions, and the profession is organized in professional organisations. Members are educated in higher education institutions (HEIs). In addition, the education is controlled, and members of the profession have an own registration system.

Nursing profession meets the criteria set for a profession as nurses provide a vital service to the society and this service is essential to the wellbeing of individuals. Nursing is an academic discipline with specialised knowledge (McEwen and Wills, 2018) and the nursing profession is based on systematic evidence, which is derived from systematic research (Stolley et al., 2000). Nursing requires cognitive and intellectual activities, critical thinking and decision-making (O'Connor et al., 2023),

creativity (Cheraghi et al., 2021) and nurses are accountable for their actions. Nurses are independent professionals and have professional autonomy of their own profession (ICN, 1987; ICN, 2021). They are committed to the profession, and they become familiar with their professional role and responsibilities through a professionalization process, and they adapt the professional identity (Douglass, 2024). A code of ethics for nurses defines and guides ethical nursing practice, and nurses behaviour in the society (ICN, 2021). Nursing education is mostly offered in higher education institutes at a bachelor-, master- and doctoral level (WHO, 2020).

2.1.2 Nursing education

Nursing education has an important role to play in developing skilled workforce capable of meeting and addressing the complex health needs of the population (WHO, 2020). The health needs of the population must be met in terms of quality and quantity, and in distribution of workforce. An educated nursing workforce is associated with better health outcomes (Aiken, 2017). Nursing education must continually adapt and evolve to meet the needs of the changing health care environment and evolving profession (Jager et al., 2020). In addition, nursing education institutions need to increase the number of nursing students and attract an increasing number of nursing applicants to meet the growing demand of nursing professionals due to the global nursing shortage (Mooring, 2016) because healthcare systems will not function without an adequate number of nurses (Adhikari and Smith, 2023).

Globally, there are differences in the structure, content, duration, and level of the nursing education between countries, and within a single country. The length of the nursing education varies from two to four years, and the average length of the nursing education is three years. In addition, nursing education is offered at the certificate level, at the diploma level in training institutions or in vocational schools, and at the bachelor level in higher education institutions (WHO, 2020). Nursing education has evolved in many countries from vocational training to an academic bachelor level degree (Collins and Hewer, 2014) following the recommendations of the WHO (2020b) and professional nursing organisations (AACN, 2024; EFN, 2017). Educating nurses at bachelor level is important because it improves health outcomes for patients (AACN, 2024; Aiken et al., 2017), makes the nursing education comparable between the countries (Collins and Hewer, 2014).

In United States, the nursing education has developed from hospital-based training schools to structured and standardised nursing education programs. Nursing education is regulated by the 50 states, not by the national government. Nursing schools must be accepted by the state, and they can apply for accreditation from non-governmental organisations (The National League for Nursing Accrediting

Commission NLNAC or The Commission on Collegiate Nursing Education CCNE) to prove that the nursing program meets the quality standards for the education (LaRocco, 2010). In US, there are several educational programs for nurses. Diploma programs are typically three years programs, associate degree nursing programs are maximum two years (18 months to two years). Baccalaureate entry programs offers Bachelor of nursing degree, which lasts four years. (Morris et al., 2019.)

In Europe, nursing education has been strongly influenced by the educational reforms that have harmonised the higher education over the past decades. One of the most important reforms in higher education has been The Bologna Process. The Bologna Process introduced new educational structure (Bachelor, Master, Doctorate) and a common system for credits (ECTS, European credit Transfer and Accumulation System, 1 credit consists of 27 hours of student work). (Humar and Sansoni, 2017). It also created European Higher Education Area (EHEA), which was formed to ensure comparable, compatible, and coherent higher education across the 48 member countries (EHEA, 2024).

Furthermore, nursing education in Europe is regulated by European directives 2005/36/EU and 2013/55/EU, which aim to recognise of professional qualifications in the European Union (EU) to facilitate the free movement of EU citizens. In addition, European Directives 2005/36/EC and 2013/55/EU set the minimum criteria for nursing education in European Union member states in terms of admission, provision of the education and the content of the education. According to the directives (Finnish nursing education follows the European Union directives 2013/55/EU and 2005/36/EU), the minimum duration of the nursing education is three years, and it must include 4600 hours (180 ECTS) of teaching from which 90 ECTS must be spent in clinical practice in the following nursing environments: general and specialist medicine, general and specialist surgery, childcare and paediatrics, maternity care, mental health and psychiatry, geriatric care and home care (2005/36/EC). According to the European Federation of Nurses (EFN, 2015) European nurses must gain competence during their education from 1) culture, ethics, and values 2) health promotion and prevention, 3) guidance and teaching, 4) decision making, 5) communication and teamwork, 6) research, development, and leadership and 7) nursing care.

In Finland, nursing education is regulated by Universities of Applied Sciences Act (932/2014), the Government Decree on Universities of Applied Sciences (1129/2014) and Health Care Professionals Act (559/1994). In addition, education is also regulated by the Ministry of Education and Culture, which provides funding and monitors the education at national level. In Finland, nursing education is offered in UAS and there are currently 21 UAS offering nursing education (Vipunen Education Statistics, 2024a). UASs provide pragmatic higher education based on the needs of the working life. UASs conduct applied research, development and innovation

activities and regional development. UAS are autonomous organisations, and they have freedom to decide about their education and research (Universities of Applied Sciences Act 932/2014).

Nursing education in Finland is at bachelor's level and consists of 210 European Credit Transfer and Accumulation System (ECTS) and it takes on average three and a half years to complete. In addition, 180 ECTSs consists of the general nurse core competencies, and the rest, 30 ECTSs, are selective studies. In addition, nursing education includes 90 ECTS of clinical training, thesis (15 ECTS) and theoretical studies (Silén-Lipponen and Korhonen, 2020), which includes for example, lectures, nursing skills training, simulations, and online studies. The education is provided in daytime studies and multiform learning (Opintopolku, 2024).

There are differences in the nursing education curricula between the UAS's, although, there has been also attempts to harmonise the national core competencies for nurses. The core competencies have been described for example by the Ministry of Education and Culture (2006), The Future of Nursing education project (Eriksson et al., 2015) and in the YleSHarviointi project. According to the YleSHarviointi, the core competence areas for nurse are the following: 1) professionalism and ethics, 2) client-centred care, 3) communication and multi-professionalism, 4) health promotion, 5) leadership and professional cooperation skills of employee, 6) information technology and documentation, 7) guidance and education competence and supporting self-care, 8) clinical nursing, 9) evidence-based practice, 10) utilization of research knowledge and decision making, 11) entrepreneurship and development, 12) quality management, 13) service system of health care and social welfare services, 14) patient and client safety (Silén-Lipponen and Korhonen, 2020).

2.1.3 Student selection in nursing education

Student selection is the process by which an educational institution selects students for the education (Talman, 2014) from a larger pool of applicants for a limited number of study places (Capponi and Mason Barber, 2020). Student selection in nursing education should be transparent, fair and the process of student selection should be clearly described. Assessment methods in nursing education should be valid and reliable (WHO, 2009). Evidence is needed to be able to recognize the best methods and contents to select students within the group of nursing applicants (Capponi and Mason Barber, 2020; Haavisto et al., 2019; Talman et al., 2018).

Globally, student selection practices vary between countries (Humar and Sansoni, 2017), and there are no global standards, regulations, or consensus on the methods that should be used for student selection for nursing education (Capponi and Mason Barber, 2020). In Europe, student selection for nursing education is lightly regulated, and EU countries follow the eligibility criteria for admission for bachelor level

studies. To be eligible for the bachelor level education, the applicant must have completed 12 years of general education in high school or in vocational school (The European Parliament and the Council of the European Union, 2013).

An applicant refers to the person who applies to the education. Usually, higher HEIs are responsible for deciding their admission criteria and selecting the students according to national laws and regulations. (Talman, 2014.) Some countries, for example UK, follow the national nursing organisations recommendations for student selection (NMC, 2023). Student selection is a challenging task for HEIs. They have to decide about the admission criteria and predict the possibility of each nursing applicants to succeed in their studies. In addition, HEIs must select students who are motivated and suitable for the profession (Haavisto et al., 2019; Timer and Clauson, 2011; Traynor et al., 2022).

Variety of contents and methods are used to select students for nursing education, and the evidence of the relevant selection methods is scarce in the literature, and it is unclear, which selection methods are the most effective (Crawford et al., 2021, Taylor, 2014). Traditionally, nursing applicants' cognitive and non-cognitive attributes have been assessed as a part of student selection. Academic-cognitive skills typically include, for example, mathematical skills, language, and reasoning skills (Zamanzadeh et al., 2020) or previous academic performance (Crawford et al., 2021; Zamanzadeh et al., 2020). Non-cognitive competencies typically include e.g., communication skills, teamwork skills or evaluation of emotional intelligence (Capponi and Mason Barber, 2020).

Furthermore, the methods used to select nursing students are varying, and common selection methods are the evaluation of the academic performance (e.g., assessment of Grade Point Average (GPA), prior academic achievement in science (Capponi and Mason Baber, 2020; Crawford et al., 2021) or using on admission tests, which can be for example standardised tests (e.g., TEAS: Test of Essential Academic Skills). Non-cognitive screening methods used are, for example, interviews, personal statements, resumes and references and previous healthcare experience (Crawford et al., 2021).

Assessment of the nursing applicants' GPA is commonly used and recommended method to assess nursing applicants' academic performance, and it has been linked to predicting student success in the studies (Capponi and Mason Barber, 2020; Timer and Clauson, 2011). Moreover, standardized tests are found to be connected to academic success (Smith Glasgow et al., 2019). Interviews (individual or panel) are a common method to select students (Joubert et al., 2022), although, interviews have been criticised as not being reliable or valid method to assess students' potential success in their studies (Crawford et al., 2021; Rodgers et al., 2013) because they are biased, and often subjective in their nature (McGraw et al., 2018, Taylor et al., 2014). In addition, personal statements (e.g., self-written essays) are used in student

selection. Personal statements can be used to assess e.g., student motivation or personal desire to apply to nursing (Traynor et al., 2022) and could add value when utilised with other selection methods (Taylor et al., 2014). However, the predictive value between the study success and personal statements is unclear, and the evaluation of the personal statements is often subjective (Rodgers et al., 2013). In addition, holistic approaches to student selection are recommended as they increase the chances of selecting suitable and successful nursing applicants (Crawford et al., 2021; Joubert et al., 2022). Holistic student selection methods combine several student selection methods such as, previous academic performance, on-site exams, and interviews (Joubert et al., 2022).

In Finland, UASs are responsible for the student selection in nursing education. UASs are autonomous and they have the freedom to decide about their student selection methods. UASs follow the criteria for eligibility for secondary studies set by the EU directives of 2005/36/EC and 2013/55/EU (The European Parliament and the Council of the European Union, 2005, 2013). UASs follow the Rectors' Conference of Finnish Universities of Applied Sciences Arene (2019) recommendation of the selection of their students. The recommendation is that most of the students should be selected to UAS based on the previous academic performance.

Currently, most of the UAS students are selected by joint application process. Applicants are selected based on the previous academic performance (GPA) or with a digital on-site joint entrance exam (UAS Exam). Nursing education is part of the joint application process. In the UAS exam, nursing students are assessed for their reasoning skills, language skills, mathematical skills, ethical skills, and emotional intelligence skills (Talman et al., 2021). In addition, all nursing applicants must have a suitable health condition to practice nursing (Valvira National Supervisory Authority for Welfare and Health, n.d.). Furthermore, it is also possible to apply for nursing education through separate application. In the separation application, the students are selected based on the criteria and selection method set by the UASs, and separate application processes are not part of the UAS exam. In the recent years, the number of students selected through separate application procedures has increased significantly in Finnish UASs (Vipunen Education Statistics Finland, 2024b).

2.2 Assessment and promotion of the perception of the nursing profession in the literature

2.2.1 Definition of the perception

The word perception comes originally from the Latin words *perceptio* and *percipere*, meaning the act of perceiving. Dictionaries define the perception as the ability to

become aware of something through the senses, or the way something is understood, interpreted, or regarded (Oxford Learners Dictionary, 2024). Perception is defined as a view, opinion, or belief about something, which is based on understanding of something, or ability to understand something that is not obvious to other people (Cambridge Dictionary, 2024). In addition, perception can be seen as a mental image or consciousness or awareness of something that has been interpreted based on experience (Merriam-Webster, 2024).

Perception has also been defined in different scientific fields. In philosophy, perception and the sense of perceiving has been debated since ancient times, and philosophers have been interested in the relationship between reality and appearance, and the perceiving and misperceiving things around us. Something that seems to exist does not exist, or it has a different nature of shape as one thinks. Our senses can mislead us, and things can be different from what they appear to be, and one can misperceive objects and be misled. (Persson, 2022).

In psychology and cognitive science, the perception is regarded as the process of acquiring and understanding sensory information (APA, 2018a; Persson, 2022) through the five senses, which are hearing, sight, touch, smell, and taste (APA, 2018b). The American Psychological Association (APA) defines perception as the process of becoming aware of events, objects, or relationships through the senses. Perception involves the act of recognising, observing, and discriminating. These activities are linked to organisms to organize and interpret the stimulus in a meaningful way, and to act in a coordinated way (Goldstein, 2018). Perceptions are fluid and influenced by environment and culture (Alexander and Diefenbeck, 2020). To develop the perception, one needs a stimulus (e.g., experience) from the environment, processes it, and is able to recall it (Granum, 2004).

In the literature, the concept “nursing image” is often used to describe the study participants perceptions in relation to the nursing profession, although, the concepts are slightly different. According to the dictionary definition, image can be defined as a visual representation of something, a mental impression or conception held by members of a group, an idea, a popular conception presented through the media, an exact likeness, visible representation, reproduction of something (Merriam-Webster, 2024). According to the definition, nursing image refers to the portrayal of nursing profession in the public eye, while the concept perception is more connected to individuals view, or mental idea of nursing profession. In this study, the perception is defined as a one’s mental image, which is based on knowledge. The perception evolves in interaction with the environment and when one gets new knowledge.

2.2.2 Studies assessing the perception of the nursing profession

In the literature, the perception of the nursing profession has been assessed from various perspectives: from children's, secondary school students', career advisors', nursing students', college and undergraduate students', the public's and from nurses' perspective (Table 1). Perceptions of the nursing profession have been assessed using qualitative (e.g., Alexander and Diefenbeck, 2020; Cilar et al., 2020; Guy et al., 2022; Kay, 2015; Lundell Rudberg et al., 2022; Mert et al., 2020; Mohsen et al., 2022; Omari et al., 2023; Palazzo et al., 2022; Skela-Savič et al., 2022; Subu et al., 2022; Teresa-Morales et al., 2023; Woods-Giscombe et al., 2020) mainly by interviews and surveys. The interviews were often individual interviews (Guy et al., 2022; Kay, 2015; Lundell Rudberg et al., 2022) or focus group interviews (Başkale and Serçekuş, 2015; McGee et al., 2019; Omari et al., 2023) and the collected material has been analysed using qualitative analysis methods. Instruments were usually developed by the researchers based on the previous literature (see also 2.2.3). In addition, literature reviews (Allen, 2022; Mimura et al., 2009; Teresa-Morales et al., 2022; Yi and Keogh, 2016) have been conducted to investigate perceptions.

According to the literature, the development of the perception of nursing the profession begins at an early age. Children are aware that nurses provide care, and they know a variety of nurses' tasks (Çakirer Çalbayram et al., 2016; Skela-Savič et al., 2022; Sluarka et al., 2004). Children described nursing as subordinate to medicine, the work was seen as suitable for women, and they did not express their interest in nursing as a career (Savic et al., 2021). Furthermore, high-achieving students are not always encouraged to apply to nursing by the significant others such as careers advisors, (King et al., 2007; Neilson and McNally, 2013), who have limited understanding of nursing (Williams and Dickstein-Fischer, 2018) (Table 1).

Similar findings have been reported among secondary school students who have misperceptions regarding the nursing profession (e.g., Beattie et al., 2014; Cohen et al., 2004; Kay, 2015; Porter et al., 2009; Raymond et al., 2018, Öncü et al., 2022; Whitehead et al., 2007;). Recent studies report that young people are aware of the variety of nursing tasks (Omari et al., 2023), and they have positive ideas of nursing (Mert et al., 2020; Omari et al., 2023; Palazzo & Eriksson, 2022; Raymond et al., 2018), although, they are not interested in nursing as a career (McGee et al., 2019, Mert et al., 2020). Career choice is also influenced by self-perception and beliefs about what is needed to succeed, and nursing does not always align with prestige held by young people (Miller & Cummings, 2009; Neilson & Jones, 2012). Reasons for pursuing a career in nursing can be intrinsic, such as a desire to help others (Halperin and Mashiach-Eizenberg, 2014; Soerensen et al., 2023), or to make a difference. Reasons may also be extrinsic, such as a good employment situation and job stability (Sillero et al., 2023; Turan et al., 2021) (Table 1).

Table 1. Studies assessing perception of the nursing profession.

Study participants	Authors
Children (<i>up to elementary school</i>)	Slusarska et al., 2004; Neilson and Lauder, 2008; Turner, 2011; Neilson and Jones, 2012; Çalbayram et al., 2018; Skela-Savič et al., 2021
Secondary school students (<i>middle school and high school</i>)	Kohler and Edwards, 1990; Rossiter and Yam, 1998; Foong et al., 1999; Cohen et al., 2004; Al-Kandari and Lew, 2005; Katz, 2007; Whitehead et al., 2007; Yeager and Cheever, 2007; Miller and Cummings, 2009; Porter et al., 2009; Beattie et al., 2014; Degazon et al., 2015; Kay, 2015; Tuckett et al., 2017; Gómez and Brostoff, 2018; Raymond et al., 2018; Maymoun and Sohail, 2020; Mert et al., 2020; Mohsen et al., 2022; Omari et al., 2023; Palazzo and Erickson, 2022
Career advisors	King et al., 2007; Neilson and McNally, 2013; Williams and Dickstein-Fischer, 2018
Nursing students	Day et al., 1995; Law and Arthur, 2003; Cook, 2003; Karaoz, 2003; Watson et al., 2003; Brodie et al., 2004; Brodie, 2004; Granum, 2004; Grainger and Bolan, 2006; Grainger and Bolan, 2006;; Sand-Jecklin and Schaffer, 2006; Escobar et al., 2007; Zhang and Petrini, 2008; Ben Natan, 2009; Bolan and Grainger, 2009; Bolan and Granger, 2009; Safadi et al., 2011; Safadi et al., 2011; Poreddi et al., 2012; Salamonsen et al., 2014; Başkale and Serçekuş, 2015; Wilkes et al., 2015; Liaw et al., 2016; Marcinowicz et al., 2016ab; McKenna et al., 2017; Ten Hoeve et al., 2017; Browne et al., 2018; Smith-Wacholz et al., 2019; Cilar et al., 2020;; Woods-Giscombe et al., 2020; Cici and Yilmazel, 2021; Mannino et al., 2021; Turan et al., 2021; Allen, 2022; Batmaz et al., 2022; Canzan et al., 2022; Kaya & İşler Dalgıç, 2022; Lundell Rudberg et al., 2022ab; Prosen, 2022; Kobayashi et al., 2023; Sillero et al., 2023; Soerensen et al., 2023; Teresa-Morales et al., 2023
College and university students (other than nursing)	Seago et al., 2006; Palumbo et al., 2008; Marcinowicz et al., 2009; Dante et al., 2013; Wu et al., 2015; Crawford et al., 2016; Liaw et al., 2017; Alexander and Diefenbeck, 2020; Cirik et al., 2022
Public	Donelan et al., 2008; Neilson and McNally, 2013; Ten Hoeve et al., 2014; Ben Natan, 2016; Girvin et al., 2016; McGillis-Hall and Kashin, 2016; Rubbi et al., 2017; Alexander and Diefenbeck, 2020; Elmorshedy et al., 2020; Uysal and Demirdağ, 2022; Woodland et al., 2022
Media	Fealy, 2004; Escobar et al., 2007; Kalisch et al., 2007; Kelly et al., 2012; Weaver et al., 2013; Koo and Lin, 2016; Alharbi et al., 2020; Daigle, 2020; Alharbi et al., 2022; González et al., 2022; Miller et al., 2022; Şahan et al., 2022
Nurses	Buerhaus et al., 2005; Hallin and Danielson, 2008; Ugur GöK and Kocaman, 2011; Emeghebo, 2012; Johnson and Covin, 2013; Marcinowicz et al., 2016; Tuckett et al., 2017; Braganca et al., 2018; Racic et al., 2019; Sasso et al., 2019; Godsey et al., 2020; Hazanov et al., 2020; Mannino et al., 2021; Raso et al., 2021; Bultas and L'Ecuyer, 2022; Durgun et al., 2022; Grinberg and Sela, 2022; Kallio et al., 2022; Prosen, 2022; Rekisso et al., 2022; Roth et al., 2022; Sayılan and Kulakac, 2023
Men	Evans, 1997; Wang et al., 2011; Rajacich et al., 2013; Zamanzadeh et al., 2013; Abushaikh et al., 2014; Valizadeh et al., 2014; Zamanzadeh et al., 2014; Yi and Keogh, 2016; Kluczyńska, 2017; Whitford et al., 2020; Guy et al., 2022; Palazzo and Erickson, 2022; Subu et al., 2022

Nursing students start their nursing studies with an altruistic and idealistic perception of nursing (Allen, 2022; Ben Natan, 2009; Lundell Rudberg et al., 2022a; Marcinowicz et al., 2016; Prosen, 2022; Sillero et al., 2023; Smith-Wacholz et al., 2019). During nursing education, the perception changes to a more versatile and professional one (Ben Natan, 2009; Kaya and İşler Dalgıç, 2022; Lundell Rudberg et al., 2022b; Ten Hoeve et al., 2017; Teresa-Morales et al., 2023). The change in the perception of the nursing profession is not linear during the education, and it seems that the perception remains partially limited until the end of the nursing education (Teresa-Morales et al., 2023) (Table 1).

Furthermore, college and university students' perception of the nursing profession has been studied mainly from the career choice perspective (Alexander and Diefenbeck, 2020; Cirik et al., 2022; Dante et al., 2013; Liaw et al., 2017; Palumbo et al., 2008; Seago et al., 2006; Wu et al., 2015) and they have misperceptions of the nursing profession (Alexander and Diefenbeck, 2020; Cirik et al., 2022; Dante et al., 2013; Liaw et al., 2017). College and university students reported that nursing did not match with their idea of an ideal career (Palumbo et al., 2008). Nursing profession was described as a less educated (Cirik et al., 2022; Liaw et al., 2017), undervalued and negatively stereotyped profession (Alexander and Diefenbeck, 2020; Liaw et al., 2017; Wu et al., 2015) (Table 1).

Public awareness of the nursing profession is limited (Girvin et al., 2016; McGillis Hall and Kashin, 2016;), although, nurses' work is often viewed positively (Girvin et al., 2016; Rubbi et al., 2017; Uysal and Demirdağ, 2022; Woodland et al., 2022). Although nurses' contributions are valued, they are not sufficiently respected by the public (Girvin et al., 2016). The public appreciates nurses for their virtuous role in patient care, but the required competencies and academic requirements of the profession remain largely unknown (Ten Hoeve et al., 2014).

Media portrayals have a significant impact on public's perception of the profession. The media often portrays nursing profession inaccurately, negatively, and stereotypically (González et al., 2023). Nurses do not identify with these stereotypical portrayals of nursing in the media (Roth et al. 2022) or among the public (Flinkman et al., 2013; Racic et al., 2019). The public's lack of understanding of the nursing profession and the general undervaluation of nurses' work influence nurses' turnover intentions (Kallio et al., 2022).

Men's perception of the nursing profession has been investigated from career choice perspective. Men have a negative perception of the nursing profession (Palazzo and Erickson, 2022; Wang et al., 2011; Whitford et al., 2020). The nursing profession is seen as feminine, and not a suitable career for men (Guy et al., 2022; Kluczyńska, 2017; Valizadeh et al., 2014; Whitford et al., 2020). In contrast, male nurses have a more positive perception of the profession (Subu et al., 2022). Male nurses report that their career choice in nursing is questioned (Guy et al., 2022; Subu

et al., 2022; Zamanzadeh et al., 2014) and the stereotypes associated with the nursing profession are barriers for men to pursue a career in nursing (Kluczyńska, 2017; Subu et al., 2022; Valizadeh et al., 2014).

2.2.3 Instruments to assess the perception of the nursing profession

There are few instruments that have been used to measure the perception of the nursing profession. Instruments used to describe the perception of the nursing profession measure perceptions, attitudes, the image of nursing, qualities and characteristics of a nurse or the nursing profession, orientation towards nursing or nursing as a career choice, and the brand image of nursing (Table 2). In addition, the theoretical background of the instruments, and especially the item development processes, are often not clearly explained in the research articles describing the instruments. All existing instruments are self-report instruments with Likert scales. Objective instruments to measure perception of the nursing profession are not reported in the literature. Psychometrically validated instruments to measure perceptions of the nursing profession are rare in the literature.

2.2.4 Interventions to promote the correct perception of the nursing profession

Promotion is the act of making something known or advertising something. Promotion can also be understood as an act of encouraging something to happen, or to elevating something or someone, to a higher or more important position (Cambridge Dictionary, 2024; Merriam-Webster, 2024).

Many researchers emphasise the need for correct and up-to-date information about the nursing profession for young people and potential applicants to the nursing profession. Young people need correct information about the nursing profession in order to develop an accurate perception of the profession (Allen, 2022; Ben Natan, 2009; Bolan and Grainger, 2009; Dante et al., 2013; Grainger and Bolan, 2006; Ten Hoeve et al., 2014; Sand-Jecklin, 2006) and to make an informed career choice in nursing (Dante et al., 2013). Promotion of the nursing profession should be targeted to young people already at school age (Hoke, 2006; Liaw et al., 2017; Turner, 2011) or no later than secondary school (WHO, 2020; Woods-Giscombe, 2020).

Young people should be informed about the competency requirements of the nursing profession and the opportunities for career development in nursing (Canzan et al. 2022; Skela-Savič et al., 2021; Teresa-Morales et al., 2023). Professional autonomy and independent decision making in the nursing profession should also be promoted

Table 2. Instruments used to describe the perception of the nursing profession (sorted by the publication year).

Instrument	Author, Year, Country	Theoretical background	Content, items	Scale
1.Perception of an Ideal Career Versus Nursing (Indiana instrument)	May et al. (1991), United States	Literature on ideal career and career in nursing.	Measures differences in attitudes between 'ideal career' and 'nursing as a career' with two set of questionnaires, 17 items	3-point Likert scale, self-report
2.Porter Nursing Image Scale, (PNIS)	Porter and Porter (1991), United States	Self-concept model.	Measures nursing image with 3 domains: Interpersonal power, Interpersonal relations, Intrapersonal ability, 30 items	7-point Likert Scale, Self-report
3. Perception of Nursing Scale	Manninen (1998), Finland	Earlier literature.	Measures perception of nursing with 3 domains: nursing as medical technical activity, nursing as promoting human wellbeing, nursing as professional activity, 25 items	5-point Likert scale, Self-report
4. Nursing Attitude Questionnaire (NAG)	Toth, Dobratz and Boni (1998), United States	Socialization and role theory, based on Hoskins Questionnaire, review of the literature, clinical experience, suggestions from a panel of experts	Measures attitudes towards nursing with 6 domains: roles, values, responsibilities, characteristics of a nurse, nursing professionalism and stereotypes of society, 30 items	5-point Likert scale, Self-report
5.Nursing Orientation Tool (NOT)	Vanhanen and Janhonen (2000), Finland	Based on earlier research by Vanhanen et al. (2000)	Measures students' orientation on nursing with 3 domains: caring, nursing expertise and life orientation, 17 items	5-point Likert scale, Self-report
6.Nursing Image Scale (NIS)	Özsoy (2000), Turkey, <i>available in Turkish only</i>	Not reported.	Measures nursing image with 3 domains: general View, communication, and vocational-educational qualities, 28 items	3-point Likert scale, Self-report
7. Nursing Profession Perception Scale	Eşer et al. (2004), Turkey, <i>available in Turkish only</i>	not reported	Measures nursing profession perception with 2 domains: professional qualities, professional status, 22 items	5-point Likert scale, Self-report

8. Perceptions of Professional Nursing Tool (PPNT)	Sand-Jecklin and Schaffer (2006), United States	Based on doctoral dissertation	Measures perceptions of professional nursing with 2 domains: nursing practice and valuing of nursing, 27 items	3-point Likert scale, Self-report
9. Attitudes Scale for Nursing Profession (ASNP)	Ipek Coban and Kasikci (2011), Turkey	Earlier literature, items developed on sample group's feelings and thoughts of nursing.	Measures attitudes towards nursing profession with 3 domains: properties of nursing profession, prefer to nursing profession, general position of nursing profession, 40 items	3-point Likert scale, Self-report
10. Qualities of Nurses Scale	Johnson and Cowin (2013), Australia	Qualitative study on statements of nursing students about nurses.	Measures mismatches between perceived and real understandings of nurses and nursing. 21/ 12 items (2 versions)	3-point Likert scale, Self-report
11. Scale for Image of Nursing Profession (SINP)	Dost and Bahcecik (2015), Turkey	not reported in English	Measures the image of the nursing profession with 6 domains: professional qualifications, working conditions, gender, education, professional status and appearance, 42 items	5-point Likert scale, Self-report
12. Nursing Career Choice Questionnaire	Liaw et al. (2017), Singapore	earlier study	Measures nursing as a career choice with 6 domains: personal interest, prior healthcare exposure, self-efficacy, perceived nature of work, job prospects and social influences, 35 items	5-point Likert scale, Self-report
13. Nursing Brand Image Scale (NBIS)	Godsey et al. (2018), United States	3 focus group discussion	Measures nursing brand image with 7 domains: strong interpersonal skills, expert healthcare providers and partners, valued by society, qualified caregivers, influential leaders/interprofessional partners, qualified for advanced nursing practice, and lack authority/professional identity, 42 items	10-point Likert scale, Self-report
14. Adolescents' Perceptions of Nursing Image Scale (APNIS)	Cirik et al., (2024), Turkey	earlier literature	Measures adolescents' perceptions of nursing Image with 6 domains: perceptions of nursing, professional Image, perception, caring and therapeutic, communication, informative, and healing environment	5-point Likert scale, Self-report

to raise awareness of nursing as an independent profession (Cohen and Palumbo, 2004), and as an independent discipline. Furthermore, the different roles of nurses in patient care, in education and in research and in societal and policy making should be more highlighted (Teresa-Morales et al., 2023). The promotion of the nursing profession should emphasise the academic requirements of the profession and the professionalism of nursing (Ten Hoeve et al., 2014, Teresa-Morales et al., 2023).

Career opportunities in nursing outside the hospital setting should be promoted to increase understanding of the diversity of career possibilities (Alexander and Diefenbeck, 2020). The promotion of nursing should be gender neutral (Prosen, 2022), showcase nurses from diverse backgrounds (Prosen, 2022; Woods-Giscombe, 2020) and break the typical stereotypes of nursing (Teresa-Morales, 2023). This is important to attract men (Prosen, 2022), underrepresented minorities, (Woods-Giscombe, 2020) or high achieving young people into nursing (Neilson and Jones, 2012). Moreover, nursing profession should also be promoted to career advisors (King et al. 2007; Neilson and McNally, 2013; Williams and Dickstein-Fischer 2018), teachers (Law and Arthur, 2003) and family members (Mohsen et al., 2022; Ten-Hoeve et al., 2014; Wu et al., 2018) who provide information and support young people in their career choices (Neilson and McNally, 2013).

Many researchers suggest structured and targeted educational events to promote the nursing profession to the potential nursing applicants. Educational events suggested in the literature include, for example, introductory nursing courses (Karaoz, 2004), career education programmes (Turner et al. 2011), nursing outreach programmes (Alexander and Diefenbeck, 2020), summer camps (Drenkard et al., 2002; Flores and Ashe, 2013; Gómez and Brostoff, 2018; Katz, 2007; Pollard et al., 2010; Yeager and Cheever, 2007), fairs and recruitment events (Bolan and Grainger, 2006; Lauver, 2011), visits to nursing schools and open days (Canzan et al., 2022; Cilar et al., 2020; Law and Arthur, 2003;), nurses visiting secondary schools (Ben Natan, 2009; Bolan and Grainger, 2009; Brodie et al., 2004) hospital visits to shadow nurses (Pollard et al., 2010; Porter et al., 2009).

Educational events should be planned in collaboration between different organisations such as secondary schools, higher education institutions and hospitals (Zamazandeh et al., 2013). The events could include lectures, practising nursing tasks, (Flores and Ashe, 2013) games, (Pollard et al., 2010), exposure to the real clinical nursing (Gómez and Brostoff, 2018) and collaboration with nurses (Gómez and Brostoff, 2018; Mohsen et al., 2022; Turner, 2011) or nursing students (Tawash and Cowman, 2018).

Intervention studies investigating whether perceptions can be influenced are scarce in the current literature. Two literature reviews by Matutina (2008) and Williams (2018) have investigated interventions to attract middle school pupils to a career choice in nursing. The interventions described in the reviews were mainly

educational events such as summer schools, careers education programmes and lectures. According to both reviews, educating young people about the nursing profession has a positive effect on their perception of the nursing profession. In addition, the effect of summer camps on the on perception of nursing has been also investigated in the previous studies (Table 3). Summer camps are intensive programmes, mainly in the US, designed to provide information about the nursing profession using a variety of methods such as lectures and hands-on nursing activities. According to the findings, the summer camps changed the perception to a more correct one (Yeager and Cheever, 2007), increased participants’ knowledge (Katz, 2007) and interest in nursing (Gómez and Brostoff, 2018; Pollard et al., 2010; Yeager and Cheever, 2007), or confirmed participants desire to pursue a career in nursing (Gómez and Brostoff, 2018). In addition, educational events, such as career education programmes (Turner, 2011), a course about the nursing profession (Karaoz, 2004) or an event that educated participants about the nursing profession, may have a positive impact on the participants’ perception of the nursing profession. Also, shadowing nurses at their workplace influenced participants’ perception of the nursing profession (Porter et al., 2009).

Moreover, contemporary modern digital tools have been proposed as a way to promote the nursing profession to the younger generations (Gómez and Brostoff, 2018; Kress et al., 2018; Linden et al., 2022; Mitchell et al., Raymond et al., 2018; Ten Hoeve et al., 2014). Currently, there are only a few intervention studies using digital methods to promote nursing. It seems that targeted videos about the nursing profession (Linden et al., 2022; Raymond et al., 2018) as well as games (Mitchell et al., 2024) can positively influence the perception of the nursing profession and increase participants’ knowledge about nursing.

Table 3. Interventions to promote correct perception of the nursing profession (sorted by year).

Authors, Year, country	Intervention content	Participants	Test	Effect +/-
1. Karaoz, 2004 Turkey	Introduction to nursing - course,	39 nursing students	One group prepost - test, no comparison groups	+
2. Hoke, 2006 United States	Educational event with lecture, video	171 middle school students	prepost -test, no comparison group	+
3. Katz J. R. 2007 United States	Summer camp (lectures, skills lab, workshops)	17 high school students	One group prepost - survey, no comparison groups	+
4. Yeager, & Cheever, 2007 United States	Summer camp (shadowing nurses, lectures, hands on skills lab	91 high school students	one-group prepost - test,	+

5. Porter et. al., 2009 United States	Shadowing of nurses	16 high school students	One group, post interview, no comparison groups	+
6. Pollard et al., 2010 United States	Summer camp (math skills, nursing skills, shadowing, simulations, shadowing nurses)	10 7 th and 8 th graders	No testing	+/
7. Turner, 2011 United States	4-week career education program (lectures, skills labs, games)	70 5 th grade students	2 prepost -tests	+
8. Gómez, & Brostoff, 2018 United States	Summer internship program	84 high school students	No testing	+
9. Raymond et al., 2018 Australia	Video about nursing	71 secondary school students	One group, pre-post survey, no comparison groups, One group prepost - test, no comparison groups	+
10. Tawash & Cowman, 2018 Kuwait	Educational Event (video, interactive seminar, hands on skills lab, information booklet)	90 high school students	one-group prepost-test, no comparison groups	+
11. Linden et al., 2022 United Kingdom	Video and discussion sessions	84 persons (16 years old)	One group prepost - test, no comparison groups	+
12. Mitchell et al., 2024	Game "nursing and midwifery as a profession"	137 primary school children	Prepost - test design	+

*+ = Intervention influenced participants perception of nursing profession, – = intervention did not influence the perception

2.3 Virtual learning environment

2.3.1 Virtual reality in nursing education

The use of virtual reality (VR) has increased in the past years in nursing education. VR can be defined as a computer-generated simulation of a realistic experience (Mann et al. 2018). VR has also been defined as an artificial digitally generated three-dimensional environment, in which the user feels physically present (Chen et al., 2020). Furthermore, the VR can be defined as a technology that allows users to interact with the three-dimensional virtual environment. VR environments can be developed using 3D modelled computer graphics, or they can be developed using 360° technology (Mancuso et al., 2024). Presence, immersion, and interactivity are key components in the VR environments (Mandal, 2013). The presence refers to the

feeling of being present in the environment (Rose et al., 2018) and is closely related to the level of immersion. Immersion can be seen as an objective characteristic of the environment, and the tools used, or as a mental psychological feeling of being in the virtual environment (Sherman and Graig, 2018). Immersion can be high, moderate, or low. In a high immersion VR environment, the user perceives being physically present in the virtual environment, and the virtual environment is used, for example, with a head-mounted display (HDM) and haptics. In moderate immersion, the user has, for example, a large screen with an extended view in the device, and the device is visible for the user. In low immersion virtual environments, the user is not present in the virtual environment and observes it from the outside by rotating or moving a device such as a smartphone, computer, laptop, tablet. (Miller and Buganariu, 2016.) Interactivity can be defined as an interaction between the user and the environment, which allows user to see the result of their actions (Koivisto et al., 2018).

In the context of nursing education, VR has been used, for example, to teach and practice clinical nursing skills (Fontenot et al., 2024; Samosorn et al., 2020; Yang et al., 2022; Yildiz and Demiray et al., 2022), decision making and clinical reasoning (Kiegaldie and Shaw, 2023; Koivisto et al., 2018; Mäkinen et al., 2023) disaster preparedness (Magi et al., 2023; Shujuan et al., 2022;) or to enhance students theoretical knowledge (Koivisto et al., 2024; Woon et al., 2021). Virtual reality has a positive effect on students learning (Huai et al. 2024) and it offers nursing students a possibility to practice decision making in varying healthcare environments, (Liu et al., 2023) and practise nursing skills repeatedly in a safe (Uemura and Kumiko, 2024) and realistic environment, and to receive feedback from the training that prepares them for the authentic real-life nursing environment (Kiegaldie and Shaw, 2023). According to the recent meta-analyses (Chen et al., 2020; Huai et al., 2024; Liu et al., 2023; Woon et al., 2021), the use of VR increases students' knowledge (Chen et al., 2020; Huai et al., 2024; Liu et al., 2023; Woon et al., 2021), self-efficacy (Huai et al., 2024) satisfaction and skills (Huai et al., 2024; Liu et al., 2023). Students' satisfaction and skills were similar to traditional teaching methods (Chen et al., 2020).

There are barriers to the implementation of VR in nursing education. Firstly, the cost and technical requirements of the VR have been discussed in the literature as a barrier (Son et al., 2022) and as a benefit of the VR (George and Titus, 2024). The investment cost of VR technology can be high for an individual and for an organisation (Son et al., 2022). However, in the long run, the investment costs may be worthwhile due to the reduced operating costs of simulations, compared to simulations with manikins. Other barriers associated with VR simulations are related to the challenges of learning outcomes, as the changing environments for implementing the VR. There may also be challenges in integrating VR into curricula,

as VR does not always fit the needs of the curriculum, and VR cannot replace clinical training. There may also be technological challenges in implementing VR in teaching (George and Titus, 2024). Finally, VR can cause cyber sickness and visual discomfort, and the equipment does not always fit everyone (Choi et al., 2022). While VR and immersive technology has a positive impact on student learning, and can effectively complement traditional teaching methods, it should be implemented in short sessions with low to moderate levels of immersion (Woon et al., 2021).

2.3.2 360° virtual learning environments

The learning environment can be defined as the social, cultural, and physical context in which learning takes place (Rusticus et al., 2023). Virtual learning environment facilitates learning online. A virtual learning environment (VLE) is a system for teaching and learning that uses the internet and specialised software (Cambridge Dictionary, 2024). VLE enables simultaneous learning for multiple students at the same time, or at a chosen time, in any location independently (King et al., 2018). VLE is a virtual space that integrates different learning materials in a meaningful way. VLE provides opportunities for student interaction and collaboration as well as student management and support. (Harden and Ronald, 2010).

360° Virtual learning environment is a VLE which has been developed utilising 360° technology. The 360° technology is a subset of the VR technology. With 360° technology it is possible to develop three-dimensional VR environments that are based on realistic 360° videos or 360° images. The 360° technology is based on 360° panoramic images, or to a 360° video that captures the image of the environment in all directions and allows the user to look around in the realistic virtual environment from the recorded position (Mancuso et al., 2024). The 360° virtual learning environments can be as immersive as any VR environment. Typically, the 360° videos or 360° images are viewed from a computer, mobile phone, or with HDM. With HDM, the user can look around in the 360°VLE by turning their head. With portable devices, the user can move and look around the 360° environment by moving, touching, or zooming the screen. (Shinde et al., 2023.)

The 360° technology has been used in the past literature in hospitality and tourism, basic education, medicine, retail, driving/logistics, emergency planning and management and psychology. Most of the studies investigate 360° videos, and only a few studies implement and investigate VLEs, which are based on 360° images (Shinde et al., 2023). 360°VLEs based on 360° images has been used for example to develop ubiquitous learning environments (Virtanen et al., 2016; Virtanen et al., 2017; Virtanen et al., 2018;) and patient counselling environments (Paalimäki-Paakki et al., 2021). In the context of nursing education, the use of 360° technology is a relatively new (Yang 2021), although it is getting more popular. The 360° videos

have been used to teach, for example, nursing skills, mental health nursing, obstetrics nursing, and treatment of trauma patients (Baysan et al., 2023). Furthermore, the 360° images have been used to teach home care nursing (Woodworth, 2022) and to develop escape rooms to teach nursing skills (Rappolt and Hadenfeldt, 2024).

The development of the 360° VLEs can be considered as an affordable and more accessible alternative for the creation of VR environments (Blair et al. 2021) and they are well suited for nursing education (Baysan et al., 2023). While the VR developed with graphics is often an artificial environment, the 360° images and videos present realistic real-life environments (Babaita et al., 2024). The 360° feature makes learning interesting because the learning happens in a realistic environment (Mancuso et al., 2024). The development of the 360° VLEs requires an external programme, and the programmes may impose restrictions on the development and use of the 360°VLE (Babaita et al., 2024). In addition, interaction with others is typically limited in 360°VLEs. However, through the use of external applications, it is possible to increase interactivity by adding elements such as hotspots or links that facilitate engagement through the app, or through the content itself. (Blair et al. 2021.) The 360°VLEs can cause discomfort, which is connected to the immersiveness of the environment, and to the tool which is used to explore the environment. Therefore, 360°VLEs should be also used in short sessions with moderate or low immersion (Woon et al., 2021).

2.4 Summary of the literature

Current literature suggests that there are misperceptions about the nursing profession in society. In order to promote the recruitment and retention of nurses, there is a need to further explore young people's and nursing applicants' perceptions of the nursing profession. Based on the literature, the following research gaps were identified:

Firstly, the evidence on young people's perception of the nursing profession is scattered, and a more consistent and comprehensive description of young people's perception of the nursing profession is needed to understand their perception and possible information needs. Furthermore, no previous studies have investigated nursing applicants' perception of the nursing profession. Investigating their perception at the application stage will provide valuable insight into how the profession is perceived by the future nurses at the application stage.

Secondly, previous literature has suggested that the measurement of the perception of the nursing profession could be incorporated into the student selection to improve the retention. Currently, all of the available instruments that have been used to measure and describe perception of the nursing profession, are self-report instruments that cannot be utilised in the student selection setting. In addition, many of the instruments used to describe the perception of the nursing profession, measure

different concepts such as orientation, attitude, ideal career, and there is a lack of instruments with a clearly described and valid theoretical base. Furthermore, there is also a lack of psychometrically validated instruments to measure perception of the nursing profession.

Thirdly, current literature suggests that educational interventions can be used to influence the perception of the nursing profession among young people. Innovative solutions have been proposed, but intervention studies using modern digital methods are rare in the literature. Furthermore, based on the current literature, the evidence for interventions that influence perceptions of the nursing profession is weak, and more evidence on the effectiveness of the interventions is needed.

Finally, most of the previous studies have been conducted outside Finland, and the perception of the nursing profession among Finnish young people and nursing applicants have not yet been investigated. As perceptions are culturally influenced, and there are differences in the nursing profession, and nursing education between the countries, it is important to gather evidence from the national context. The evidence is needed to recruit new candidates to the nursing profession and to design interventions that are tailored to the local needs in the national context.

3 Aims

This study included three phases, which were theoretical phase (I), development phase (II), and evaluation phase (III). The purpose of this study (Figure 1) was:

- I. To develop a theoretical base for the perception of the nursing profession.
- II. To develop and psychometrically test the Perception of Nursing Profession Instrument (PNPI₂) to measure the perception of the nursing profession in the entrance exam setting.

To develop a 360° virtual learning environment (360°VLE) to share correct information about the nursing profession to nursing applicants.
- III. To evaluate the effect of the 360°VLE on the nursing applicants' perception of the nursing profession. To evaluate the usability of the 360°VLE.

The ultimate goal of the study is to develop evidence-based and objective student selection methods in nursing education, and to promote correct perception of the nursing profession to foster the career choices in nursing. The research questions (RQ) in phases I, II, and III were:

- I. Theoretical phase

- RQ1: What is the perception of the nursing profession among young people and which factors influence on their perception of the nursing profession? (Paper I)

- RQ2: What is the perception of the nursing profession among nursing applicants and which factors influence on their perception of the nursing profession? (Paper II)

- RQ3: What is the nursing profession according to the national regulation regarding the nursing education? (Paper III, summary)

- RQ4: What is the theoretical base for the perception of the nursing profession? (Paper III, Paper IV, summary)

II. Development phase

RQ5: What is the content and the psychometric properties of the PNPI₂ to measure the nursing applicants' perception of the nursing profession? (Paper III)

III. Evaluation phase

RQ6: Is there a difference in the perception of the nursing profession between the intervention and the control groups? (Paper IV)

Hypothesis: Nursing school applicants who use the 360°VLE intervention have more correct perception of the nursing profession.

RQ7: Which factors explain nursing applicants' perception of the nursing profession? (Paper IV)

RQ8: What is the usability of the 360°VLE? (Paper IV)

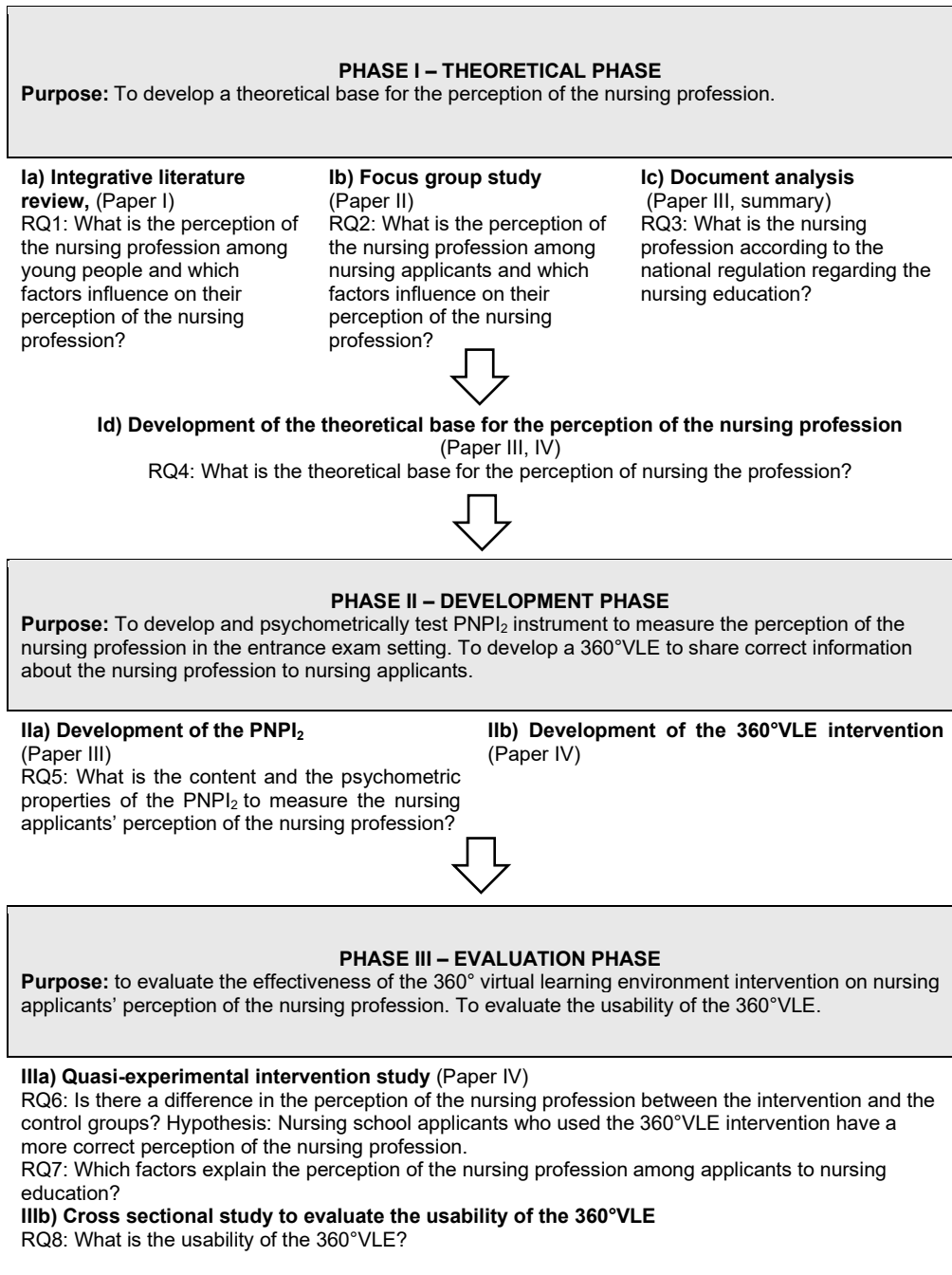


Figure 1. Overview of study phases, purposes, and research questions.

4 Materials and Methods

This chapter describes all the materials and methods used in the study phases I-III to answer the RQs from 1 to 8 (Table 4). In addition, the ethical aspects of the study are discussed at the end of this chapter.

Table 4. Overview of study the phases, designs and methods used in the study.

Phase and time	Paper	Sub-phase, design	Setting and sample	Data collection	Data analysis
I THEORETICAL PHASE 2016–2019	I	Ia) Descriptive design: integrative literature review	Research articles from CINAHL, Medline/PubMed, /ERIC (n = 8)	Systematic literature search	Qualitative content analysis (CA)
	II	Ib) Descriptive qualitative design	Nursing applicants (n = 18)	Semi-structured focus-group interview (n=3)	Inductive CA
	III, IV	Ic) Descriptive qualitative design	Online documents (n = 6)	Literature search	Deductive and inductive CA
	III	Id) Descriptive qualitative design	Qualitative descriptive datasets	Data based on a, b and c sub-phases	Applied meta-ethnographic synthesis
II DEVELOPMENT PHASE 2018–2023	III	IIa) Descriptive quantitative and qualitative design	Expert panel (n = 7)	Questionnaire	I-CVI, content analysis
	III	IIb) Cross-sectional design and methodological design	Nursing applicants n = 1115	Electronic questionnaire (PNPI ₂), demographic factors	Descriptive statistics, IRT, Partial Credit Model
	IV	IIc) Descriptive qualitative	Intervention test users, (n = 4)	Oral & written feedback	CA
III EVALUATION PHASE 2019–2024	III, IV	IIIa) Quasi-experimental design	Nursing applicants, Intervention group n = 450, control group n = 665	Electronic questionnaire (PNPI ₂)	Descriptive statistics, linear regression model
	IV	IIb) Cross-sectional design	Nursing applicants from the intervention group n=36	Positive System Usability Scale (P-SUS)	

4.1 Study design, setting and sampling

Phase I: Theoretical Phase

In the first phase of the study, the purpose was to develop a theoretical base for the perception of the nursing profession. In this phase, an integrative literature review, a focus group study and a deductive document analysis were conducted. The theoretical base for the perception of the nursing profession was developed based on qualitative synthesis using meta-ethnographic approach. Descriptive study designs were used. Sampling methods were systematic and purposive sampling (Table 4).

In phase 1a), an integrative literature review was conducted to describe the young people's perception of the nursing profession, and the factors influencing the perception (Paper I). The integrative literature review was selected as a review method because there was a need to review and summarise the existing literature with diverse methodologies to gain a more comprehensive description of the perception of the nursing profession (Dhollande et al., 2021; Whittemore and Knafl, 2005). In addition, the integrative review focused on describing young people's perceptions because the preliminary database searches revealed that the perception of nursing the profession among nursing applicants had not been investigated in the earlier studies. Thus, it was considered important to understand young people's perceptions of the nursing profession because they are the largest group of nursing applicants (Vipunen Education Statistics Finland, 2024a) and the future workforce sustainability is dependent on the societies capability to attract and recruit young people into nursing (Price et al., 2014; WHO, 2020).

The literature review followed the Whittemore and Knafl's (2005) process for conducting integrative reviews. The process includes: 1) problem identification, 2) literature search, 3) data evaluation, 4) data analysis, and 5) presentation of the results. The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flowchart was also used to plan and document the literature search (Moher et al., 2009). Articles were systematically selected from three databases (CIHNAL, PubMed and Ovid/Medline) (Paper I).

In phase 1b), a qualitative descriptive design was utilised to describe the nursing applicants' perception at the application stage (Paper II). Focus group interviews were conducted to describe the nursing applicants' perception of the nursing profession, and to identify the factors influencing their perception of the nursing profession. The focus group interview was selected as a study method because of the paucity of the studies describing nursing applicants' perception of the nursing profession, both nationally and internationally. Focus group interviews provided an opportunity to gain rich insights into nursing applicants' perception of the nursing profession. Furthermore, focus group interviews were seen as an efficient way to

explore nursing applicants' perceptions of the nursing profession, and allowing participants to express their perspective regarding the topic in interaction with other group members (Doody et al., 2013; Jayasekara, 2012). Three focus group interviews were held on the entrance examination day of three UAS in December 2016. Purposive sampling was utilised to gain information-rich study cases as participants (Campbell et al., 2020). Participants were recruited to the study with an information letter, which was sent to nursing applicants who were invited to nursing education entrance examination. They were also informed that the focus group interviews were held after the entrance exam, and the participation to the study did not influence on their application process. (Paper II).

In the phase 1c), a qualitative descriptive design was utilised to investigate what the nursing profession is in the documents regulating the nursing education in Finland. The analysis was conducted in order to obtain correct information regarding the nursing profession and to complement the previous studies (Paper III). The analysed documents were in a digital form online, and they were selected purposefully. (Paper III).

In the phase 1d), descriptive qualitative design was utilized to synthesize the results of the earlier collected qualitative descriptive studies (1a,1b,1c) to form a theoretical base of a perception of the nursing profession, which was utilized as a base for the development phase (Paper III).

Phase II: Development Phase

In the development phase (IIa; IIb), the PNPI₂ was developed and psychometrically tested to measure the perception of the nursing profession in the entrance exam setting (Paper III). Moreover, the 360°VLE was developed to share correct information about the nursing profession to nursing applicants before the entrance exam (Paper IV). Various study designs were used (Table 4). Purposive sampling method was utilised in both development processes. The full description of the PNPI₂ development is described in the chapter 4.3 and in Paper III. The development and description of the 360°VLE has been described in chapter 4.4. as well as in the Paper IV.

Phase III: Evaluation Phase

In Phase III, the effectiveness of the 360°VLE was evaluated utilizing quasi-experimental study design with non-randomized control group (Paper IV). The study was conducted as a part of an entrance exam to nursing education in the six UASs participating the ReSSNE project during the spring 2019. The sample consisted of purposeful selected voluntary nursing applicants (n = 1115) who applied to the six

UAS participating the study, gave their consent to the study, and completed the PNPI₂ as a part of the entrance exam (Paper IV). The nursing applicants were nonrandomly divided into the intervention and control groups based on the UASs cooperation agreements. According to the cooperation agreement an applicant can apply with the same entrance exam to all UASs covered by the cooperation agreement. Therefore, the randomisation of the applicants was not possible, because the control and intervention groups could not be mixed to ensure fair treatment of the nursing applicants. The intervention group consisted of nursing applicants to two UASs (n = 450) that had a cooperation agreement in the student selection. The control group consisted of nursing applicants from the other four UASs (n = 665) that did not have a cooperation agreement in the student selection.

4.2 Data collection

Phase I: Theoretical phase

In phase 1a) The systematic literature search was carried out in October 2016 to three databases (CIHNAL, ERIC, PubMed/Medline) (Paper I). Before conducting the extensive literature search, preliminary literature searches were conducted to recognize the correct keywords and the most suitable databases. Following keywords: perception, attitude, belief, view, nurse, nursing care, career profession, role, teen, middle school student, high school student, adolescent, and pupil (Paper I). The search was limited to the articles published between the years 2006 to 2016 to focus on the recent literature. The literature search was also limited to studies, which examined the perception of the young people from ages 15 to 24 following the UN's definition of a young person (UN, n.a). In addition, to be selected, articles had to be a research article with abstract available and written in English. The literature search to the databases identified in total 4,705 articles and seven articles were chosen to the review. Furthermore, two articles were chosen based on the manual search of the reference lists of the included articles (Paper I). The literature search was carried out by the main researcher and verified by a member of the research team. The selection process is described in Figure 2.

Finally, the quality appraisal of the chosen articles was conducted with JBI (2017) quality appraisal tools (Critical Appraisal Checklist for Analytical Cross-sectional Studies JBI_a, 2017 and Critical Appraisal Checklist for Qualitative Studies JBI_b, 2017). Two researchers evaluated the articles independently. In the end, each article was discussed, and consensus of the selected articles' quality was reached after a discussion. The quality appraisal indicated variation in the quality of the chosen articles, however, all the articles were kept in review because the aim was to evaluate

the perceptions broadly, and the chosen articles included valuable information about the understudied phenomenon (Lubbe et al., 2020, Paper I).

In phase Ib), the data were collected through three focus group interviews with voluntary applicants to undergraduate Bachelor of Science (BSc) nursing programme ($n = 18$) (Paper II). The interviews were conducted in 2018 in three UAS simultaneously with 5–7 participants in a one group, which enabled open interaction between the participants. The interviews conducted after the entrance exam in a quiet classroom at the entrance exam venues. The interviewers ($n = 3$, 1 per site) were experienced researchers. They were responsible for conducting and audio-recording the interviews and taking notes of the interviews. (Doody et al., 2013.) The nursing applicants arrived at the interview venue at a specific time, and all were included in the focus group study. Participants' background information was collected with a questionnaire. The themes for the interviews were the perception of the nursing profession and the factors influencing the perception. The themes were based on the results of the integrative literature review. The interviews' length varied from 50 to 60 minutes. The interview audio recordings were transcribed to verbatim after the interview by the main researcher (Paper II).

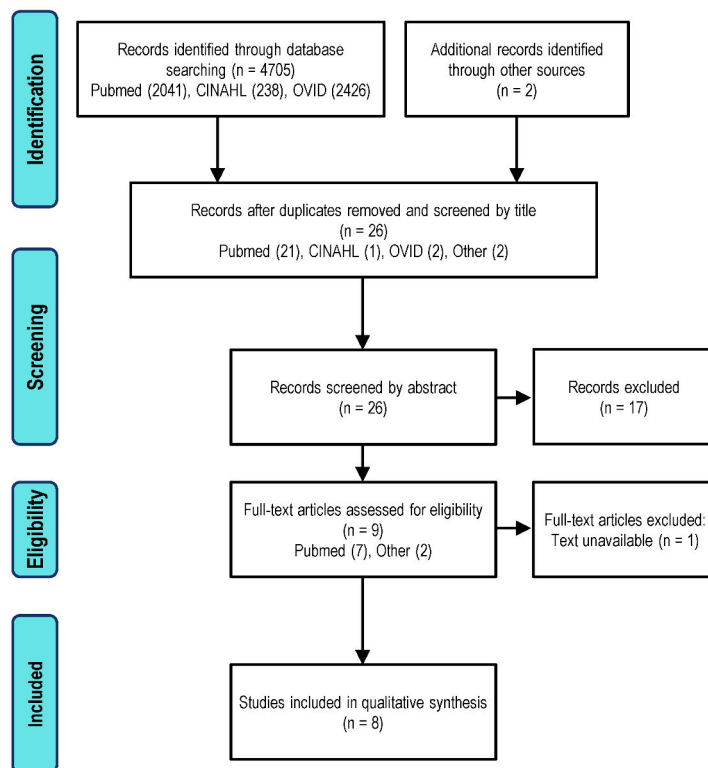


Figure 2. PRISMA flow diagram.

In phase Ic), the documents regulating nursing education in Finland were collected from internet in a digital form. In the end, the dataset consisted of (n = 6) digital online documents. The documents (n = 6) were the following: International Council of Nurses' Definition of Nursing (ICN, 1987), Professional Competence of a Nurse Responsible for a General Care 180 ECTS (Eriksson et al. 2015), Ministry of Education Report on the Required Professional Competence of Nurses (Ministry of Education, 2006), EU-directives (2013/55/EU and 2005/36/EY), and the Act on Health Care Professionals (Act on Health Care 1326/2010) (Paper III).

In phase Id), the data consisted of the earlier collected qualitative descriptive datasets (Ia, Ib and Ic). The datasets consisted of the factors, sub-categories, and main categories of the literature review, focus group study and the deductive document analysis (Table 4; Paper III, Paper IV).

Phase II: Development phase

In phase IIa), the PNPI₂'s items were evaluated for relevance and clarity in a two round expert panel of registered nurses (n = 7). Moreover, PNPI₂'s psychometric properties were tested as a part of the entrance exam to nursing education on 28th of May 2019. The data was collected in UASs (n = 6) participating in the ReSSNE project from the voluntary nursing applicants (n = 1115) (Paper III). Full description of the development phase is available in chapter 4.3 and in Paper III.

In phase IIb), the 360°VLE intervention was developed based on the Perception of the Nursing Profession theoretical base (full description on the chapter 5.4, table 5). Furthermore, P-SUS was used to collect data about the usability of the intervention (Brooke, 2013). P-SUS was integrated as part of 360°VLE as a digital questionnaire (described in chapter 4.3; Paper IV).

In the end, test users (n = 4) gave written and oral feedback of the 360°VLE in free form. Full description of the development phase is available in chapter 4.4 and in Paper IV.

Phase III: Evaluation phase

In the phase IIIa), the quasi-experimental intervention study was conducted (Paper IV). The intervention group (n=450) and the control group (n=665) received a digital entrance examination invitation letter with information about the study. In addition, the intervention group received information about the 360°VLE and a weblink to the virtual environment. The intervention group was invited to use the 360°VLE and were informed that the 360°VLE would be open until the end of the entrance exam day on 28th of May 2019. The applicants in the intervention group were allowed to use the 360°VLE as many times as they wanted from 7th May until the entrance

exam day on 28th of May 2019. The students in the control group did not receive such information or a link to the 360°VLE.

The data was collected with the PNPI₂ and with the background questionnaire from the intervention group (n=450) and from the control group (n= 665) as a part of the entrance exam to nursing education on May 28th, 2019 in the six UAS participating ReSSNE project.

4.3 Instruments

The Perception of the Nursing Profession Instrument (PNPI₂) was used to measure the nursing applicants' perception of the nursing profession as a part of a student selection to nursing education (Paper III, Paper IV). The Perception of the Nursing Profession Instrument was developed between the years 2016 and 2022. The first version of the Perception of the Nursing profession Instrument (PNPI₁) was developed by the researchers in the ReSSNE project between years 2015–2016. The second version of Perception of the PNPI₂ was developed between the years 2016–2022 as a part of this study. A new version was needed to offer more structured, in-depth and international description of perception of the nursing profession. Both instruments are described in detail in the Paper III. In addition, Positive System Usability Scale (P-SUS) (Brooke, 2013; Jokela, 2013) was utilised to measure the usability of the newly developed 360°VLE, which was utilised as a part of the intervention study.

Perception of nursing profession instrument -version 2 (PNPI₂)

PNPI₂ was developed in two phases, which were development of the PNPI₂, and psychometric testing of the PNPI₂ (Figure 3). The current recommendations for instrument development were followed in the process (e.g., DeVellis, 2017, Rattray and Jones, 2007, Tennant and Conaghan, 2007, Stolt et al., 2022).

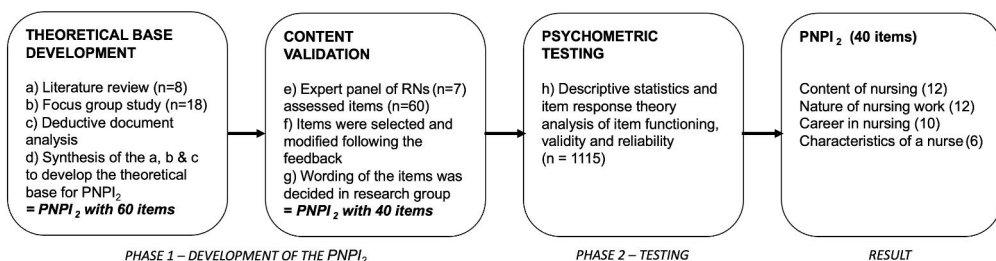


Figure 3. Development process of the PNPI₂.

The theoretical base of the instrument was based on the integrative literature review (1a), focus group study (1b), deductive content analysis of the documents regulating the nursing education nationally (1c) (Figure 3) and the qualitative synthesis of the qualitative datasets (1a, 1b and 1c). As a result of the synthesis, four main categories emerged: 1) the content of the nursing work, 2) the nature of the nursing work, 3) career in nursing profession, and 4) characteristics of a nurse. Furthermore, PNPI₂'s items (n = 60) were developed based on the Perception of the Nursing Profession theoretical base (chapter 5.4, Figure 9).

Items' content validity (n = 60) was assessed by an expert panel of voluntary registered nurses (Rattray and Jones, 2007) (Figure 3, Paper III). The experts were purposefully selected registered nurses (n = 7) who were recruited from Finnish Nurse Association's regional boards. The experts were invited to participate via email from different nursing specialty fields, and they all had more than five year's work experience as a registered nurse. The Expert panel (n = 7) evaluated the items relevance and clarity in two rounds with a four-point Likert scale (1 = not relevant, 4 = very relevant) and Item -level Content Validity Index (I-CVI) for the items' relevance was calculated (range 0,57–1,00) and 80 % was set as a limit for the item's acceptance to the instrument (Polit et al., 2007). Furthermore, the clarity of the items was assessed with dichotomous scale (yes/no). Items (n = 10) clarity was enhanced following the experts' suggestions. The modified items were sent back to the experts, and no further modification were suggested. The items inclusion and exclusion to the instrument was based on the expert evaluation and group discussion in the research group (total amount of items was 40: 31 items with I-CVI = 1, 8 items with I-CVI 0,86 and one theoretically important item with I-CVI = 0,57).

Finally, the research group decided the exact wording of the selected items and formulated the items as statements of the nursing profession. In addition, 14 statements from the PNPI₁ were included to PNPI₂ because items discriminatory power was stated good in the earlier pilot test by ReSSNE project, and the items matched with newly developed theoretical base's items. Moreover, new positively and negatively worded statements (n = 26) were developed, reaching 40 items in total for the PNPI₂.

In the psychometric testing phase, PNPI₂'s psychometric properties were tested in six UAS who participated ReSSNE project, among applicants to nursing education (n = 1115) who completed the digital entrance examination and gave a consent to participate the study as a part of an entrance exam to nursing education (28 May 2019) (Figure 3, Paper III). The psychometric properties were tested using Item Response Theory (IRT) (Phase IIa) Paper III). The psychometric tested offers information about the instrument's validity and reliability (DeVon et al., 2007). In addition, item difficulty and instrument's ability to separate high and low performing students was analysed. This was important aspect to test because the instrument was

developed for the student selection purposes (Boone, 2016). The results of the psychometric testing are reported in the chapter 5.5 and in Paper III.

Finally, PNPI₂ consists of 40 items, which measures the perception of the nursing profession based on the following domains: the content of nursing work (12 items), the nature of nursing work (12 items), the career in the nursing (10 items) and the characteristics of a nurse (6 items) (Figure 3, Paper III). Items are statements of the nursing profession, and respondent answers by selecting one of the following: correct, uncertain, incorrect. In this study, the instrument was in a digital form integrated to the joint entrance examination digital platform. It was completed under supervision in a quiet classroom. The time limit for the joint entrance examination was two and a half hours and student could proceed in their own pace. The scoring of the PNPI₂ is based on the number of the correct answers. Every correct answer is 0,5 points, uncertain answer is 0 points and incorrect and unanswered answers are - 1 points (Paper III).

Positive System Usability Scale (P-SUS)

Positive System Usability Scale (P-SUS) was utilised to measure the usability of the 360° virtual learning environment, which was developed as a part of this study (Jokela, 2013, Paper IV). P-SUS is based on System Usability Scale (SUS), which was originally developed by Brooke (1996, 2013) as an easy, reliable, and quick way to measure usability. The SUS includes ten negatively and positively worded items measuring the usability subjectively from the system users. The scale uses 5-point Likert scale (1 = strongly disagree- 5 = strongly agree). The score is presented in the range between 0-100. The SUS score above 68 can be considered as better than the average usability, and in contrary, score below 68 indicates lower than the average usability (Brooke, 2013, Paper IV).

In this study, the Finnish version of the P-SUS was utilised. In P-SUS all the items are positively worded (Jokela, 2013) to make the items more easily understandable for the user responses and to avoid mistakes in interpreting the items and reporting the users responds (Sauro and Lewis, 2011).

4.4 Development and description of the 360° virtual learning environment (360°VLE)

4.4.1 Development of the 360°VLE

In this study, the intervention is a 360° virtual learning environment, which shares correct information about the nursing profession. The intervention was developed together with the PNPI₂, and they are both based on the Perception of Nursing

Profession theoretical base developed in the theoretical phase of this study (More information in chapter 5.4, Figure 9). The intervention development process was guided by the main principles of Medical Research Council’s (MRC) recommendations of developing complex interventions (Craig et al. 2013; Figure 4). Additionally, Tidier checklist was utilised to describe the intervention (Hoffmann et al., 2014). The intervention development process included three phases (Figure 4) which were 1) intervention development, 2) piloting and 3) intervention evaluation among applicants to nursing education in the entrance exam setting (Paper IV).

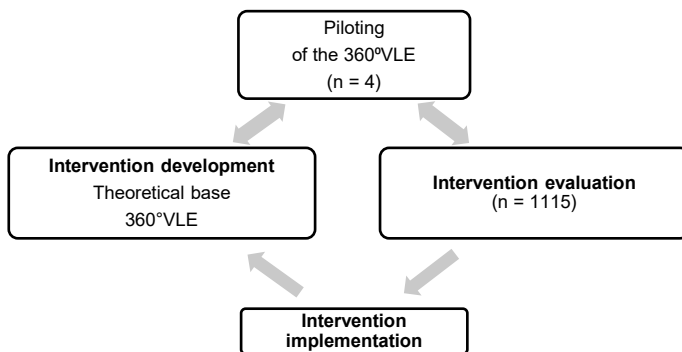


Figure 4. Intervention development process following the MRC framework (Craig et al., 2013)

The intervention development started with developing the Perception of the Nursing Profession theoretical base (see chapter 5.4).

The development of the 360°VLE was carried during the spring 2019 (Figure 4). The content for the 360°VLE was collected from internet following the theoretical base. The material was searched from Google, YouTube, and other relevant websites, because the idea was to use already existing online material which was available for nursing applicants. Main researcher collected the material on a word spreadsheet, and after that, the materials suitability for the 360°VLE was evaluated in research group. In addition, a short video about the nursing profession, and short texts were written to fully cover the theoretical base. The short film described nursing education from nursing student’s perspective. The video was scripted, filmed, and produced by voluntary second year nursing students in co-operation with the main researcher. The short texts were written by the research team.

Also, two digital discussion boards were created with WordPress to allow interaction, and they were integrated in the 360°VLE. The first one was for nursing applicants’ discussion and comments, and the second one was for questions about the nursing profession or nursing education. Short introduction texts were written for the discussion boards, and 360°VLE users were informed, that the possible questions

about the nursing profession were answered by voluntary registered nurses and nurse educators, who were part of the research team. Moreover, Positive System Usability Scale was made as digitally available to measure the usability 360°VLE (see more from 4.3 Instruments section).

In the end, an expert took the 360° images in co-operation with the research team. The 360° images were taken in a hospital setting in a collaboration with voluntary nurses. Finally, the 360°VLE was developed utilising ThingLink program.

In the intervention piloting (Figure 4), purposefully selected voluntary test users (nursing science students $n = 3$, audio visual media student $n = 1$) gave feedback on the 360°VLE's content and on the technical structure after testing the 360°VLE independently (Figure 4). Following their feedback, hotspots were relocated on the learning environment to improve the usability of the 360°VLE with mobile phone interface (Paper IV). Estimation of the recruitment and retention, and sample size determination was not carried out because the study was conducted in entrance exam setting and the entrance exam material had to be kept secret.

Finally, the 360°VLE intervention's effect was evaluated among applicants ($n = 1115$) to nursing education in entrance exam setting (Figure 4, Paper IV).

4.4.2 Description of the 360°VLE

The Perception of Nursing Profession theoretical base (See chapter 5.4, table 5) consists of following categories: the content of nursing work, the nature of nursing work, the career in nursing profession and characteristics of a nurse, which are also the content areas of the intervention. The 360°VLE consist of two panoramic 360° images of nurses' work environments (Figure 5, Figure 6). The user can move and look around in the virtual space and read and watch the selected online material (Table 5, Table 6) about the nursing profession. The users can access the 360°VLE with weblink using smartphones, laptops and or VR glasses (Paper IV, Table 5–6, Figure 5–6)

The 360°VLE was developed utilising a ThingLink, which is a web-based program, which allows developing immersive and interactive learning materials such as 360°VLEs. ThingLink can be used anonymously with smart phones, computers or HDM's, and it is accessible with a weblink. Moreover, ThingLink collects four types of user statistics: number of views (e.g., how many times the content has been viewed) number of tags opens (how many times the user has opened a tag or a hotspot), number of actions (click on the link buttons) approximate time users spent on the media (all views average). The user statistics of the 360°VLE are reported in the Paper IV, supplementary material.

4.5 Data analysis

Phase I: Theoretical phase

In the phase Ia), inductive content analysis was used to analyse the data (Graneheim and Lundman, 2004). Inductive content analysis was selected because it is standardized way to analyse qualitative data (Whittemore and Knafl, 2005), and it is well suited when there is not much prior knowledge and the existing knowledge is fragmented (Elo and Kyngäs, 2008). The main researcher read the articles many times to be familiar with the analysed content. In the data reduction, the perception of the nursing profession was identified from the articles and collected on a word spreadsheet. The meaning unit was a sentence or a word which described young people perception of the nursing profession. The meaning units were coded, and the codes were compared, and similar codes were grouped together to form subcategories. Eventually subcategories were evaluated and synthesised to form the main categories. (Elo and Kyngäs; Graneheim and Lundman, 2004, 2008; Paper I.) In the phase Ib), the data derived from the focus group interviews were analysed using inductive content analysis to describe nursing applicants' perceptions of the nursing profession (Paper II). First, the researcher listened to the audio recordings and transcribed them verbatim. In addition, the researcher read the transcripts (53 pages) several times to be a familiar with the data before organising it. Secondly, meaning units (words, sentences, paragraphs) were condensed close to the original text and coded. The codes were organized to subcategories and later into four categories based on similarities between the codes. (Graneheim and Lundman, 2004; Paper II.)



Figure 5. Room 1 in 360°VLE.

Table 5 Intervention content for Room 1.

Tag content	Learning material
Introduction and instructions	text
Content of nurses' work	text
What is evidence-based health care?	YouTube video
Development of nurses' work	YouTube video
A nurse (surgical ward)	YouTube video
Where nurse's need math? (Perioperative nursing)	YouTube video
What is a nurse doing? (Mental health nursing)	YouTube video
Ethical principles in nursing	Text + external link to website
Evidence-based nursing	Text + external link to website
Working as a nurse in inpatient ward -nurse's role	Blog post
A nurse (cardiology ward)	YouTube video
Ethical guidelines in nursing	Text + external weblink
At home hospital (home nursing)	YouTube video



Figure 6. Room 2 in 360°VLE.

Table 6. Intervention content for Room 2.

Tag content	Learning material
Introduction to the room and instructions	text
Nursing education	text
Nursing student's experiences from nursing education and work of a nurse	YouTube video
Postgraduate studies and work career	text
Nursing science studies	YouTube video
Professional development model for nurses (AURA)	YouTube video
How to apply to study nursing science	YouTube video
Continuous professional specialisation education	text
Nurse prescribing brings health benefit and reduces costs	Weblink to an article
Clinical nurse specialist	YouTube video
Discussion and Q&A forum	WordPress

In the phase Ic), the data was analysed utilizing deductive content analysis to confirm and complement the earlier results (1a, 1b, Paper III). The focus group study results were used as a matrix for the data analysis. The main categories in the categorization matrix were 1) the content of nursing work, 2) the nature of nursing work, 3) the career in nursing profession, and 4) the characteristics of a nurse. In the analysis process, the meaning units were descriptions of the nursing profession and meaning units were conceded and coded following the categories on the analysis matrix. The subcategories were formed inductively. The data fit with the analysis matrix categories, and there was no left-over data.

In the phase Id), the earlier collected qualitative datasets were synthesised utilising meta-ethnographic approach for synthesising qualitative data. A word spreadsheet was made in a way that all the content (factors, sub-categories, and main categories) were visible on one table, which allowed researchers to observe the data in its entirety. In the analysis process, the similarities between the factors, sub-categories, and main categories were looked, and similar factors were moved together. The new group of factors were renamed if it was necessary. (Campbell et al., 2011.) (Paper III).

Phase II: Development phase

In phase IIa), the two-way expert panel ($n = 7$) evaluations analysed items ($n = 60$) relevance and clarity utilizing Content Validity Index (I-CVI) (Rattray and Jones, 2007, (Paper III). The analysis has been described in detail in the chapter 4.3, and in Paper III.

The psychometric properties of the PNPI₂ were tested as a part of an entrance exam to nursing education (28 May 2019) among applicants to nursing education ($n = 1115$). The psychometric properties were tested using IRT (Phase IIa), Paper III). Partial Credit Model (PCM) was utilized in the evaluation of the items' properties. PCM is a an extended Rasch model for polytomous scales. Freely available eRm (Mair et al., 2007) and iarm (Müller, 2020) R packages were utilised in the data analysis. In the analysis, the missing values were located and replaced with medians. The analysis is described in the Table 7 and R code used for the analysis is shared with the paper III.

In the phase IIb), The 360°VLE was test-used by voluntary test users ($n = 4$). Their oral and written feedback was analysed, and requested changes were conducted to improve the 360°VLE.

Table 7. A summary of the methods used in the psychometric tested.

Steps	Psychometric property	Statistical approach and criteria used in this study
1	Instrument functioning and item thresholds Does the instrument function consistently across items?	The partial credit model was used to assess the items difficulty. From this step items thresholds are expected to uniformly cover the entire range of difficulties for the ability of the individuals. The thresholds for each item are also expected to follow the response categories order. (Bond et al., 2020)
2	Internal validity Does each item match the response expected according to the Rasch model?	In this stage the item conditional infit and outfit statistics are computed, and their significance is assessed with Bonferroni corrected p-value < 0.05. (Bond et al., 2020)
3	Internal validity Is the instrument unidimensional?	The Martin-Löf's Likelihood-Ratio-Test was used to assess the unidimensionality of the latent trait. A p-value > 0.05 means that the instrument is unidimensional. (Christensen et al., 2017)
4	Internal validity Are the items independent?	The test of local dependence for the items identifies those times that are very similar. Dependent items are those with residual covariance > 0.2 or < -0.2. (Christensen et.al., 2017)
5	Instrument reliability Is the person sample large enough to confirm the item difficulty hierarchy (= construct validity) of the instrument?	To assess the instrument reliability, the item-separation reliability is expected to be larger than 0.9. (Linacre , 2019)
6	Person-response validity How closely do the individual responses match the responses expected according to the Rasch model?	The persons' infit and outfit statistics are expected to have Z values between -2 and 2. A maximum of 5% of participants should be outside the desired range. (Kottorp et al., 2003)
7	Person-separation reliability Can the tool separate two distinct groups of participants?	The persons-separation reliability is expected to be larger than at least 0.7, ideally larger than 0.8 to claim that two or more groups can be identified. (Milliken et al., 2018)

Phase III: Evaluation phase

In the phase IIIa), the data was analysed utilising multiple linear regression model to control for the possible confounding participant background factors (James et al., 2013) (Paper IV). The data consisted of the measured background factors. The dependent variable was the total score of the PNPI₂ (a number between 20 and -20)

for each individual. In the data analysis, the data was pre-processed, and quality of the data was verified with a custom Python script, which checked that the data consisted of participants gave their consent for the quasi-experimental study, and who answered at least 75% of the items. In addition, median value was used to replace the missing values, outliers were identified with Hampel filter approach (Leys et al., 2013) and removed from subsequent analyses steps. Moreover, participants who reported that they did not visit the 360°VLE were also removed from the intervention group. In the end, descriptive statistics were computed for all participants, and separately, for participants in the control group and for participants in the intervention group. The participant flow is described in the Figure 7.

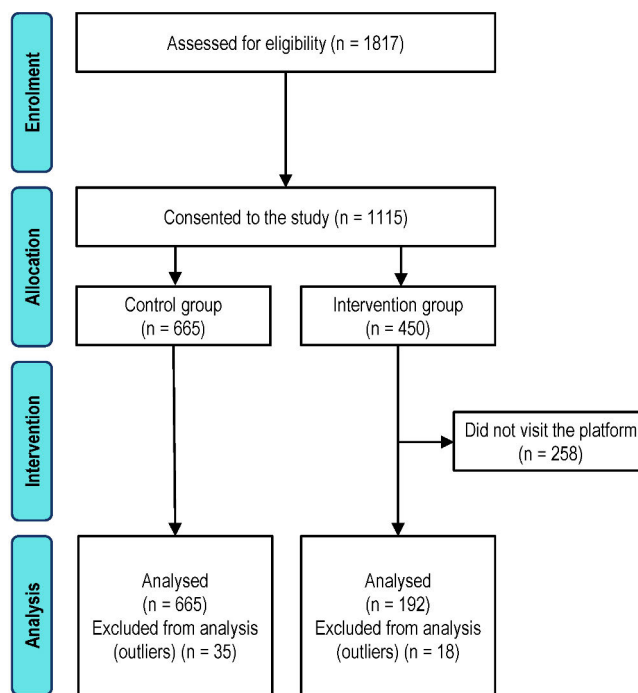


Figure 7. Participant flow in the quasi-experimental intervention study.

In phase IIIb), the usability of the 360°VLE was evaluated with P-SUS (Brooke, 1996; Jokela, 2013,). The questionnaire was developed in digital form utilizing Google Forms. The responses were scored with Google Sheets so that the final score for each answering participant was a value between 0 (all items marked with the lowest Likert option) and 100 (all items marked with the highest Likert option).

4.6 Ethical considerations

The ethical principles of responsible conduct of research, good scientific practice (European Code of Conduct on Research Integrity, 2017; National Advisory Board of Research Ethics, 2012, 2019; General Data Protection Regulation, European Union 2016; Data Protection Act 1050/2018) were followed throughout the study. The ultimate goal of the study was to develop evidence-based and objective student selection methods in nursing education, and to promote correct perception of the nursing profession to foster the career choices in nursing. The study is ethically acceptable and relevant as it produces new knowledge on the young people and nursing applicants' perceptions of the nursing profession, which is an under researched topic. Results of this study can be used to update how the nursing profession is perceived among young people and nursing applicants, and to support the career choices in nursing. Fostering the recruitment of new generations to the nursing field and preventing wrong career choices has an impact on nursing shortage and eventually to patient safety and to the quality of the patient care (WHO, 2020). Moreover, this study produced an evidence-based, objective and valid instrument to measure perceptions of the nursing profession as a part of student selection in nursing education. Developing valid and objective student selection methods is ethically very important, as the student selection processes should treat applicants fairly and equally, and be transparent (WHO, 2009).

Phase I: Theoretical phase

In theoretical phase, an integrative literature review and focus group study were conducted. In the literature review, ethical approval and study permissions were not requested since the dataset comprised as earlier published research articles, which were available on in the selected databases.

In the qualitative descriptive focus group study, the ethical approval was gained from the Ethics Committee of Higher Education Institution (11 September 2017) (Paper II). The permissions to conduct the study as a part of student selection were granted from the participating universities of applied sciences. Moreover, an informed consent was obtained from all the study participants. The study participants were invited to participate the study via entrance examination letter three weeks before the interview. In the information letter they were informed about the study and their possible contribution to the study. They were informed about the voluntary nature of the study, their rights as study participants. They were also provided the contact information of the principal researcher. Moreover, it was emphasised that their participation to this research would not affect their student selection to nursing education. On the entrance exam day, applicants were informed about the study on the registration desk and before the interview. All the participants signed the consent

form prior to the interview. With the signature, they confirmed that they had understood the aim of the study, their role, and rights as study participants. Moreover, participants were encouraged to respect the anonymity of the other participants and confidential nature of the group interview, as the full anonymity could not be fully due to the nature of the data collection method. In data processing, the anonymity of the study participants was protected. The interviews were recorded, and the audio recordings were stored securely and protected with passwords. The audio recording to were transcribed to verbatim and the responses were anonymised by giving codes to different study participants (e.g., I3P4 = interview 3, participant 4) to anonymise the responses. The data will be stored until the end of the project, and it will be destroyed after.

In the document analysis, all the material was freely available online and no permission were needed to analyse the articles.

In the qualitative synthesis, the data consisted earlier collected datasets, which were already anonymised and analysed earlier. In the synthesis process

Phase II: Development phase

In the expert panel evaluation (Paper III), the experts were recruited through the Finnish Nurses Association, and they participated in the panel on a voluntary basis. Participants received information about the study through an information letter which was sent to them by email from the Finnish Nurses Association. Voluntary participants contacted the main researcher and they consented to participate the study via email. Expert panel participants received more information about the study and its purpose and their rights and role as expert and information about the participation.

In the psychometric testing of the PNPI₂, the ethical approval was requested and obtained from Human Ethics Committee of Satakunta region (14 of April 2019). In addition, the permission to conduct the study was received from the six UAS, who participated the ReSSNE project. Moreover, nursing applicants received the study information letter with the entrance exam invitation in a digital form. They were also informed that the UASs did not receive information about their participation to this study. The informed consent was obtained digitally from the voluntary study participants (n = 1115), who completed the PNPI₂ as a part of the entrance exam. The main researcher obtained the data from the ReSSNE project manager. The data was pseudo anonymised, stored securely, and it was protected with a password.

In the intervention development, only freely available online materials (YouTube videos and articles) were used in the learning environment. One blogpost was selected, and the permission to use it as a learning material on the 360°VLE, was requested from the blogger. Furthermore, one short video was filmed for the learning environment. The video described nursing education from the nursing student's

perspective, and it was planned and produced by two nursing students. The video was part of their voluntary project studies, and they received 3 ECTS for planning and producing the video. The students recruited voluntary nursing students to be interviewed on the video. All the participants in the video were informed about the use of the video, and they signed a filming permission.

In the technical development, the digital learning environment was developed on a ThingLink learning platform, which required a license to develop the 360°VLE. The users could use the 360°VLE free of charge without registering on any time during in the intervention delivery time. The virtual tours were developed on 360° images, which were taken in hospital environment. The unit head nurse worked as a contact person and the contact person was informed about the study and the use of the learning environment. The head nurse applied the filming permission from the hospital board and informed the staff members of the filming location well in advance. The staff members received the information about the study in their weekly meeting and with an information letter, which they received via email. Moreover, voluntary nurses were recruited to participate the filming of the 360° images. The invitation and information letter were sent to the nurses who had a work shift on the filming day in the unit. They were provided information about the project aims, their possible contribution in the development of the digital learning environment, their rights as a voluntary participant, the use of the 360° images as a part of virtual learning environment, and in reporting the study findings in scientific journals and conferences. They were also informed about the future use of the learning environment. On the filming day, the filming was conducted following the guidelines and instructions from the hospital. The filming team (n = 2) had both bachelor level healthcare education, and they were both aware how to operate safely in hospital environment. The filming did not affect the care of the patients. The anonymity of the patients was protected with portable walls and making sure that the patients were not recognizable. Moreover, the head nurse had chosen the filming locations and made sure that the confidential material was removed from the space before the filming. In the end, the 360° images were sent to the head nurse, who confirmed that the pictures did not include confidential information and gave a permission to use the 360° images in the 360°VLE.

Phase III: Evaluation phase

In the quasi-experimental intervention study (Paper IV) was conducted together with the psychometric testing. Thus, the ethical procedures related to obtaining research permissions, and recruiting participants for the study are the same in both phases (IIa and III).

Moreover, in the quasi-experimental study, the participants could not be randomized to intervention and control group because of a fair treatment of applicants. UASs participating the ReSSNE project had mutual co-operation agreements, and according to the agreement, applicant could apply with one entrance exam to those UAS, who were under the same agreement. Therefore, the research group had to make sure that all the nursing applicants in the intervention group and in the control group were under the same co-operation agreement. In this way it was made sure that everyone applying to same UAS were instructed to the entrance exam in the same way, and they had equal access to the 360°VLE.

5 Results

In this section, the results will be described following the study phases (I–III) and RQs from 1 to 8. Finally, the main results of the study are summarised. More detailed description of the results is presented in the original research publications (I–IV).

5.1 Perception of the nursing profession among young people and factors influencing the perception

Young people's perception of the nursing profession

The integrative literature review (n = 8, articles published between 2006–2016) described young people's perceptions of the nursing profession (Paper I). The articles were from USA (n = 4), UK (n = 2), Italy (n = 1) and one study was from USA and Israel (Paper 1). In the review, young people's perception consisted of five categories which were 1) contents of nursing work, 2) nature of the nursing work, 3) nursing as a career choice 4) requirements of the nursing profession, 5) characteristics of a nurse (Paper I).

The contents of nursing work was described as patient care, assisting doctors, and working with technology. The nature of nursing work was described as nurses' working conditions, working hours, and the autonomy of nurses. Working conditions were considered poor, and nursing was described as stressful, busy, and hard work with restricted level of autonomy and flexibility. Nursing as a career choice was discussed by describing the career progression opportunities in nursing, nurses' salary, job security, and the status of the nursing profession in the society. The career progression opportunities were described as limited, and the opinions of nurses' salary varied from low income to good income, and some young people were unaware of the nurses' income. Moreover, nursing was seen as stable job. The status of the profession was described as low, although the work of nurses was also considered meaningful and important. Requirements of the nursing profession were educational requirements and personal interest in nursing. Educational requirements were considered as non-academic, and the length of the education was described

long. Some young people were not aware of the educational requirements. Young people's personal interest to nursing varied. Characteristics of nurse were described in terms of their personal and physical qualities and skills. Nurses were considered as kind, caring and open-minded people with good physical condition, and good social skills. Finally, young people described nurses as less intellectual persons (Paper I).

Factors influencing the perception of the nursing profession among young people

Factors influencing young people's perception were 1) personal factors, 2) friends, 3) family and relatives, 4) other significant people and 5) media (Paper I). Personal factors were described as personal interest towards nursing, experiences from nursing, gender, and success in the studies. Nursing was considered as an occupation, which fits better to females. People with high GPA were less interested in applying for the nursing profession. Furthermore, friends have an impact on young people's perception of the nursing profession. Friends who work as nurses provide information to nursing applicants, although, the information did not always encourage young people to pursue a career in nursing. Furthermore, family members and relatives influence on the perception of the nursing profession was stated meaningful. Support for the career choice especially from mothers and grandmothers, were identified to influence on the perception. Families with academic background, did not recommend nursing to young people. Family members working as nurses, did not encourage young people to apply to nursing. Other significant people, such as teachers and career advisors, also influence the perception. Moreover, media influences young people's perception of the nursing profession. The portrayal of nurses on the internet and TV shows did not motivate young people to pursue a career in nursing (Paper I).

5.2 Perception of the nursing profession among applicants to nursing education and factors influencing the perception

Nursing applicants' perception of the nursing profession

Nursing applicant's perception of the nursing profession was studied among 18 voluntary nursing applicants (61% females, 39% males, median age 21) (Paper II). None of them had previous work history in nursing, however, approximately half of them (56%) had applied to nursing education before. For most of them, (78%) nursing was a first choice to study, and they all agreed with the statement that they

have realistic perception of the nursing profession (strongly agree 56%, agree 44%). Nursing applicants' perception of the nursing profession consisted of following categories 1) the content of nursing work, 2) the nature of nursing work, 3) career in nursing profession, and 4) characteristics of a nurse (Paper II).

The content of nursing work consisted of direct nursing tasks, indirect nursing tasks and decision making in nursing. Direct nursing tasks were caring, helping patients with their daily activities, and carrying out practical nursing tasks such as administering medication, taking samples and taking measurements. Being present for the patient was described as co-operation with the patient, giving them time and creating a feeling of trust. Patient counselling was described as health promotion and offering information and instructions to patients and their families. Moreover, indirect nursing tasks such as documentation on preparatory nursing tasks were mentioned. Documentation was described as documenting important things about the patient. Preparatory tasks were described as handing medicines, scheduling, preparing operating theatres and instruments for surgery. Furthermore, nursing applicants stated that nurses must do decisions in their daily work, but they were not sure what kind of decisions nurses are allowed to do, and whether they are allowed make them independently. Patient care planning, diagnosing, and evaluating the need for treatment were mentioned as an examples of decisions made by nurses (Paper II).

The nature of nursing work was described as demanding and rewarding work with limited autonomy. Nursing was stated as evidence-based practice, and nurses were told to work in multiprofessional teams. Moreover, nursing applicants stated that the work environment influences on the nature of the work. Nurses were told to work under high stress and pressure, although, the rewarding nature of nursing and pleasure of helping others was also discussed. The autonomy of the nurses was seen limited. Furthermore, nursing was seen as evidence-based practice, in which the theory is used in practice to justify different actions and tasks. Teamwork was also told to be an important part of the work and nurses were told to work in teams with practical nurses, doctors, medical laboratory scientists and physiotherapists. The nature of nursing work was also said to vary between the workplaces and nurses might have different responsibilities, working conditions and autonomy in different places (Paper II).

Career in nursing was described in terms of nurses' educational opportunities, versatile career options and nurses' employment situation. Nursing applicants described nursing education as short, but with good opportunities for further education. In addition, midwifery, paramedic, and public health studies were also mentioned as further educational opportunities, as well as studies in psychology, psychotherapy, and psychiatry. Nursing applicants described nurses career options versatile and the possibility to change the specialization field and the work unit were

seen as positive aspects in nurses' work. Moreover, the nurses' employment situation was stated good, and nursing was seen as steady work with financial security (Paper II).

Characteristics of a nurse nursing applicant's mentioned suitable attitude, character, good general education, theoretical competence and working skills. Suitable attitude was described as patient-centred, open-minded, positive, adaptable to constant changes and unpleasant working conditions. Furthermore, nurses must have suitable character, which was described as social, pedantic, and brave. According to nursing applicants' nurses must have a good general education and theoretical competence in nursing. Nursing competence included knowledge of diseases, the chosen specialty field, anatomy, physiology, hygiene, medication, and nursing equipment. Theoretical competence related to laws, rights and responsibilities was also mentioned. In addition, working skills, such as, professional nursing skills, management skills and communication skills were also mentioned (Paper II).

Factors influencing the perception of the nursing profession among applicants to nursing education

Most of the nursing applicants (94%) reported seeking information about the nursing profession before attending the entrance exam (Paper II). They sought information of the nursing profession from internet (78%) and from family (50%), and friends (39%) who have a degree in nursing. Factors influencing nursing applicants' perception of the nursing profession consisted of 1) personal factors, 2) family and friends 3) career counselling and 4) media.

Nursing applicants indicated that personal factors influencing on their perception of the nursing profession were personal interest in the nursing profession and experiences from the nursing influence on their perceptions. Personal interest motivates them to seek information about the profession. In addition, positive, and negative experiences from healthcare encourage them to apply to nursing education. Family and friends' roles were also discussed. Family and relatives' support for the career choice in nursing was stated important, although nursing applicants often did not receive support from family, relatives, and friends. Moreover, nursing applicants received information from the nursing profession from career counselling at schools and UAS's open day events. Also, media, and especially internet and social media were also highlighted as an important source of information about the nursing profession (Paper II).

5.3 Nursing profession according to the national regulation of the nursing education

The nursing profession according to the national regulation of the nursing education is presented in the figure 8.

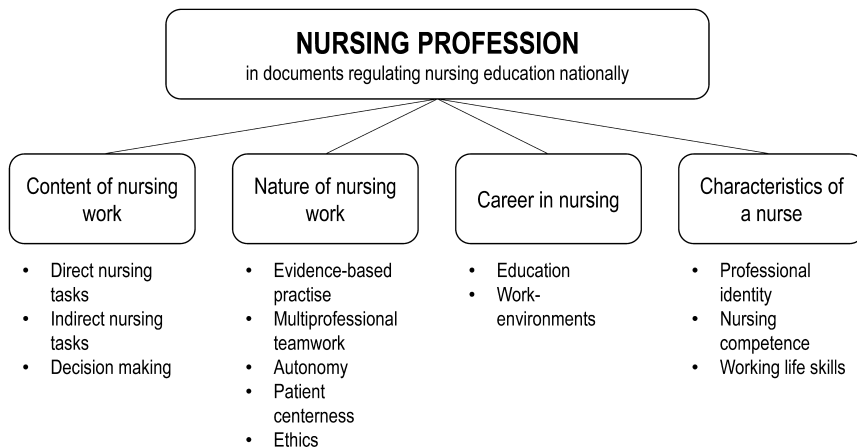


Figure 8. The nursing profession according to the national regulation of the nursing education.

The content of the nursing work was described as direct nursing tasks, Indirect nursing tasks and decision making in the nursing profession. Direct nursing tasks were support, care and assistance of patients, the use of nursing interventions in patient care, implementation of clinical procedures and examinations, responding to patients’ needs, patient guidance and teaching, health assessment, medical care and health promotion and utilization of technology in direct patient care. Indirect nursing tasks were documentation and use of information systems, use of digital services, quality management, patient and social advocacy, guidance, and education of staff members, producing educational and guidance material and development and innovation work. The decision making was described as assessment and prioritization of care needs of patients, care planning coordination and evaluation of the care. In addition, decision making is based on nursing process and is based on evidence.

The nature of nursing work was presented as evidence-based practice, multiprofessional teamwork, autonomy, patient-centredness, and ethics. Evidence-based practice was described as the use of up-to-date information and care guidelines, evaluation of the care practices, use of research/scientific knowledge and evaluation of the research/ scientific knowledge. Multiprofessional teamwork was described as teamwork and collaboration with colleagues, working in workgroups,

working in networks, and working in pairs with colleagues or other healthcare professionals. Autonomy of the profession was presented as an independent work and operating autonomously in nursing. In addition, autonomy was described as taking responsibility of one's own work and evaluating it and acting as an expert in nursing. Moreover, patient-centredness was also portrayed as patients' active participation in nursing care as well as being an expert of their own care. The nursing care is patient-centred and considers cultural factors. In addition, ethics were linked to nursing and nursing was described as a value-based work guided by ethical principles and guidelines.

The career in nursing was presented as a description of the nursing education and nursing work environments in nursing. Nursing education is regulated, and nursing applicants must meet the eligibility criteria to apply for nursing education. The education includes theoretical studies and clinical training at school and clinical training in nursing environments. Nursing education prepares for expert tasks (or professional level tasks) and nurses are required to maintain their professional skills throughout the career. Moreover, nurses' work environments were described as social and healthcare environments, organisations, communities, and virtual environments.

Characteristics of a nurse were described as professional identity, nursing competence and work life skills. Professional identity included adopting professional identity and being professionally active and understanding the importance of evidence-based practice. Nursing also requires adequate competence related to the nursing profession and work life skills such as leadership and management skills, communication, interaction skills and language skills, information use skills and international skills/preparedness for international activities.

5.4 Theoretical base of Perception of Nursing Profession

In the synthesis, theoretical base for the perception of the nursing profession was developed. The perception of the nursing profession consists of the following categories: the content of nursing work, the nature of nursing work, career in nursing and characteristics of a nurse (Figure 9).

The content of the nursing work included indirect nursing tasks, direct nursing tasks and decision making. Career in nursing included education and work career. The nature of nursing work included evidence-based practice, multiprofessional teamwork, workload, autonomy, ethical principles in nursing, required competence. Characteristics of a nurse included attitude, personal characteristics, and professional identity. The full content of the Perception of the Nursing Profession theoretical base is described in the Figure 9.



Figure 9. Perception of the nursing profession theoretical base.

5.5 The content and the psychometric properties of the PNPI₂

PNPI₂ measures perception of the nursing profession with 40 items in four subscales: content of nursing work (12 items), career in nursing (10 items) nature of nursing profession (12 items) and characteristics of a nurse (6 items) (Paper III, IV, Figure 3). The items are statements of the nursing profession (e.g., nurses work in multiprofessional teams, nurses have career development possibilities). The items are in mixed order. The instrument was developed in Finnish, and in digital form. Response options are: 1) correct, 2) uncertain, 3) incorrect and the respondents were requested to pick the right box. The maximum score is 20 points (every correct response equal to 0,5 points, uncertain response equals to 0 points, and incorrect response equals to - 0,5 points) (Paper III, Paper IV).

The psychometric properties of PNPI₂ were tested in nursing education entrance exam among (n = 1115) voluntary nursing applicants in May 2019. The demographic information of the participants is provided in the Table 8.

Table 8. Demographic information of participants (n = 1115).

Variable	N	%	Range	Mean (SD)
Age in years	1108		18—55	24.41(7.12)
Sex				
Female	954	86		
Male	155	14		
Background education				
High school	596	53.7		
Vocational school	514	46.3		
Previous degree in higher education				
Yes	97	8.8		
No	1007	91.2		
Previous applications for nursing education				
Yes	452	40.8		
No	655	59.2		

* Missing participant values: Age in years (n =7), gender (n = 6), background education (n = 5), previous degree in higher education (n =11), previous applications for nursing education (n = 8).

The psychometric testing revealed that most of items in the PNPI₂ were easy and items did not cover the full range of difficulty of the participants ability (Figure 10).

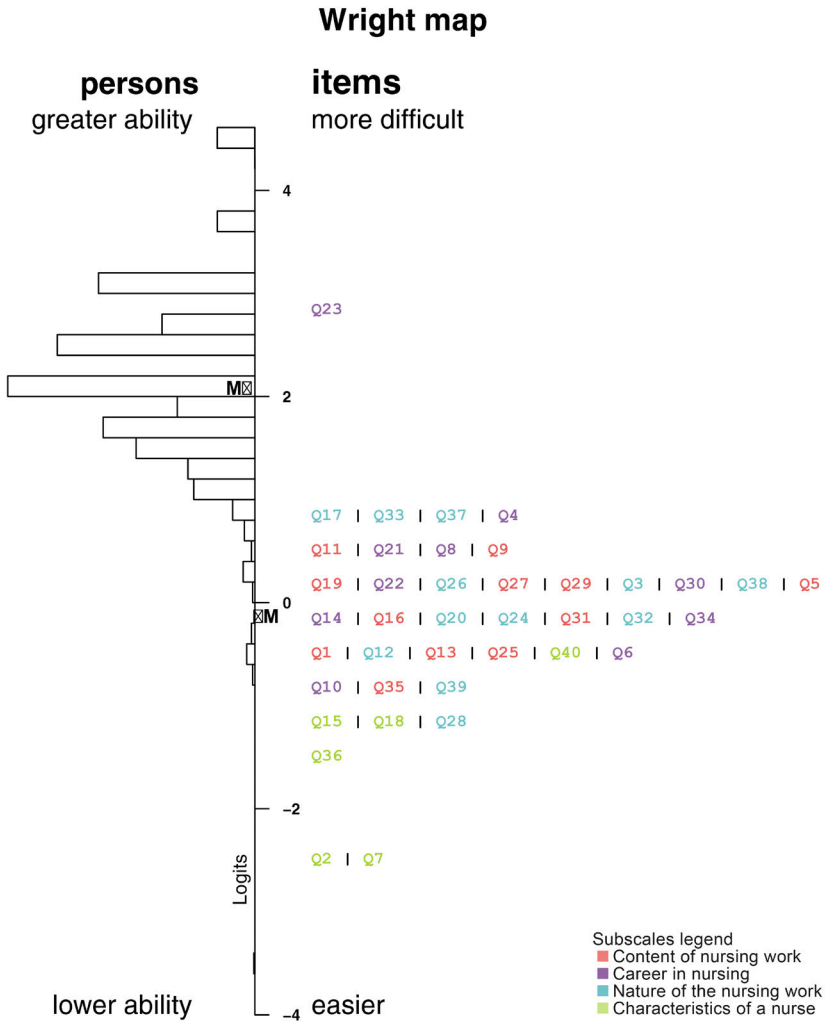


Figure 10. Wright Map.

Each item (on the right-hand side) is shown at the measured location (equivalent to item difficulty). Items on the lower part of the figure are easier, items on the top are more difficult. Items belonging to the category “Characteristics of a nurse” were the easiest. Participants' performance (on the left-hand side) is skewed towards the top as most participants correctly answered most of the questions. This results in a large gap between the means M of the two distributions.

The results indicated good internal validity and reliability for the PNPI₂. Three items did not fit to the model and items in the subscale four showed dependency indicating that the items are measuring the same thing. The summary of the results is provided in Table 9 and more information is provided in Paper III.

Table 9. Results of the psychometric properties of the PNPI₂

Steps	Psychometric property	Results
1	Instrument functioning and item thresholds Does the instrument function consistently across items?	Most of the items were easy, and the order of thresholds was inverted for most of the items, which is a consequence of the low degree of difficulty of the items.
2	Internal validity Does each item match the response expected according to the Rasch model?	Three items (n = 3) were not fit to the model (C2–Q4, C2–Q23 and C3–Q37)
3	Internal validity Is the instrument unidimensional?	The unidimensionality was successfully confirmed.
4	Internal validity Are the items independent?	Seven items (n = 7) showed significant dependence, especially items belonging to subcategory 4.
5	Instrument reliability Is the person sample large enough to confirm the item difficulty hierarchy (= construct validity) of the instrument?	Item separation reliability (ISR) was 0.945, indicating that the sample used was large enough to assess the properties of the instrument
6	Person-response validity How closely do the individual responses match the responses expected according to the Rasch model?	Only 4.70% of participants did not show acceptable goodness-of-fit.
7	Person-separation reliability Can the tool separate two distinct groups of participants?	PSR was 0.605, indicating that the instrument is not able to properly separate the high-performing participants from the low-performing

5.6 The effect of the 360°VLE on nursing applicants' perception of the nursing profession

In total, 1115 nursing applicants participated the study. The participants were divided to intervention (n = 665) and control (n = 450) group based on the UAS they applied to. After removing outliers and the participants who did not visit the 360°VLE, the total number of participants was n = 804 (intervention group n = 174, control group n = 630). The participants were mostly females (85,32 %) and their median age was 22 (18–55). Half of the participants prior work experience from the healthcare.

Most of the participants sought information about nursing profession before attending to the entrance exam. Most participants sought information from nurses (control group 85,87 %, intervention group 77, 59 %) internet (control group 67,3

%, intervention group 88,51%) or friends who were nursing students (control group 57,62%, intervention group 56,9 %). The full description of the participant characteristics is described in in Table 10, the participants' allocation flowchart is visualised in Figure 7, and the results are presented in Table 11.

Table 10. Characteristic of the control and intervention groups and statistical comparisons.

Background factors	Total (N = 804)	Control group (N = 630)	Interventio n Group (N = 174)	P-value
age: median (min, max)	22 (18, 55)	23 (18, 55)	21 (18, 53)	< 0.001**
sex (% of females)	85.32%	84.76%	87.36%	0.392
education (% of high school)	49.38%	44.76%	66.09%	< 0.001**
sought information	97.64%	97.46%	98.28%	0.531
sought information from nurses	84.08%	85.87%	77.59%	0.008*
sought information from nursing student friends	57.46%	57.62%	56.90%	0.865
sought information from other friends	19.53%	19.52%	19.54%	0.996
sought information from the Internet	71.89%	67.30%	88.51%	< 0.001**
sought information from TV and movies	26.87%	24.29%	36.21%	0.002**
sought information from magazines and books	26.12%	24.60%	31.61%	0.063
sought information from a career counsellor	19.15%	15.56%	32.18%	< 0.001**
sought information from events by UAS	11.32%	9.52%	17.82%	0.002**
applied to nursing education in the past	42.54%	43.97%	37.36%	0.118
worked in healthcare in the past	52.74%	57.14%	36.78%	< 0.001**
self-reported perception of the nursing profession: median (min, max)	1 (-1, 1)	1 (-1, 1)	1 (0, 1)	0.662

* = statistically significant at the level of $p < 0.05$. ** = statistically significant with Bonferroni correction ($p < 0.00357$).

The results of the multiple linear regression model indicate that the use of 360°VLE has a statistically significant effect on the PNPI₂ score (effect size 0.3, CI 0.13 0,46, p value = 0.0002). Previous work experience in healthcare, age, seeking information from nurses and friends and events organised by UASs were significant in explaining higher PNPI₂ score. However, the model explains around 15% of the

variance of the scores (adjusted $R^2 = 0.151$), which could indicate the presence of other unknown background factors connected to the PNPI₂ score.

Table 11. Results of the multiple linear regression for the factors explaining the PNPI₂ score.

	Effect Size	Effect Size confidence interval (5th and 95th percentiles)	Estim.	Std Error	t-value	P-value
(Intercept)	-0.44	[-0.72, -0.15]	15.33	0.38	40.85	< 0.001*
age	0.15	[0.08, 0.22]	0.03	0.01	4.36	< 0.001*
sex	-0.01	[-0.20, 0.17]	-0.02	0.18	-0.10	0.919
education	-0.14	[-0.30, 0.02]	-0.24	0.15	-1.60	0.110
sought information from nurses	0.2	[0.01, 0.38]	0.35	0.17	2.08	0.037*
sought info from friends who study nursing	-0.02	[-0.16, 0.11]	-0.04	0.12	-0.35	0.727
sought info from other friends	0.17	[0.01, 0.34]	0.30	0.15	1.98	0.048*
sought info from the Internet	-0.07	[-0.23, 0.09]	-0.12	0.15	-0.84	0.399
sought info from TV programs and movies	0.06	[-0.10, 0.21]	0.10	0.14	0.70	0.483
sought info from magazines and books	0.1	[-0.06, 0.26]	0.17	0.14	1.22	0.221
sought info from a career counsellor	-0.18	[-0.37, 0.00]	-0.32	0.18	-1.78	0.076
sought info from events organised by UAS	0.24	[0.01, 0.47]	0.42	0.21	2.05	0.041*
applied to nursing education in the past	0.04	[-0.10, 0.17]	0.07	0.12	0.55	0.580
worked in healthcare in the past	0.51	[0.34, 0.67]	0.89	0.16	5.57	< 0.001*
self-reported percept. of nursing profession	0.03	[-0.04, 0.10]	0.12	0.14	0.84	0.402
visited the 360° VLE	0.3	[0.13, 0.46]	0.52	0.14	3.72	< 0.001*

* N-total = 804, (N-intervention = 174, 21.6%). Residual standard error: 1.62 on 788 degrees of freedom. Multiple R-squared: 0.167. Adjusted R-squared: 0.151. F-statistic: 10.49 on 15 and 788 DF, p-value: < 2.2e-16. * = statistically significant at the level of $p < 0.05$.

5.7 The usability of the 360°VLE

Eventually, 174 nursing applicants in the intervention group had access to the 360°VLE. Based on the anonymous user data from ThingLink programme, the 360°VLE's room 1 was viewed 585 times, and tags were opened 1762 times. The

approximate time spent in the room 1 was 6 hours 32 minutes. In addition, the 360°VLE 's room 2 was viewed 184 times and tags were opened 673 times. The approximate time spent in the room 2 was 20 minutes 33 seconds. Nursing applicants did not make any questions or comments about the 360°VLE.

A total of $n = 37$ participants answered the P-SUS. The usability score calculated with P-SUS was 92, which indicates very good usability (Brooke, 2013).

5.8 Summary of the main results

Based on the findings, the perception of the nursing profession (Figure 11) consists of the content of nursing work, the nature of nursing work, career in nursing and characteristics of a nurse. Young people held misperceptions regarding the nursing profession, and they had a limited understanding of nurses' work. Nursing applicants had more varied understanding of nursing, although their perception was also one-sided and partly incorrect. The perception of the nursing profession is influenced by personal factors, media, family, relatives, and friends. Also, career counselling, encounters with nurses and experiences from healthcare influences the perception of the nursing profession

PNPI₂ is an evidence-based, valid, and objective instrument to measure the perception of the nursing profession. The psychometric testing supported unidimensionality of the PNPI₂, although, some items ($n = 9$) were misfit, and require revision. Items of the PNPI₂ were relatively easy, and the difficulty of the items must be enhanced in the future development. The use of 360°VLE had an effect of nursing applicants' perception of the nursing profession, although the model explains only 15% of the variance.

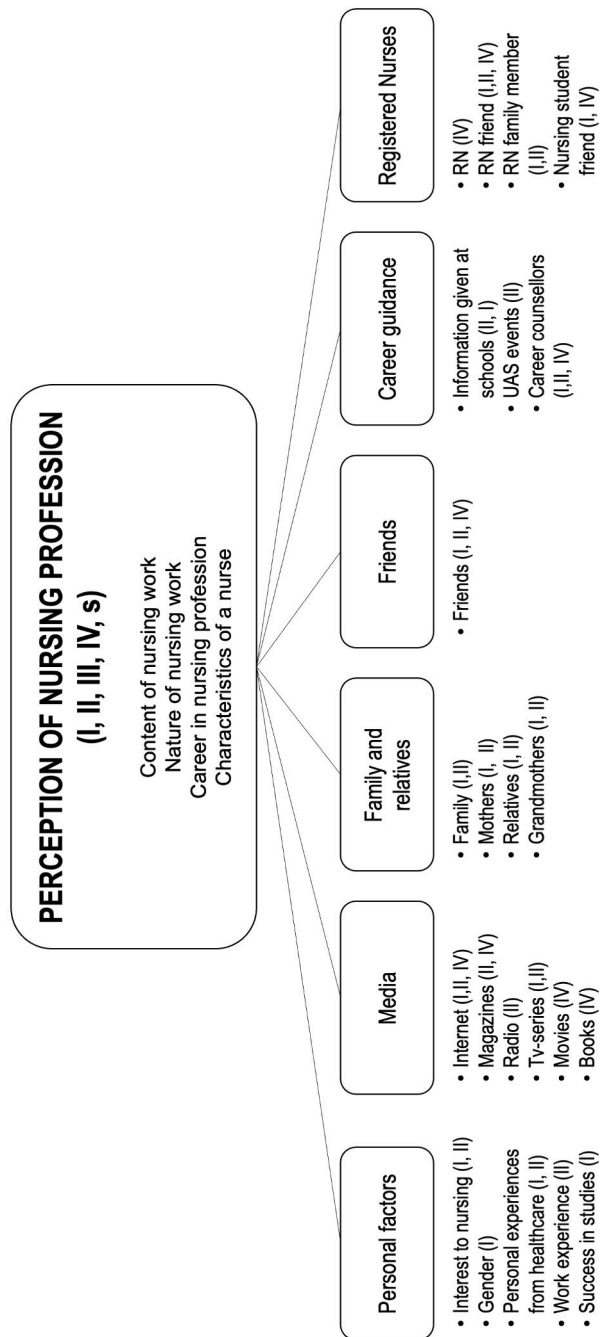


Figure 11. Perception of the nursing profession and the factors influencing the perception among young people and nursing applicants. I = Paper I, II = Paper II, III=Paper IV= Paper IV, s=summary.

6 Discussion

In this chapter, the main results of the study are discussed and reflected based on the earlier literature. In addition, the validity and the reliability of the study are discussed. Practical implications of the study as well as suggestions for future studies are presented in the end of the chapter. More detailed discussion is included in the Papers I-IV.

6.1 Discussion of the results

Young people and nursing applicants' perception of the nursing profession

The literature review revealed that young people's perception of the nursing profession is limited and incorrect. Young people's perception reflects the common stereotypes of nursing profession which has described in the literature (Teresa-Morales et al. 2023). Nursing is portrayed as an unknown profession, valued but not prestigious, and often seen as subordinate to the medical fields. Nursing is also perceived as a profession with low academic requirements and questionable working conditions. These results are in line with the previous studies investigating secondary schools' students' perceptions of the nursing profession in the past (e.g., Brodie et al., 2004; Cohen et al., 2004, Grossman et al., 1989; Miller and Cummings, 2009). Similar findings were reported in the studies conducted after the integrative literature review (McGee et al., 2019; Mert et al., 2020; Mohsen et al., 2022; Palazzo and Eriksson, 2022; Raymond et al., 2018; Omari et al., 2023; Tawash et al., 2018; Öncü et al., 2022). It seems that the perception of the nursing profession has not changed over the past decades, although, nursing profession has evolved. Furthermore, it seems that the perception of nursing profession is similar despite the cultural environment. It has been suggested that the undervaluing of the nursing profession is linked to the fact that nursing is a female dominated profession, and undervaluing the profession is linked to the undervaluing of feminised work (RCN, 2021). The perception that caring is a natural role for females is an opposite to the high level of competence what is required in modern evidence-based nursing. This stereotypical gendered idea of nursing is harmful also for those males, who are considering a

career in nursing. (Prosen, 2022). Efforts must be therefore made to change the gendered perceptions of the nursing profession and to promote the high level of competence required in the profession.

This study highlights the need to correct the misperceptions among young people. Young people need more information about the nursing profession. Young people should be informed about the content of nursing work, and in particular the different roles of nurses' in patient care, the role of nurses in education and research and in societal work should be more highlighted. The nature of nursing work needs to be promoted, and the autonomy of the profession and the independent role of nursing in healthcare should be underlined to correct perception. The autonomy of the profession should be also be promoted to raise awareness of the nursing profession as an independent profession, and as an independent discipline. Promotion of the nursing profession should emphasise the academic requirements of the profession and the professionalism in nursing as stated before in the literature (e.g., by Ten Hoeve et al., 2014, Teresa-Morales et al., 2023).

Nursing applicant's perception of nursing has not been studied in the past literature. This study showed that nursing applicants' perception of the nursing profession was more knowledgeable and diverse compared to the young people's perception of the nursing profession. They were aware that nursing is based on evidence, and it requires knowledge. Although, the stereotypes and the altruistic idea of nursing was present in their perception. Helping others was seen as the main role of a nurse. Nursing was described as rewarding profession, and with high workload and stress. These findings support previous studies describing that nursing students start their studies with idealistic and altruistic ideas of nursing (e.g., Allen, 2022; Prosen, 2022; Sillero et al., 2023). Similar findings were found in a recent study by Lundell Rudberg et al., (2022) who studied newly admitted nursing students before they started their nursing studies According to their study, newly admitted students held a positive and altruistic view of nursing, and they expected nursing to be hands on teamwork, which is demanding and requires knowledge. Newly admitted nursing students were concerned about organisational shortcomings such as working hours, risky working environment, and the salary issues. These findings are noteworthy, as they suggest that although nursing students typically begin their studies with positive perception, they also have doubts and anxieties of their future workplace conditions. These anxieties and doubts may lead to negative perceptions of the profession later in their nursing studies.

Furthermore, this study shows that nursing applicants and young people had a limited understanding of the career possibilities within nursing profession. Nursing was viewed as a secure career choice, however, the awareness of the career opportunities in nursing remained unknown. Similar findings have been reported also in previous studies (Canzan et al. 2022; Skela-Savič et al. 2021; Teresa-Morales

et al. 2023). In this study, nursing applicants described the career progression opportunities in terms of vertical movement, such as changing their work environment, rather than horizontal career progression, such as seeking more advanced roles in the nursing field. In addition, some of the nursing applicants were not aware of the postgraduate study opportunities in nursing (e.g., master programs in nursing science).

These findings highlight the need for a more proactive approach to promoting the career opportunities in nursing. The development of more advanced roles and clear career paths is essential to attract a more diverse range of nursing applicants in the nursing field. In Finland, the career progression in the nursing profession has traditionally involved leaving the clinical work to pursue a career in management, education, or research. In the future, it is important to further develop career progression opportunities within clinical practice itself, and to promote these specialised roles to potential nursing candidates, and for the public. The promotion of the more advanced roles and career possibilities in nursing can eventually lead to a better understanding of the work of nurses and make the independent role of the nursing profession in patient care more visible. In addition, the development of recognized career pathways will make nursing more attractive to those young people who are career orientated or looking for nursing roles outside of traditional patient care.

Factors influencing the perception of the nursing profession among young people and among applicants to nursing education

According to the results, personal factors such as experiences from the healthcare and personal interest in nursing influence young people's and nursing applicants' perception of the nursing profession. Interest in nursing is related to the perception of the nursing profession. This finding is consistent with previous studies which reported that those young people who were interested in nursing tended to have more positive perception of the profession. (Alexander and Diefenbeck, 2020; Subu et al., 2022; Öncü et al., 2022). Furthermore, this study showed that family members play an important role in influencing young people's perception of the nursing profession, which has been also reported previously in the literature (e.g., Kay et.al., 2015; McGee et al. 2019; Mert et al., 2020; Raymond et al., 2018). Although, in this study, nursing applicants' career choice in nursing was not always supported by the family members, and their career choices were questioned. Previous evidence suggests that family support and encouragement is important, particularly for men and boys. Earlier studies suggest that positive reinforcement from family members influences men's decision to pursue a career in nursing (Whitford et al., 2020). Family members perception of nursing profession has not been studied previously despite its

significance. This finding emphasizes the importance of promoting the nursing profession also to the family members, and to the public.

Furthermore, the media influence the young people's and nursing applicants' perception of the nursing profession. According to a recent literature review, the media fails to represent nurses in a modern way and nurses' achievements in clinical, managerial, and academic roles are not portrayed or supported in the media. Unrealistic portrayals of nurses influence the perception of young people and nursing applicants and might not attract young people to apply nursing. (González et al., 2023.) In the past, media campaigns have been used to promote nursing. Recent international campaigns to promote nursing include the Year of the Nurse and the Midwife (WHO, 2020c), Nursing Now Campaign (2018-2021) Nursing Now Challenge (ICN, 2021) and International Nurses Day (ICN, 2024), which is celebrated annually on 15 May. These campaigns aimed to increase the visibility of the nursing profession internationally, for example, Nursing Now Movement has been reported successful (Holloway et al., 2021). In Finland, the campaigns to promote nursing profession have been organised, for example, by the Finnish Nurses Association and the Unions for Health and Social Care Professionals and they have aimed, for example, to improve the working conditions of nurses (Unions for Health and Social Care Professionals, 2022) or to prevent the violence against nurses (Unions for Health and Social Care Professionals, 2023). In the future, more general campaigns aimed at the public could be one way to promote nursing and share information about the nursing profession among the public. Public media campaigns should be organised in collaboration with different professional agents, and funded by the government, as the nursing shortage is a societal challenge.

According to this study, the internet and social media have a great potential to change the perception of the nursing profession. Most of the study participants reported that they searched for information on the internet, which is understandable because the internet and social media are a daily environment for Millennials, and generation Z, who make up the current, and the future nursing workforce. Millennial or Generation Z generations who have grown up with the internet and social media, and the tools of the digital age such as computers, smart phones, and video games. (Hampton et al., 2020.) Both generations are technology savvy, and Generation Z in particular are digital natives, who never lived without the internet (Chicca and Shellenbarger, 2018). For them, internet and social media is used for academic, social and entertainment purposes (Elkatmış, 2024). Therefore, to change the stereotypical perception of nursing among these generations, there should be correct portrayals of nursing on the internet. In addition, reliable, objective, and interesting information should be available for young people on the internet and in social media. Currently, the information about nursing profession is scattered in many different places on the internet making it is difficult to find. Moreover, information is limited

and often presented in written content, which might not be the most appealing for young people (Hampton et al., 2020).

In the future, it would be beneficial to develop an online portal to provide correct and objective information about the nursing profession. In addition, the perception of the nursing profession theoretical base would work as an excellent base for the development. The theoretical base offers a comprehensive perspective of the nursing profession, and it has been developed based on the young people's and nursing applicants' perception of the nursing profession, instead of professional description of nursing profession, which are usually targeted to nursing professionals. The online portal could portray nurses in clinical roles as well as in leadership, education, and academic roles. Serious games, videos, or 360°VLEs could be included in the portal to share the information in an interesting way and to improve the learning (Koivisto et al., 2018). The online portal could have separate sections for young people, nursing applicants, public or even foreign trained nurses, who are interested in a nursing career in Finland. In addition, the online portal could include information for career counsellors and teachers, who work with secondary school students and support them in their career choices. In addition, the theoretical base can be utilised to guide nursing profession's promotion activities in the future, such as promotional material on websites, advertising campaigns or educational events targeted at secondary school students.

HEIs have an important role in influencing the perception of the nursing profession. In addition, it is also an advantage for the HEIs if the nursing applicants have a correct perception of the nursing profession at the application stage, because those students are more likely to finish their studies. Thus, HEIs should make sure that they share comprehensive information about the nursing profession in an interesting way on their websites and social media platforms. HEIs should have targeted promotion material for different kind of nursing applicants, and the promotion material should not foster the current stereotypes related to nursing. HEIs should work in collaboration with the secondary schools and the local hospitals and bring different parties together and to collaborate in the promotion activities and ensure young people a smooth transition from secondary schools to HEIs. Furthermore, nurse educators have an important role to play in marketing and promoting nursing in the society. In addition, nurse educators should consider how they can enhance nursing students' skills to promote nursing profession and make the nurses' contribution visible in the society. It is important that also nursing students are aware of their role in supporting the career choices in nursing. Nurse educators should also work in close collaboration with secondary schools and career counsellors to provide up-to-date information about nursing education and the nursing profession.

Finally, this study highlights the key role that nurses play in promoting the profession in their close immediate surroundings, and in the society. This study supported earlier findings (e.g., Whitford et al., 2020) that nurses are role models for younger generations, and encounters with skilled nurses inspired them to pursue a career in nursing. However, according to this study, nurses did not always encourage young people to take this path, and nurses advised them to reconsider. Therefore, to increase nurses' willingness to promote the profession to younger generations, it is crucial that nurses' have a positive perception of their work, and they feel that their work is respected and valued. Improving nurses working conditions salaries and career opportunities and raising public awareness of nurses' contributions and expertise can strengthen nurses' willingness to promote the profession (Kallio et al., 2022), and make the nursing as a more attractive career choice to younger generations. Nurses should be also involved in planning the promotion of the profession, and they should be also educated to demonstrate their competence, professionals, and nurses' contributions to the public, as stated before in the literature (e.g., Godsey et al., 2020; Ten Hoeve et al., 2014; Tuckett et al., 2017).

The PNPI₂ and the psychometric properties of the instrument

The PNPI₂ is a valid and objective instrument that can be used to measure perceptions of the nursing profession. The instrument was developed because there were no objective instruments available that could be used in an entrance exam setting. The ability to measure the perception of the nursing profession is important to understand current perceptions, to influence the perceptions, and ultimately to support the career choices in nursing. In the entrance exam setting, measuring the perception can help to identify those applicants who have a correct understanding of the nursing profession, and prevent wrong career choices (Chan et al., 2019; Haavisto et al., 2019).

In this study the perception of the nursing profession was defined as a mental image of the nursing profession consisting of the content of the nursing work, the nature of the nursing work, the career in nursing profession and the characteristics of a nurse and it is based on knowledge. The theoretical base for the instrument has been developed carefully, and in the development process several methods and various perspectives (young people, nursing applicants, documents, panel of registered nurses, nursing education researchers) of the nursing profession were investigated to operationalise the concept in a measurable and valid form. Compared to the other existing instruments (Table 2), the PNPI₂ offers a theoretically more structured and comprehensive perspective to the perception of the nursing profession. The earlier instruments have measured the perception from a more limited perspective measuring for example career choice (e.g., Liaw et al., 2017; May

et al., 1991), attitudes (e.g., Ipek & Kasicki, 2011; Toth et al., 1998), nursing image (e.g., Porter & Porter, 1991; Özoy, 2000) or qualities of a nurse (Johnson and Cowin, 2013). None of the existing instruments, measures all four categories of the PNPI₂ (content of nursing work, nature of nursing work, education and career in nursing and characteristics of a nurse.)

Psychometric testing examined the PNPI₂' item functionality, item difficulty and PNPI₂' s ability to separate high and low performing individuals. The evaluation revealed that PNPI₂ can be used to assess perceptions of the nursing profession in a valid and objective manner, although, the instrument needs to be further developed and tested in different settings to improve the measurement accuracy. Moreover, the psychometric testing revealed that the items were too easy for nursing applicants' (see Wright Map and most items under 0 logit, PSR 0,6). Also, some items showed misfit to the model (item 4 and item 37) and there might be need to modify the items content, structure, or wording of the item. Item 23 had the highest difficulty level, but the item did not meet the satisfactory level in the goodness of fit criteria, which can mean a difficulty in understanding the item. Eventually removing these items, might improve the model fit, although, the removal of the items must have solid reasons (e.g., similar results in different settings) as they are theoretically important. In addition, the removal of the items should be done one by one, because removing one item, might be enough to improve the model fit (Hagquist al., 2009).

Moreover, the PNPI₂ presents high local dependence, which is visible especially in the last subscale describing characteristics of a nurse. High local dependence means that the items are measuring the same thing and are not necessary in the instrument. The high local dependence can be also connected to the easiness of the items, and therefore, enhancing the difficulty of the items is also important. Lastly, in the future analysis attention must be paid to the threshold ordering for each item. In this analysis 35 items had reverse threshold, which might indicate an opportunity to join response categories together (e.g., merging uncertain with incorrect) (Wetzel and Carsted, 2014). The reverse categories can also be a consequence of the easy items, thus, improving the item difficulty is the priority in the future analysis. In the future development, it is important to pay attention to the enhancing the difficulty level of the items, the instrument structure and especially the last subcategory which describes characteristics of a nurse.

The PNPI₂ was developed for entrance exam purpose, however, it can be also well applied in other types of contexts. The instrument can be utilized in career counselling secondary students, it can be used to assess societal information needs regarding the nursing profession and in planning interventions to enhance nursing's professional image. It is also essential to test the instrument in different cultural setting to further develop the instrument and to compare these views across various contexts.

The 360°VLE's effect on the nursing applicants' perception of the nursing profession

In this study, an educational 360°VLE intervention was developed to share correct information about the nursing profession, and to influence nursing applicants' perception of the nursing profession. The 360°VLE was implemented as a quasi-experimental study, which investigated the effect of the 360°VLE on nursing applicants' perception of the nursing profession. According to the evaluation phase results, the 360°VLE was successful in improving nursing applicants' perception of the nursing profession and it can be considered as an effective intervention to support the correct perception of the nursing profession among nursing applicants.

The need to develop educational digital interventions targeted to young people was identified in previous studies, as there were only a few previous digital interventions to influence the perception of the nursing profession, and none of them used VR or 360° technology. The theoretical base of the 360°VLE, was developed by synthesising the scientific evidence from the integrative literature review, which was the starting point for the intervention development. Additionally, intervention's theoretical base was fostered with focus group study, document analysis and synthesis of the qualitative datasets to develop a comprehensive theoretical base for the perception of the nursing profession.

The content for the intervention was collected from the internet and consisted mainly of videos. The videos used in the 360°VLE were not originally developed to promote the nursing profession, and most of the videos were not targeted to nursing applicants. In addition, the material was limited in number and most of the collected material focused only on presenting nursing in hospital setting, although, variety of nursing environments were finally presented in the videos selected for the 360°VLE. It is possible that by having more tailored and diverse learning material on the 360°VLE, would have been more effective in promoting the profession to nursing applicants. In addition, selecting a setting for the 360° images outside of the hospital setting would have probably offered a new perspective on nursing. The 360° images were taken in collaboration with voluntary nurses, and their participation in developing the 360° images was valuable. Finally, the 360° images were taken in a specialised care unit, in an area which is typically inaccessible to most people, and therefore it worked well as an environment for the 360°VLE. The 360°VLE was designed as an independent learning environment, where the nursing applicants could go through the material independently in their chosen order. Users had a possibility to leave questions or comments on the discussion boards.

In the future development, more attention should be paid for guiding in the user in the 360° VLE. In addition, the location of the learning material must be carefully considered. In this study, according to the user data provided by the Thing Link, it seemed that most of the nursing applicants spent most of the time in the Room 1 and

many did not continue to the Room 2 (Table 6). In addition, it seems that the nursing applicants were more engaged with the material in the Room 1 (585 views, 1764 tags opens, average time spent across all users: 6h 36min), as they opened more hotspots, links and the average time spent in the Room 1 was much higher than in Room 2 (184 views, 673 tag opens, average time spent across all users: 20min 55c). The Room 1 contained information about nurses' daily work, and the Room 2 concentrated sharing information about nursing education, and the career in nursing. Considering the results of this study, it is also possible that the learning material related to work of a nurse might be more appealing to young people than the material related to the education and career in nursing. In the further development, it is important to consider the location of the important elements, and possibly locate the important elements (e.g., instructions, communication platforms, questionnaires) in the beginning of the 360°VLE and encourage the user to move around the 360°VLE. Adding game elements, and more rapid tools for communication, might improve the users' engagement, and eventually improve the effect of the intervention if the users engage more with the material.

The usability of the 360°VLE was evaluated as very good (92 = very good, range 0–100). It is possible that a feasibility study before the intervention evaluation would have provided valuable information about the appropriateness and key uncertainties of the intervention with this target group (Bowen et al., 2009; Craig et al., 2013) In particular, assessing acceptability (e.g., how the target group reacts to the intervention, is it appropriate in their opinion) of the intervention would have been useful, as less than a half of the participants in the intervention visited the 360°VLE. In the feasibility study, it would have been possible to examine the reasons why so many participants did not use the 360°VLE, and if the reasons were connected to the 360°VLE or to their interest in learning more about nursing profession. In the future, it would be also important to examine the user experience in the 360°VLEs. Investigating user experience would provide information from users' motivation and engagement to use the 360°VLE, which is important if the 360°VLE is used for educational purposes.

6.2 Validity and reliability of the study

The findings of the study must be trustworthy, and therefore it is essential to evaluate the procedures which have been used to produce the findings (Graneheim and Lundman, 2004). Validity and reliability of the study were carefully considered at all study phases and in the sub-studies. This chapter discusses the validity and reliability of the data collection, data analysis and in presenting the results in each phase of the study.

6.2.1 Validity and reliability of the theoretical phase

In the literature review process multiple actions were considered to improve the validity and reliability. The integrative literature review process followed previously published framework by for conducting integrative review to ensure the validity and reliability of the process. The research question was clearly defined, which set the boundaries and guided the data search from the primary sources (Whittemore and Knafl, 2005). The literature search, and the quality appraisal were conducted and validated in a research team with methodological experience to ensure the validity of the process (Lasserson et al., 2023). Literature started with a preliminary literature search using web-based search engines and databases to find the correct search terms and relevant databases (Aromataris and Riitano, 2014) to develop the search strategy. The search string with keywords was developed between two researchers and evaluated with an information specialist to improve the quality of the search strategy (Grewal et al., 2016, Li et al., 2022). Inclusion and exclusion criteria were made to target the literature search following the purpose and research questions. It is possible that some relevant studies were not found with the search because of the key words did not match the search, the language of the publication was other than English or Finnish, the abstract was not available. Finally, the search was conducted to three databases (CINAHL, PubMed and Medline Ovid), and manual search was conducted to reference lists of the chosen articles to complement the search. The selected articles were evaluated with Joanna Briggs Institute's checklists (Checklist for Qualitative Research and Checklist for Analytical Cross-Sectional Studies) because the quality of the original articles influences the validity of the results produced with the literature review (Whittemore and Knafl, 2005). The quality appraisal revealed variation in the quality of the chosen articles (Paper I). For example, confounding factors were poorly reported in the chosen studies, which might e.g., overestimate or underestimate the effects in the study. Also, the number of the selected articles was rather small. Consequently, the dataset was small, and this might have influenced the categorization and abstraction in the analysis as well as results of the study. When considering the generalisability of the results, it must be noted that the original articles were collected mainly in western countries and there is variation in the nursing profession and nursing education between the countries (WHO, 2020). Therefore, the results might not be generalisable to other types of educational or cultural contexts (Paper I).

In the focus group interview, credibility, dependability, and transferability were considered to ensure trustworthy results (Graneheim and Lundman, 2004) (Paper I). To improve the credibility the sample was selected purposefully from nursing applicants, as they were expected to have knowledge on the nursing profession as they were applying to the nursing education. The focus group interviews were held in three different locations and there was one interviewer per location, who worked

as interviewer and moderator. To improve the credibility, the interviewers were registered, nurses, nursing educators and nursing researchers and they were experienced collecting data with focus group interviews. To improve the dependability the interviews were held in a similar setting in every UASs after the entrance exam, and semi structured interview sheets supported the consistency in collecting the data. In the data-analysis the credibility was ensured by selecting a meaning unit, which was not too broad, or too narrow (Elo et al., 2014; Graneheim and Lundmann, 2004). The preliminary analysis process started immediately after the interviews to enhance the credibility and dependability. In addition, the analysis process was discussed and verified in the research group and described in detail with tables, and eventually with clear figures presenting the results. Although the analysis was conducted carefully, it is possible that the researcher's own perceptions, experiences as registered nurse, and nurse educators has influenced on the data interpretation. When considering the transferability of the results, the sample characteristic and the cultural context should be considered. In addition, the data was collected after the entrance exam, and this might have influenced on the sample characteristic, and to their responses on the focus group interview. It is possible that only selected people had a motivation to participate the interviews, as they may have been tired after a long entrance exam.

In the document analysis, credibility, dependability, and transferability were considered. The data were collected from purposefully selected documents (Paper III). The selection of the articles was decided in the research group, who were experienced registered nurses, nursing educators, and researchers who were aware of the documents regulating nursing education nationally. The selected articles represented nursing profession from the professional-, European -, governmental-, and nursing education's perspective, and complemented the previously collected research data. Although the selected documents covered a broad perspective to the nursing profession at the national level, it is possible that some relevant documents were not included in the analysis. Furthermore, the deductive analysis used a categorisation matrix based on a previous study. In the analysis process, the unit of analysis was a description of the nursing profession, and descriptions were collected in the analysis matrix and, they were further analysed inductively. In the end, there was no left-over data, which indicates that the matrix was suitable for analysing the data (Graneheim et al., 2017). To enhance the dependability, the data analysis process was documented in transparent way and the process was verified in the research group. Transferability of the results in the international context, especially outside Europe, might be limited, because the documents were selected based on their relevance on Finnish nursing education. Finland follows the European regulation for the nursing education (The European Parliament and the Council of the European Union, 2005, 2013).

A synthesis utilising applied metaethnographic approach was used to develop the theoretical base for the PNPI₂. To improve the credibility, the synthesis was conducted by the whole research group, who had diverse knowledge and expertise, and experience on qualitative synthesis. This is important from the credibility perspective because the qualitative synthesis requires interpretation of the data and concepts, which requires high level methodological and topic related expertise. In addition, the interpretation influences the credibility and dependability of the analysis. The dataset consisted of three datasets, which were collected and analysed by the same research team, thus, they had good understanding how the data and the concepts were derived in the original studies. For the same reason, the quality appraisal was not conducted. Moreover, the number of studies was rather small ($n = 3$), which might influence the synthesis and the depth of the analysis (Soundy and Heneghan, 2022). In contrary, the small size of the dataset made it manageable to synthesise. During the synthesis process alternatives were discussed and the consensus was reached. The dependability was enhanced by conducting the analysis in one long session, and by documenting the synthesis on a word spreadsheet. The credibility of the perception of the nursing profession theoretical can be considered good, as multiple datasets and various methods were used to obtain the result. The transferability of the theoretical base can be limited because it has been developed in Finnish context, and there are differences between the content of nursing work, nature of nursing work, and education and career possibilities in nursing between the countries. In the future it is important to evaluate the theoretical base in different cultural settings, before implementing it.

6.2.2 Validity and reliability of the development phase

Perception of the nursing profession instrument was developed to measure perception of the nursing profession from nursing applicants as a part of the entrance exam. PNPI₂ is based on the Perception of Nursing Profession theoretical base (Figure 9), which was derived from an integrative literature review, a focus group study, a document analysis and a qualitative synthesis, which improves the credibility of the theoretical background. In order to improve the PNPI₂'s construct validity, items' ($n = 60$) content validity (item relevance, item clarity) was evaluated in two-round expert panel of experienced registered nurses (Polit et al., 2007). The experts were selected following selection criterion to make sure that they are experienced (more than five years' experience in nursing) and come from diverse nursing speciality fields to make sure that the items are evaluated from different nursing perspectives (Polit et al., 2007). The experts ($n = 7$) were given clear written instructions with the questionnaire. Although, they were given the flexibility to complete the questionnaire at their own pace within a week, it is possible that the

high number of evaluated items ($n = 60$) may have impacted their concentration on the task. Furthermore, experts gave feedback on items clarity and for the second feedback round items ($n = 10$) clarity was enhanced. I-CVI was calculated for all the items, and 40 items were chosen to be based on the expert evaluation ($n = 39$ items in total, 31 items with $I-CVI = 1$, 8 items with $I-CVI = 0,86$) and based on their theoretical importance ($n = 1$, $I-CVI = 0,56$) PNPI₂. Overall, the PNPI₂ content validity can be considered excellent (Polit et al., 2007). Furthermore, in the psychometric testing of the PNPI₂, the IRT was considered as suitable method, as it produces item level information of the instrument. In entrance exams, the nursing applicants were ranked in order of their responses to the test items and therefore, it was important to evaluate the item difficulty. In the analysis, the unidimensionality requirement was met, which confirmed that the instrument measures one latent construct. The methods to analyse the validity and reliability are described in Table 7. The validity and reliability of the PNPI₂ are described in detail in Table 9.

This study produced 360°VLE, which is a digital virtual educational intervention, which aimed to share correct information to nursing applicants. The intervention development was guided by the MRC intervention development guideline (Craig et al., 2013), and the Tidier checklist (Hoffmann et al., 2014) was used to report the intervention (Paper IV). The intervention was based on the perception of the nursing profession theoretical base. The development included several studies with different target groups and perspectives to enhance the comprehensives of the theoretical base. The content for the intervention was collected following the Perception of Nursing Profession theoretical base, and the collected material was evaluated by two researchers to make sure that it fits with the theoretical base and the content areas. Furthermore, an expert was hired to support the development of the 360°VLE and improve the quality of the technical production of the 360VLE. Research team made a written plan of organising the learning material in a meaningful way, and the plan was improved based on the suggestions of the expert before developing the 360°VLE. The intervention was test used by voluntary test users ($n = 4$) to make sure that the 360°VLE was functioning as planned. Because of the technical limitations of the ThingLink program, the 360°VLE was optimised for computers, tablets, and mobile phones, as some of the features were not working with VR-glasses/head mounted displays. The weakness of the 360°VLE development process is that proper feasibility study was not carried out.

6.2.3 Validity and reliability of the evaluation phase

The quasi-experimental study design was used in the evaluation phase of the study. The quasi-experimental setting lacks the randomisation, which limits the ability to explain the causal relationship between the intervention and outcome (Andrade,

2021.) In this study, the quasi-experimental study setting was chosen because randomisation of study participants was not possible due to the student selection setting. In addition, baseline measurement could not be conducted because the data was collected as a part of student selection, and PNPI₂ could not be revealed to nursing applicants. Therefore, it is possible that the differences in the groups were already present at baseline. In addition, nonrandomised groups might lead differences between the groups at the baseline, and it might influence the outcome of intervention. To overcome this, multivariable regression was used to analyse the data. (Andrade, 2021.) In addition, also a matched group analysis was performed to support to the validity of the results and to ensure that the results were not affected by the differences in the background factors of the participants. In matched group analysis, each participant in the intervention group is matched with a counterpart from the control group so that the background factors are similar in both groups. Both analyses supported the effectiveness of the intervention.

The PNPI₂ instrument was used to measure the perception. According to the psychometric evaluation, the PNPI₂ is valid instrument. The items in the PNPI₂ were easy, which influences the measurement accuracy of the PNPI₂.

6.3 Practical implications

Based on the results of this study, following practical implications can be addressed

Nursing education:

- HEIs have an important role in promotion the nursing profession in a correct and comprehensive way to possible nursing applicants. HEIs should have targeted promotional material for different target groups, and the promotional material should also educate the public about the nursing profession. The information about the nursing profession should be available online. The promotional material can be, for example, 360°VLEs, games or videos, which are effective ways the share information. Social media platforms should be used to share the information about the nursing profession.
- The Perception of Nursing Profession theoretical base can be utilised in developing comprehensive promotional material for young people and nursing applicants. Information should be provided on the content of nursing work, the nature of nursing work, career in nursing and characteristics of a nurse. In addition, the academic requirements, professional autonomy, independence in the nursing profession should be highlighted in order to clarify the independent nature of the profession and to inform prospective nursing applicants about the career development possibilities in nursing.

Stereotypical portrayal of the nursing profession should be avoided. Information should be given in a gender-neutral way presenting various types of nurses in different specialty fields also outside hospital setting.

- 360°VLE environments are an effective way to promote correct perception nursing profession. The 360°VLE provides an opportunity to share correct information about the nursing profession and it offers the possibility to virtually visit in real-life nursing environments. The 360°VLE can be used with desktop computers or with portable devices.
- UASs open day event influence young people's and nursing applicants' perception of the nursing profession. Perception of the nursing profession - theoretical base can be used to plan UAS open day events. UAS open day events could be meeting points for potential nursing applicants and their families, teachers and career advisors, nurses, nursing educators and nursing students. The open day events could be also be held virtually using 360°VLEs and targeted promotional material.
- PNPI₂ is a transparent, valid and objective instrument for measuring perception of the nursing profession at the student selection stage. Misperceptions of the nursing profession influence young people's career choices in nursing, nursing student's retention in nursing education and later in nursing profession. Evaluating nursing applicants' perception of the nursing profession at the student selection stage and selecting students with correct perception of the nursing profession could lead to greater retention in the nursing education, and later in the nursing profession.

Clinical practice:

- Nurses have a key role to play in influencing young people's and nursing applicants' perceptions of the nursing profession. Nurses should be invited to participate recruiting young people to the nursing profession and in promoting the profession to the public. The PNPI₂ could be used for recruitment.
- Nurses should be provided with training and resources to promote the nursing profession. Improving the working conditions of nurses' may increase their willingness to recruit young people to choose a career in nursing.
- Nurses should provide correct information about the nursing profession and make their contribution in healthcare visible and educate the public of their independent role in health care. The theoretical base for the perception of the nursing profession can used to describe the nursing profession in a comprehensive way.

- Welfare districts and hospitals should ensure that they promote correct information about the nursing profession on their websites and social media platforms. The promotion must be well planned, targeted at different audiences and avoid stereotyping nurses. The recruitment activities should be based on evidence, portray nurses' independent role in patient care. The career development opportunities in the nursing profession in clinical practice should be further developed and promoted.
- Nurses have an essential role in attracting young people to the nursing field, and their interest to motivate young people to pursue a career in nursing is important. Investments should be made to improve the working conditions of nurses.

Policy development and society:

- The sustainability of the nursing workforce depends on young people's interest to seek a career in nursing. Measures must be taken to attract young people to the nursing profession, and to promote the nursing profession in the society.
- Young people and nursing applicants' need correct information about the nursing profession in order to develop a correct perception of the profession, and to make an informed career choice in nursing.
- The promotion of the nursing profession is needed at the societal level to correct the misperception related to nursing profession. The promotion activities should be planned together with different key agents such as professional organisations, HEIs, nurses and young people. The promotion activities must be planned based on the current evidence.
- There is a need to develop a national online platform to support informed career choices in nursing. The online portal would share correct, evidence-based, objective and gender-neutral information about the content of nursing work, the nature of nursing work, career and education in the nursing profession and characteristics of a nurse. The online platform should have tailored material for different kind of target groups (young people, nursing applicants, public, career advisors and teachers, and nurses).
- Career paths in the nursing profession must be developed and promoted further to attract wider number and pool of nursing applicants.

6.4 Suggestions for further research

Following suggestions for further research are presented based on the results of this study:

- Secondary school students' perception of the nursing profession should be investigated in a national context, as there are no previous studies conducted in Finland. Investigating secondary school students' perception of the nursing profession is important because secondary school is important time from the career choice perspective. The PNPI₂ can be used to measure the perception, although, qualitative interview studies are also needed to understand the current perception in depth.
- Young people's and nursing applicants' career choice in nursing must be further explored through qualitative descriptive interview studies to understand what factors influence the career choice in nursing, and what motivates them to seek a career in nursing. Information is particularly needed at the national level to foster the recruitment of young people to nursing profession, as international evidence already exists.
- A follow-up study could be conducted to investigate whether dropout from nursing education is connected to incorrect perception of the nursing profession.
- The public perception of the nursing profession should be studied because public perception influences on young people's and nursing applicants' perception of the nursing profession. PNPI₂ could be utilised to measure the perception of the nursing profession among the public.
- Career advisor's perceptions of the nursing profession should be studied further because they offer the career counselling at schools. The topic is underreached internationally and nationally, and qualitative descriptive studies are needed.
- Media portrayals of the nursing profession should be investigated nationally to describe how nurses and the nursing profession are presented in the media. Information is needed to promote the correct image of nursing profession in the media, and to improve the visibility of the nursing profession.
- Men's perception of the nursing profession should be further investigated to discover their perception of the nursing profession and the factors that influence their choice of nursing as a career. The studies should be conducted on a national level to foster the recruitment of men into the nursing profession in Finland.
- The current level of evidence for interventions to promote the nursing profession is low. More robust intervention studies are needed to improve the quality of the evidence on effective interventions to promote nursing among different target groups.

- PNPI₂ must be further validated to enhance the item difficulty and to further investigate the instrument structure, and the number of the items to improve the validity and reliability of the instrument. In addition, PNPI₂ could be validated in different populations (e.g., high school age students, public) and in different cultural contexts as there are differences in nursing practice between the countries.
- The IRT approach is recommended for the psychometric testing of new or existing instruments, as IRT offers a great opportunity to evaluate item properties in a robust way.

7 Conclusions

This study provided new insights on young peoples and nursing applicants perceptions of the nursing profession, and the factors influencing their perception. This study also investigated how the nursing profession is described in the national key documents regulating nursing education and produced a theoretical base for the perception of the nursing profession. In addition, this study provided a new evidence-based, objective PNPI₂, which can be utilised to measure nursing applicants' perception of the nursing profession. Moreover, this study produced 360°VLE sharing correct information about the nursing profession to nursing applicants.

As a conclusion, this study suggests that young people and nursing applicants have limited perception of the nursing profession. The perception of the nursing profession includes content of the nursing work, nature of the nursing work, career in nursing and characteristics of a nurse. The perception is influenced by personal factors, media, family and relatives, friends, career guidance, and nurses.

Furthermore, PNPI₂ is a valid and objective instrument to measure the perceptions of the nursing profession. In the future development, the difficulty of the items must be enhanced. The 360°VLE is an efficient intervention to promote correct perception of the nursing profession to nursing applicants. Although the 360°VLE was effective, it could be further developed. More targeted promotion material should be developed and adding game elements could foster the effectiveness of the intervention.

Acknowledgements

This study was conducted at the Department of Nursing Science, University of Turku. I have been privileged to be surrounded by talented and inspiring people and I have received support from several people during this process. I would like to express my gratitude and appreciation to all of them, although I cannot name each one of them individually.

First, I would like to express my sincere gratitude to my supervisors Professor Elina Haavisto, PhD Kirsi Talman and PhD Maija Hupli. It has been a great learning process, and I have been lucky to have you as my supervisors. I appreciate your broad expertise and experience in nursing education and nursing science. I am grateful for the support that I have received over the years. I have really enjoyed working with you. Elina, I appreciate that you have challenged my scientific thinking throughout the process. I appreciate that you have always had time for me. Kirsi, I have always admired your systematic and precise approach to things, which has helped me to improve these skills as well. Maija, I appreciate that you agreed to be my supervisor after being a member of the follow-up -committee. I appreciate your kindness and help during the process.

I am also very grateful to my official reviewers Professor Maria Kääriäinen from the University of Oulu and Associate Professor Marja Härkänen from the University of Eastern Finland, for agreeing to review this dissertation. Thank you for your precise feedback, which helped me to improve the dissertation. I would like to thank PhD Mari Virtanen for accepting our invitation to join the follow-up -committee. You have played an important role in this study by introducing the 360° environments to me and helping us to develop the 360°VLE. I would also like to thank Docent Satu Elo from Oulu University of Applied Sciences for accepting the invitation to be the official opponent for my dissertation defence.

Warm thanks to the seminar group in the Doctoral Programme in Nursing Science. Thank you, Professor Leena Salminen, for your constructive feedback and excellent questions in the seminars, which has helped me to improve my work. I would also like to thank Professor Riitta Suhonen, the CIDI course teacher and the Director of the Doctoral Programme in Nursing Science. I would like to thank PhD Mika Alastalo for the support I have received as a fellow doctoral researcher in

seminar group as well as a work colleague, especially during last years. I would also like to thank doctoral researcher Tanja Hakkarainen for your support and fun times together travelling aboard. My very special thanks go to PhD Anne Pienimaa and doctoral researcher Eini Koskimies for the friendship, that I hope will last for a long time. Without you, Eini, I would not have started the studies in Turku with a 5-month-old baby, but I am glad that we did it together.

I owe gratitude to all healthcare professionals, nurse educators and nursing applicants who participated the study in different phases of the study. I would also like to thank the members of the Reforming Student Selection in Nursing Education (ReSSNE) project. I would like to thank my colleagues at Lyhty and Laurea University of Applied Sciences. It has been a privilege to work with a very talented, inspiring, and motivated group of people. People of the Lyhty community, you have a very special place in my heart, and I will always be grateful for the support that I have received from you as a young public health nurse. I would especially like to thank Helka Liimatta for inspiration and encouragement to study nursing science. I am also very grateful to my current colleagues at Laurea University of Applied Sciences who have encouraged me in the process and who have taken a greater role with our joint projects, when I have been away.

I would like to thank my friends and family, who have supported me over the past few years. Thank you so much for your understanding, and especially for the long Sunday walks together. A very special thanks goes to my parents, Sinikka and Markku, and my brothers Niko and Juhana, and Reea, Titta, Jesse, Jasu, Isla and Linda, for being the best family anyone could ask for. I am truly grateful for all the help you've given me, but even more so for the fun times we've spent together. There is no place like Leppävesi. I would also like to thank my extended family members Gilberto, Regina, and Paolo for all the nice moments together in Italy.

I would like to express my deepest gratitude to my dear husband Enrico. Thank you for taking part in this research project. Thank you for the late-night discussions on research methodology. Thank you for the long summer holidays in Italy. Thank you for taking such a good care of me. Thank you for your love.

Finally, I would like to extend my deepest gratitude to my beloved children Edvin and Liisa, to whom I dedicate this book. You were born when this process began. Watching you to grow has been the greatest joy, and reminder of the most important thing in life during this journey. The book is finally ready and now we can celebrate.

This study was financially supported by the Finnish Nursing Education Foundation, the Finnish Association of Nursing Research, and the University of Turku.

20th November 2024
Niina Glerean

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ISBN 978-951-29-9998-9 (PRINT)
ISBN 978-951-29-9999-6 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)

