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Development and evaluation of a digital intervention

Jenni Rinne

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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 OriginalityCheck service.

Generated by Artificial Intelligence (AI) by Magic Studio

ISBN 978-951-29-9739-8 (PRINT)
ISBN 978-951-29-9740-4 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
Painosalama, Turku, Finland 2024

To my children, Iida and Onni.
Anything is possible when you have the right people there to support you.

UNIVERSITY OF TURKU
Faculty of Medicine
Department of Nursing Science
Nursing Science
JENNI RINNE: Occupational well-being of nurse educators – development and evaluation of a digital intervention
Doctoral Dissertation, 146 pp.
Doctoral Programme in Nursing Science
May 2024

ABSTRACT
The occupational well-being of educators is not only essential for educators themselves, but also affects the well-being of their students and the whole of society regarding having a healthy and productive workforce. The main aim of this study was to develop and evaluate a digital occupational well-being intervention to support the occupational well-being of nurse educators.

The development PHASE I (2019-2022), consisted of a national cross-sectional occupational well-being survey study among health and social care educators in Finland (n=552) and a systematic review (n=13 studies) to discover occupational well-being interventions among educators. The SHINE (Self-Help INtervention for Educators) was developed and implemented including self-conductive exercises done during working hours with workplace support. In the evaluation, PHASE II (2022-2023), the effectiveness of SHINE was tested on resource-workload-balance (self-evaluated and heart rate variability, HRV), overall occupational and general well-being, physical activity, recovery, self-regulation and workplace support among nurse educators using a controlled quasi-experimental study (intervention group n=37, control group n=40). In addition, the process evaluation of the usability and utility of SHINE was conducted with a cross-sectional survey design among the intervention group. The data were analysed statistically and using content analysis.

As a result, there were found the need to support occupational well-being, especially towards managing mental workload and workplace support to enhance occupational well-being by promoting activities during working hours. Beneficial self-conductive interventions to promote personal resources of educators were identified, where were used self-conductive exercises such as walking and self-regulation of personal resources. SHINE was found effective on promoting recovery and general well-being between groups comparison but didn't find statistically effects on resource-workload-balance. SHINE was found easy to use and applicable during working hours. It was seen as useful for promoting physical activity, personal resources, recovery experiences and increasing breaks.

As a conclusion, SHINE could support occupational well-being of nurse educators, promoting well-being activities during working hours possible to implement as part of everyday working life and promoting recovery at work.

KEYWORDS: a digital intervention, heart rate variability, nurse educator, occupational well-being, personal resources, recovery, workload

TURUN YLIOPISTO
Lääketieteellinen tiedekunta
Hoitotieteen laitos
Hoitotiede
JENNI RINNE: Sosiaali- ja terveysalan opettajien työhyvinvointi
– digitaalisen intervention kehittäminen ja arviointi
Väitöskirja, 146 s.
Hoitotieteen tohtoriohjelma
Toukokuu 2024

TIIVISTELMÄ

Opettajien työhyvinvointi on keskeinen asia heille itselleen, mutta on yhteydessä myös opiskelijahyvinvointiin. Työhyvinvoinnilla on yhteiskunnallinen merkitys työntekijöiden terveyden ja työn tuottavuuden edistämisessä. Tämän tutkimuksen tarkoituksena oli kehittää ja arvioida päivittäistyössä digitaalinen työhyvinvointi-interventio sosiaali- ja terveysalan opettajien työhyvinvoinnin tukemiseksi.

Kehittämisvaiheessa, VAIHE I (2019-2022), toteutettiin kansallinen kyselytutkimus sosiaali- ja terveysalan opettajien (n=552) työhyvinvoinnista ja systemaattinen kirjallisuuskatsaus, joka kohdistui opettajien työhyvinvointi-interventioita kuvaaviin tutkimuksiin (n=13). Näiden perusteella kehitettiin SHINE (Self-Help INtervention for Educators) interventio sisältäen työajalla tehtäviä harjoitteita. Arviointivaiheessa, VAIHE II (2022-2023), SHINE intervention vaikuttavuutta testattiin kvasikokeellisella tutkimuksella (koeryhmä n=37 ja kontrolliryhmä n=40) suhteessa sosiaali- ja terveysalan lähihoitajakoulutuksessa toimivien opettajien voimavarakuormitustasapainoon (itsearvioitu ja sykevälivaihtelu mittaus), kokonaistyöhyvinvointiin, yleiseen hyvinvointiin, fyysiseen aktiivisuuteen, palautumiseen, voimavarojen itsesäätelyyn ja työyhteisön tukeen. Tämän lisäksi interventioon osallistuneet opettajat (n=37) arvioivat intervention käytettävyyttä ja hyödyllisyyttä. Aineisto analysoitiin tilastollisin menetelmin ja käyttäen sisällön analyysia.

Tutkimustuloksena opettajat kokivat työhyvinvoinnin tukemisen tarpeita, etenkin psyykkisen työkuorman hallinnassa. Lisäksi opettajat kokivat työyhteisön tuen tarpeet riittämättömänä työpäivän aikaisille työhyvinvointitoimille. Tuloksellisia työajalla tehtäviä opettajien voimavaroja lisääviä työhyvinvointi-interventioita tunnistettiin, joissa käytettiin harjoitteita, kuten kävelyä ja voimavarojen itsesäätelyä. SHINE interventiolla oli vaikutusta ryhmien välisessä vertailussa opettajien palautumisen ja yleisen hyvinvoinnin kokemusten edistämisessä, mutta ei voimavarakuormitustasapainon edistämisessä. Opettajat kokivat intervention helppokäyttöiseksi työpäivän aikana ja hyödylliseksi fyysisen aktiivisuuden, omien voimavarojen, palautumisen, tauottamisen edistäjänä.

SHINE interventio voi mahdollisesti tukea sosiaali- ja terveysalan opettajien työhyvinvointia edistäen hyvinvointitoimintoja ja palautumisen kokemuksia työssä.

AVAINSANAT: digitaalinen interventio, palautuminen, sosiaali- ja terveysalan opettaja, sykevälivaihtelu, työhyvinvointi, työkuorma, voimavarat

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Abbreviations

CVI	Content Validity Index
ECTS	European Credit Transfer and Accumulation System
EFA	Explorative Factor Analysis
ERIC	Education Resources Information Center
EU	European Union
EQF	European Qualifications Framework
GDPR	General Data Protection Regulation
GW	General Well-being
HRV	Heart Rate Variability
MEDLINE	Medical Literature Analysis and Retrieval System Online
MRC	Medical Research Council
OECD	The Organisation for Economic Co-operation and Development
OW	Occupational Well-being
PA	Physical Activity
RWB	Resource-Workload-Balance
RE	Recovery experiences
SD	Standard Deviation
SHINE	Self-Help Intervention for Educators
SPSS	The Statistical Package for the Social Sciences
SR	Self-Regulation
SUS	System Usability Scale
TENK	Finnish National Board on Research Integrity
THL	Finnish Institute for Health and Welfare
UEF	University of Eastern Finland
USA	United States of America
UTU	University of Turku
VET	Vocational Education and Training
WHO	World Health Organization

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 Rinne, J., Leino-Kilpi, H., Saaranen, T., Pasanen, M., & Salminen, L. Educators' occupational well-being in health and social care education. *Occupational Medicine,* 2022; 5: 289–297.

II Rinne, J., Koskinen, S., Leino-Kilpi, H., Saaranen, T., & Salminen, L. Self-conductive interventions by educators aiming to promote individual occupational well-being—A systematic review. *International Journal of Educational Researc*h, 2021; 107: 101755.

III Rinne, J., Leino-Kilpi, H., Saaranen, T., Tarvainen, M. P., Pasanen, M., Koskinen, S., & Salminen, L. Effectiveness of an Occupational Well-being Intervention Among Nurse Educators. *Nurse Educator*, 2024; 49(1): p E26-E31.

IV Rinne, J., Leino-Kilpi, H., Koskinen, S., Saaranen, T., Pasanen, M., Vauhkonen A. & Salminen, L. An intervention to address nurse educators' occupational well-being: a process evaluation. *Nurse Education Today*, 2024; 138: 106219.

1 Introduction

This study of occupational well-being concentrates on personal resources and workload in the daily working life of nurse educators. Occupational well-being is essential for the whole of society concerning a well-functioning workforce, a reduction in sick leave and promoting the retention of workers (Forastieri, 2014). Therefore, the occupational well-being of workers requires a critical insight into working conditions and the need for research to find effective methods for occupational well-being management (e.g. activities supporting occupational well-being).

Globally, the World Health Organization (WHO) has initiatives for occupational well-being management, as it is estimated that almost three percent of global disease prevalence is related to occupational risks (e.g. mental disorders and injuries) (Wolf et al., 2018). In Europe, workers have reported that musculoskeletal disorders, stress, depression and anxiety as having been caused by work (EUROSTAT, 2020). There are possibilities to shape work conditions that enable occupational well-being management, but they need encouragement and effective implementation (Lovejoy et al., 2021). In Finland, the Ministry of Social Affairs and Health (2022) have a policy for safe and healthy working conditions and work ability, where one main priority is to promote the mental and physical work ability of the workers. The Finnish law of occupational safety was updated in 2023 to particularize the resources of individuals to aid physical and mental workload factors as being the responsibility of both the worker and the management (738/2002).

Every profession, including that of educators, has their own occupational well-being management issues due to different job descriptions (Hascher & Waber, 2021). Rapid changes in the working life of educators, such as digitalization, has created new challenges: psychosocial risks are experienced as being more difficult to manage, work includes more interruptions, prolonged sitting time, and the work intensity has increased (European Agency for Safety and Health at Work, 2020). Further challenges to occupational well-being management were created during the transition to remote education as a result of the COVID-19 pandemic in 2020. These particularly affected those students needing more educational support (Hughes, 2021; Ncube & Dangwa, 2022). This study concentrates on nurse educators, defined in this study as a professional workforce educating future nurses (WHO, 2016).

Nurse educators work includes teaching in educational organizations and in digital learning environments, managing development and innovation projects, research and collaboration with the health and social care workforce (Campos Silva et al., 2022). Occupational well-being management is not only important for educators themselves, but also for their students who need support to manage their well-being at school (Aldrup et al., 2020; Klusmann et al., 2008). The National Academy of Medicine in the United States of America (USA) have stated issues known to cause burnout among health care workers and suggested that their occupational well-being management is addressed in the educational curricula, where nurse educators train new nurses to face these challenges (National Academy of Medicine, 2022). In Europe, there are similar initiatives, suggested that nurse educators' new competence area should include occupational well-being management and enhancing the student nurses' ability to reflect on their own well-being (Salminen et al., 2023).

The early research on the occupational well-being of nurse educators was conducted in the 1990s, where in Finland the working life of nurse educators was found satisfying (e.g. student and colleague interactions) but as having a high workload which reduced well-being and lacking in management support (Harri, 1995, 1996, 1997, 1998). Similar results were reported from Norway (Stamnes et al., 1998) and from the USA (Anderson, 1998; Fong, 1993). In the 2020,challanges were reported as regards the retention of nurse educators and attracting new nurse educators into the field; thus, recognizing the need to address the workload issues already found in the late 90s (Dalby et al., 2020; Frost, 2023; Mermer et al., 2022).

The Finnish institute for health and welfare has estimated the need for 50 000 more workers in the field of nursing by the year of 2040 in addition to those 150 000 workers retiring. Therefore, strategies are needed for occupational well-being in order to retain nursing staff (Croell et al., 2023; Ministry of Social Affairs and Health 2023:34, 2023). This issue also concerns nurse educators, where approximately 40% of educators working in secondary vocational and higher education are due to retire (KEVA, 2024). Nurse educators' retention in the profession needs more interventions targeted at their occupational well-being management (Salminen et al., 2023).

This study conducted in the University of Turku (UTU) aimed to develop and evaluate a self-conductive digital occupational well-being intervention. This study was part of "Social and Health Care Teachers' Occupational Well-being in Finland—research and development project, 2020–2023" led by the University of Eastern Finland (UEF), with UTU working as an independent partner. In the project, the national data of occupational well-being of health and social care educators were collected, and at the individual level (the study in UTU) and the communal level (UEF) occupational well-being interventions were developed and evaluated. The main goal of this study was to support the occupational well-being of nurse educators in their daily working life.

2 Review of the Literature

In this chapter, the key concepts, nurse educator, health and social care education, occupational well-being, digital interventions, are described (2.1). In addition, the occupational well-being studies of nurse educators are searched from the relevant databases synthesizing the previous research (2.2).

2.1 Definition of the study concepts

2.1.1 Nurse educator

A nurse educator in this study is defined as an educator educating theoretical or practical subjects to student nurses (e.g. in practical nurse and registered nurse programs) (Oermann & Frank, 2021; WHO, 2016). The definition of nurse educator varies within the context and countries in Europe, having no mutual understanding (Campos Silva et al., 2022). WHO identifies nurse educators as highly important for meeting the global needs for future skilled nurses (WHO, 2021). Therefore, this occupational well-being study included all professional educators educating the future workforce of nursing in educational setting (excluding clinical educators), including those who are not registered nurses.

From the global perspective, nurse educators are responsible for educating future nurses and other health care professionals with their orientation and continuing education and training in educational institutions (Oermann & Frank, 2021; WHO, 2016). In Europe, nurse educators' educational requirements differ between countries (Campos Silva et al., 2022; Salminen et al., 2021). In Finland, nurse educators have a permanent employment contract and are qualified professionals having at least a master's degree either from a university or a university of applied sciences (European qualification framework, EQF 7). In this study, these educators teach practical (e.g. nursing and rehabilitation) or general subjects (e.g. mathematics and languages) to the student nurses; the teaching of practical subjects also requires having at least three years of related work experience (1129/2014; 986/1998). Moreover, educators teaching in practical nurse education are required to have 60 ECTS pedagogical studies (986/1998).

As the definition of nurse educator varies, their work description is also not conclusively defined. In Europe, there is agreement that the work of nurse educator includes at least classroom teaching, research and development projects, working in digital environments and collaborating with health and social care workforce (Campos Silva et al., 2022).

The employment contracts of nurse educators (e.g. defining vacations and working hours) varies between countries. In Finland, there is a general working time act regulating the working time in any employment relationship (872/2019). In addition, every profession has their own employment contracts, where nurse educators have a yearly base working time schedule. This means a working time of 1500–1700 hours per year and a 10–12 week free period per year; thus generating weekly working hours of approximately 38 hours per week (Avaintyönantajat AVAINTA ry, 2022; Local Government and County Employers KT, 2022).

To better understand the work of a nurse educator, the educational work environment of educators in health and social care education in Finland is described comparing the educational setting in other western countries (i.e. Europe and USA).

2.1.2 Health and social care education

Nursing education is part of the health and social care education providing education for the future health and social care workforce, such as registered nurses, public health nurses, social services professionals, practical nurses (i.e. licensed practical nurse, LPN), midwifes and physiotherapists. Nurse educators educate in health and social care educational organisations. The focus of this study was on nurse educators working in practical nurse programs.

In Finland, health and social care education is provided in vocational nursing schools (lower-level nursing education practical nurse program, vocational education and training, VET) and in the University of Applied Sciences (higher level nursing education, educating registered nurses and other health care professionals). Health and social care education is regulated by "Act on Vocational Education and Training" (531/2017) and "Universities of Applied Sciences Act" (932/2014). Nursing education is the largest part of health and social care education preparing the future nursing workforce educated by nurse educators.

Nursing education varies within countries educating nursing graduates in lower or higher level education to become licensed nurses or registered nurses (OECD, 2023). In Finland, practical nurses are educated in VET (EQF level 4). The practical nurse program is a nationally regulated program (180 competence points) (Ministry of Education and Culture, 2017). The students who have completed a practical nurse program, are able to work in multiprofessional health and social care teams to plan, implement, and assess nursing aimed at promoting health and wellbeing and the

functional capacity of a client or a patient (National Board of Education, 2021). A practical nurse is a protected occupational title granted by "National Supervisory Authority for Welfare and Health" in Finland. In Europe, there is a lack of consensus on practical nurse programs. However, in the United States of America (USA), there is a nationally regulated practical nurse program which grants the title of licensed practical nurse (LPN).

In Finland, registered nurses are educated in universities of applied sciences (EQF level 6). A registered nurse is a licensed registered profession in Finland granted by "National Supervisory Authority for Welfare and Health" and the professional qualification to practice in the nursing profession is defined in the Health Care Professionals Act (Ministry of Social Affairs and Health 559/1994). Registered nurses have completed a bachelor's degree program (210 ECTS), where their competence area includes performing various nursing procedures and engaging in multiprofessional teamwork training (Finnish national agency for education, 2023). In Europe, there is also heterogeneity concerning the higher level registered nurse program, even guided at EU-directives (2005/36/EY; 2013/55/EU; Campos Silva et al., 2022; Salminen et al., 2010). In the USA there is a similar program to the European bachelor's degree for registered nurses (RN). This program has national minimum standards for nursing programs and established criteria for certification and licensing (National Academies of Sciences, 2021).

The number of nursing graduates (as regards practical nurses and registered nurses) across OECD countries is increasing, in 2021 the number was over 40 graduated nurses per 100 000 population on average and for practical nurses 9.2 per 1 000 population on average, in Finland it was higher being over 18 per 1 000 population (OECD, 2023). Consequently, the increasing need for nurses (practical nurses and registered nurses) sets nurse educators in an essential position in this endeavor, where nurse graduates are becoming part of the health care workforce.

2.1.3 Occupational well-being

Occupational well-being is defined in many ways depending on the context and the field of research where the definition is used (Hascher & Waber, 2021). The International Labor Organization (ILO) defines occupational well-being as including all aspects of working life from the physical, mental and social working environment and considers all the elements of safety to affective feelings and work ability of the individual and thus creating a state of overall occupational well-being (Forastieri, 2014). The Ministry of Social Affairs and Health in Finland emphasizes the importance of the individual, where the occupational well-being is considered to encompass worker's experiences of the physical, mental, and social work environment

and the resources at work in relation to workload (Ministry of Social Affairs and Health, 2022).

Occupational well-being is closely connected to general well-being, that is, well-being in life; these aspects can never quite be separated and affect each other in both directions (Weziak-Bialowolska et al., 2020). General well-being can be understood as subjective feelings of satisfaction and happiness in everyday life, work being a major part of a worker's everyday life (Topp et al., 2015). Therefore, occupational well-being promoting programs should enable the promotion of well-being in general as well (Weziak-Bialowolska et al., 2020).

This study goal was to support the occupational well-being of nurse educators by producing an effective, usable and useful intervention in their daily working life. This study follows these occupational well-being definitions considering overall occupational well-being as a subjective experience consisting of all aspects of working life. As the definition of occupational well-being is wide, this study focuses on personal resources and workload to support the individual level occupational well-being. This is in line with the current Finnish national strategy for promoting occupational well-being 2024–2027, where one of the targets is to identify and manage the psychosocial strain in order to reduce the workers' psychosocial workload; therefore, creating better overall occupational well-being (Ministry of Social Affairs and Health, 2023).

Because the goal of this study is targeted to the individual level and considers personal resources and workload, there were many relevant theoretical frameworks suitable for the study aim. There was a wide range of occupational well-being models describing the essence of occupational well-being from the perspective of the individual, usually examined in the research field of occupational health psychology and human resource management. This study used the "Content Model for the Promotion of School Community Staff's Occupational Well-being" (Saaranen et al., 2007, 2015), where occupational well-being is considered to consists of four aspects:

1) worker's resources and work,
2) work community,
3) professional competence and
4) working conditions.

To further describe the chosen theoretical model for this study, a short description is presented of five other potential models that consider individual level personal resources and workload factors:

- Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007, 2017).

This model presents occupational well-being as having low job demands, and high job resources leading to high work engagement and low risk for burnout (Bakker & Demerouti, 2007, 2017). To promote occupational well-being, attention should be paid to promoting job resources (e.g., managers support and performance feedback and in-service training for professional development) and decreasing job demands (e.g., workload and work conflict). This model has been developed over many years and focusing now more on personal resources (e.g., self-efficacy, optimism and resilience) in addition to job resources to buffer the undesirable impact of job demands on strain. Furthermore, previous studies have shown that self-regulating personal resources help employees to recognize and regulate their workload effectively (Bakker & de Vries, 2021). The JD-R model has been applied in educators' occupational well-being research, where personal resources and workload are differently defined (Björk et al., 2019; Bottiani et al., 2019; Dicke et al., 2018; Evers et al., 2017).

- Job Demand−Control model (Karasek, 1979).

This model was developed for stress management, where the mental strain resulted from the interaction between the job demands and the individual's control over their work; personal control buffers the impact of job demands generating less occupational stress (Karasek, 1979). The model is widely studied in the research on occupational stress and promotion of job satisfaction but has had challenges in previous research as regards the definition of the concepts used in the demands and control (Kain & Jex, 2010).

- Effort-Reward Imbalance (ERI) model (Siegrist, 1996).

This model contributes to occupational well-being by assessing health effects of stressful experience at work, where high-cost/low-gain (e.g. high work pressure and lack of promotion prospects) conditions are considered particularly stressful (Siegrist, 1996). A questionnaire has been created for the definition of the concepts in this model, which investigates the prevalence stress from the result of an effort-reward imbalance (Stanhope, 2017).

- Work ability (WA) model (Ilmarinen, 2006, 2009).

Occupational well-being and work ability are closely related concepts used in conjunction with each other, but they also have differences (Vauhkonen et al., 2021). In the field of occupational health, work ability is the balance between the resources of the individual (e.g. health, functional abilities, education, and values) and work-related factors (e.g. work content, and organisation) (Ilmarinen, 2009). There is a work ability measurement tool, the work ability index (WAI), used to study educators work ability and consisting of items such as work ability in relation to work demands, illness and sick leaves and mental capacities (Grabara et al., 2018; Ilmarinen, 2006). Work ability is a well-known concept in Finland and used by the Finnish institute of occupational health (TTL) and Finnish institute for health and welfare (THL). The model is described as the "house of work ability" (Ilmarinen, 2019) and included the different dimensions of the work ability concept.

- Effort-Recovery model (Meijman & Mulder, 1998).

This model indicates well-being as constructed through a post work unwinding process involving work detachment, where the effort expended on work demands triggers psycho-physiological activation and behavioural reactions needing recovery (Meijman & Mulder, 1998). The model indicates the link between the need for recovery and health, absenteeism and work incapacity, where the need for recovery is a strongly workload-related (van Veldhoven et al., 2008). Based on this theory, a recovery experiences questionnaire has been developed, where the focus is on the relaxation, psychological detachment, control and mastery of worker's leisure time (Sonnentag & Fritz, 2007). This questionnaire has also been developed and used to measure recovery during working hours (Kinnunen et al., 2019).

Overall, there were several applicable models to be considered for this study to capture the essence of occupational well-being at an individual level. This study utilizes the "Content Model for the Promotion of School Community Staff's Occupational Well-being" (Saaranen et al., 2007, 2015). The selection was based on this model capturing the nature of the multilateral profession of the nurse educator which is used specifically among health care educators (Saaranen et al., 2020) who have their own special work description (Campos Silva et al., 2022).

The Content of the Model for the Promotion of School Community Staff's Occupational Well-being

The content model for the promotion of school community staff's occupational well-being has been developed and tested among educators (Laine et al., 2018; Saaranen

et al., 2007, 2015) and further developed applicable among health and social care educators (Saaranen et al., 2020; Vauhkonen, Honkalampi, et al., 2023). In this developed model, the educators' overall personal and communal occupational well-being consists of four aspects of educators' working life: 1) worker's resources and work, 2) work community, 3) professional competence and 4) working conditions (Rautiainen et al., 2023; Saaranen et al., 2015; Vauhkonen, Honkalampi, et al., 2023) (Figure 1). This model suggests each aspect has its own resources and workload factors that need balancing to gain the best level of overall occupational well-being (Saaranen et al., 2007). Occupational well-being consists of several aspects, and not all can be promoted at once. This model's four aspects can be investigated separately, where occupational well-being promotive actions are targeted within the chosen aspect, all aspects having associations either to prevent or promote the experiences of occupational well-being (Saaranen et al., 2015).

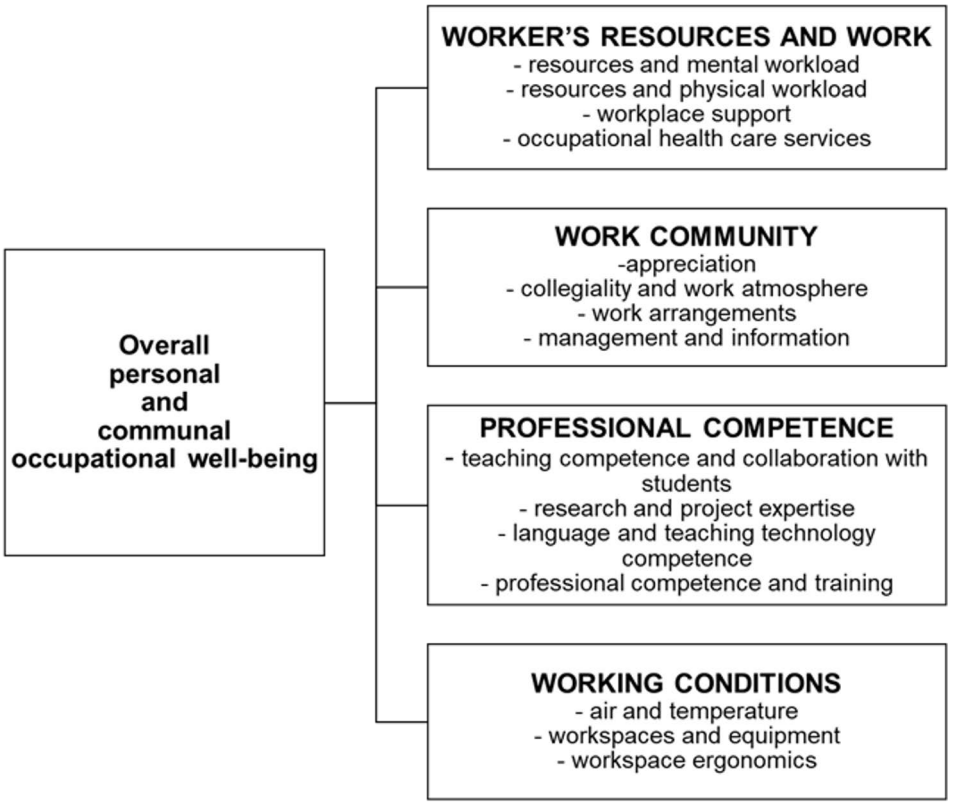


Figure 1. Content model for the promotion of School Community Staff's Occupational Well-being (modified from: Saaranen et al., 2007, 2015, 2020 and Figure 1 in Paper I).

This study goal was to support the occupational well-being of nurse educators. The aspect of worker's resources and work was chosen by investigating the improvement needs among nurse educators found in previous occupational well-being studies. The aspect worker's resources and work includes personal physical and mental resources at work, personal workload factors and supporting factors: occupational health care services and workplace support (Saaranen et al., 2007, 2020). There have been findings that there is a need for more investigation regarding personal resources as having positive associations with the experienced overall occupational well-being among educators working in secondary education (Brouskeli et al., 2018).

Worker's resources and work (Figure 1), considers the balance between resources and workload as being able to generate a better overall occupational well-being and seen as a sufficient resource for mental or physical workload (Saaranen et al., 2007, 2015). The supporting factors in the aspect of worker's resources and work are defined as **workplace support** (e.g. activities promoting occupational well-being) and **occupational health care services** (e.g. health examinations) (Saaranen et al., 2007, 2020). Altogether, the aspect worker's resources and work investigates the individual level of occupational well-being, where the contribution of personal attributes (resources and workload) are associated with the overall occupational well-being experience that needs balancing (Saaranen et al., 2007, 2020).

This model refers to the Conservatory Of Resources (COR)-theory (Hobfoll et al., 2018); this model lacks a specific definition for personal resources at work (Saaranen et al., 2020). COR-theory has been utilized in occupational well-being research, where personal resources at work are defined as being a great asset for occupational well-being and should be fostered and protected against resource loss (Hobfoll, 1989; Hobfoll et al., 2018). Moreover, engaging in activities that maintain and promote resources, workers can foster and protect their resources against resource loss engendered by high workload factors (Hobfoll et al., 2018; Saaranen et al., 2007, 2020). Consequently, the COR-theory and the content model implies the importance of maintaining and promoting personal resources but presents no strict definition. In this study, personal resources in the aspect of worker's resources and work are defined as health, fitness and vigor at work.

In this study, personal resources are recognized as physical and mental health, fitness and vigor. They are connected to the perspective of the resources of an individual to function in daily life, and in this context, daily working life. Physical and mental health, can be seen as a personal perception of the state of well-being necessary in everyday life for mental and physical functioning (Ministry of Social Affairs and Health, 2020; Moriarty et al., 2003; WHO, 1986). Health can be seen as the capability to react to all kinds of environmental events with the desired emotional and behavioral responses, and mental health (e.g. emotional regulation, optimism) as having a strong impact on physical health by laying a vital foundation for general

wellbeing and functional capacity; health does not necessarily mean the absence of an illness or a disability (Leonardi, 2018; Ministry of Social Affairs and Health, 2020). Physical and mental fitness refers to the ability to perform daily activities with physical endurance and emotional resilience, physical strength and emotional management (self-efficacy) and physical flexibility and mental acceptance (Campbell et al., 2013; Mikkelsson et al., 2005; Robinson et al., 2015). Vigor is personal physical and mental liveliness, seen as physical energy, mental creativity and cognitive liveliness (Boonyasiriwat et al., 2021; Shirom, 2011).

In this study, personal workload (i.e. work strain) is recognized as physical and mental workload factors defined in the content model. These workload factors are: the appropriateness of the physical and mental workload, time pressure, and the uneven distribution of work over an academic year (i.e. backlog situations at work), having time for breaks, musculoskeletal symptoms and vocal strain (Saaranen et al., 2020). Workload factors can either promote or prevent overall occupational well-being depending on personal resources and support, for instance, when a reasonable workload is seen as a positive factor towards occupational well-being (Saaranen et al., 2007).

In this study, resource-workload-balance is the experience of a balance between personal resources and workload is recognized in this study. In addition to the self-evaluated experiences, the physical state of the autonomic nervous system was assessed via **heart rate variability (HRV).** HRV provides an objective approach to evaluate the changes within the balance between sympathetic and parasympathetic nervous system activities. High resting HRV indicates good recovery and readiness (increased parasympathetic activity) and a greater ability to tolerate workload factors, thus creating the best level of resource-workload-balance (Järvelin-Pasanen et al., 2018; Shaffer & Ginsberg, 2017).

2.1.4 Digital occupational well-being interventions

This study aimed to develop and evaluate a self-conductive digital occupational well-being intervention. Digital occupational well-being interventions use mobile applications or web-based programs, and are increasing the field of health promotion at work due in part to their usability for a large population (Howarth et al., 2018; Thai et al., 2023).

Digital occupational well-being interventions have shown to be important for obtaining personal resource related outcomes, such as decreasing sedentary behavior and relieving stress (Beiwinkel et al., 2017; Thai et al., 2023). The importance is not solely individual, but also important as regards cost effectiveness. Investing in workplace well-being programs is shown to significantly decrease employees' medical costs and absenteeism by approximately twice the amount spent on occupational

well-being actions (Baicker et al., 2010). There is an increasing amount of remote work in society, and digital interventions allow access to the intervention wherever the work takes place and has potential to reach a larger number of individuals (Thai et al., 2023).

When evaluating a digital occupational well-being intervention, effectiveness is usually mentioned. For example, programs aiming to increase physical activity were found acceptable in raising awareness of the need in the workplace for inner motivation and management support (Blake et al., 2019; Macdonald et al., 2020). However, research should also indicate comparisons and account for confounding factors (e.g. the comparison organizations similarity and work descriptions of the employees) (Baicker, 2021). Digital interventions can be effective, but there are also barriers to consider. Lack of time for the program when working and integrating the digital program into the organization's culture is one cofounding factor that needs to be addressed in research (Macdonald et al., 2020; Muuraiskangas et al., 2016).

In addition to the evaluation of the effectiveness, the process of the intervention should also be evaluated that is, its acceptability, fidelity and quality of the implementation of the intervention (Murray et al., 2016; Perski & Short, 2021; Skivington et al., 2021). Process evaluation can help to determine why an intervention succeeds or fails. Although specific methods to evaluate the process of a digital interventions is lacking (Perski & Short, 2021), evaluating the usability of a digital intervention can demonstrate to what extent an intervention can be used by specified users to achieve specified goals, the learnability, the amount of satisfaction and adoption rate (Brooke, 2013; Lyon et al., 2021).

2.1.5 Summary of the study concepts

This study of occupational well-being of nurse educators uses various concepts previously presented in the study background. Because of the various concepts used in this study, the summary of the key concepts is proved in the order of their appearance in the background chapter (Table 1). The defined concepts are: nurse educator, practical nurse program, overall occupational well-being, general well-being, personal resources at work, personal workload, resource-workload-balance, a digital occupational well-being intervention, usability and utility of the intervention.

Table 1. Summary of the study concepts (modified from supplementary material in Paper IV).

Concept	Definition of the concept used in this study	References
Nurse educator	Nurse educator educates theoretical and/or practical subjects to student nurses in educational settings (e.g. in digital or classroom environments) at all levels of education, this study including also those not nurses. In Finland, nurse educators with permanent employment contract are qualified professionals having at least master's degree either from university or university of applied sciences (EQF 7).	1129/2014, 2014; 986/1998, 1998; Campos Silva et al., 2022; Oermann & Frank, 2021; WHO, 2016
Practical nurse program	In Finland, practical nurse program is part of health and social care education educated in Vocational Education and Trainee nursing schools (VET, EQF level 4). Practical nurse program is national regulated program, where professional practical nurses work in multiprofessional health and social care teams to plan, implement, and assess nursing.	Ministry of Education and Culture, 2017; National Board of Education, 2021
Overall occupational well-being	This study considers overall occupational well-being including all aspects of working life encompassing worker's experiences of the physical, mental, and social work environment and the resources at work in relations to workload. Moreover, this study concentrates more on personal resources and workload being one part of the overall occupational well-being.	Forastieri, 2014; Ministry of Social Affairs and Health, 2022; Saaranen et al., 2007, 2020
General well-being	General well-being encompasses subjective feelings of satisfaction and happiness in everyday life being closely connected to overall occupational well-being.	Topp et al., 2015; Weziak-Bialowolska et al., 2020
Personal resources at work	Personal resources in the aspect of worker's resources and work are recognized as physical and mental health, fitness and vigor in this study. These are connected to the perspective of persons own abilities to function in daily working life with physical and mental strength, endurance, flexibility and energy.	Boonyasiriwat et al., 2021; N. Campbell et al., 2013; Leonardi, 2018; Mikkelsson et al., 2005; Ministry of Social Affairs and Health, 2020; Moriarty et al., 2003; Robinson et al., 2015; Saaranen et al., 2007, 2020; Shirom, 2011; WHO, 1986
Personal workload	Personal workload in the aspect of worker's resources and work is recognized as physical and mental workload factors; voice strain, prevalence of musculoskeletal symptoms, appropriateness of workload, time pressure, the uneven distribution of work and possibilities to have breaks.	Saaranen et al., 2020; 2007
Resource-workload-balance	Resource-workload-balance in this study consists of the experiences of personal resources at work and workload factors and the balance between them, seen also being a physical state of the autonomic nervous system assessed via heart rate variability (HRV) indicating the ability to tolerate workload factors creating the level of resource-workload-balance.	(Järvelin-Pasanen et al., 2018; Saaranen et al., 2007, 2020; Shaffer & Ginsberg, 2017).
A digital occupational well-being intervention	A digital occupational well-being intervention means mobile application or web-based programs to promote occupational well-being.	Howarth et al., 2018; Thai et al., 2023
Usability of an intervention	Usability means what extent an intervention can be used to achieve specific goals, learnability and adoption in real life context.	Brooke, 2013; Lyon et al., 2021; Skivington et al., 2021.
Utility of an intervention	Utility means finding the quality of the intervention having practical worth, usefulness or applicability.	An et al., 2020; Skivington et al., 2021

2.2 Literature of the occupational well-being studies among nurse educators

2.2.1 Literature search

The aim of the literature review was to describe all relevant occupational well-being studies among nurse educators from the perspective of personal resources and workload factors. Literature searches were conducted in four databases: PubMed (MEDLINE), CINAHL, ERIC and PsycINFO in November 2023. Different search terms describing occupational well-being and nurse educator were used connecting the terms with Boolean operators (AND, OR, title/abstract). The search terms used in the databases were:

- occupational well-being, occupational health, job satisfaction, quality of working life, work ability, work capacity, work engagement, work well-being, work-life balance, personal resources, individual resources, vigor, physical health, mental health, fitness, resilience, self-efficacy
- nurse educator, nurse teacher, nursing educator, nursing teacher, nurse instructor, nurse lecturer, nurse faculty, nursing faculty, health care educator, health care teacher

The searches were limited (when applicable) to the English language (or English abstract) and the availability of the abstract. Search results were exported to a Rayyan review - program (https://www.rayyan.ai/) resulting in altogether 1086 records after removing duplicates. The screening of the relevant literature was started first by screening the titles and abstracts, and then assessing the full texts of the selected 90 records for eligibility.

The first eligibility criterion was that the article should include professional nurse educators (educating nurses) working in educational settings (excluding clinical educators). The second eligibility criterion was that the study aim should focus on personal resources and workload in the daily working life of nurse educators; studies were excluded if they investigated collegiality, professional development, work surroundings and safety, retention or management as these aspects belonged to other aspects of occupational well-being (Figure 1). The studies in this literature review conducted before the year 2000 (n=7) were excluded as it was felt they were not comparable with work descriptions of todays nurse educators (Campos Silva et al., 2022; Mikkonen et al., 2020; Salminen et al., 2023). However, four national (n=4) and three international studies (n=3) from the excluded nine studies were presented in the introduction chapter to gain historical perspective about the beginning of occupational well-being research (Anderson, 1998; Fong, 1993; Harri, 1995, 1996, 1997, 1998; Stamnes et al., 1998).

As a result, 43 studies were included in the literature review, all of which aimed to investigate the occupational well-being of nurse educators from the aspect of worker's resources and work (e.g. personal resources at work, workload factors). These studies were analyzed deductively and the studies categorized according to the aim using a narrative synthesis (Popay et al., 2006) and the guidelines of conducting and reporting a literature review without a meta-analysis (Campbell et al., 2018, 2020) (Table 2).

The eligible studies of personal resources and workload were from the years 2000–2023. Occupational well-being has been a growing research interest; therefore, the majority of the included studies were from the years between 2020–2023 (n=30). Most of the studies used negative indicators of personal resources, such as burnout and mental exhaustion (e.g. Boamah et al., 2023; Dugger, 2023; Hosseini et al., 2022; Poole & Spies, 2022). The second most addressed topic in the studies was job satisfaction, seen in this review as a personal resource for mental health (positive affective feelings towards work) (e.g. Arian et al., 2018; Kippenbrock et al., 2022; Sapkota et al., 2019) (Table 2).

Most of the included studies (n=32) were conducted in the USA or in Canada representing a western context for the selected studies. Nurse educators were addressed as educators teaching in a school of nursing (e.g. Zangaro et al., 2023). Nurse or nursing faculty (n=26) were the most used term in the studies addressing nurse educators, other terms were nurse educator, nurse academic, health care educator and nurse teacher. The study designs were mostly cross-sectional survey studies (n=28), including a few literature reviews (n=5) and qualitative studies (e.g. interview, case studies) (n=6). Only four intervention studies were found (Bentley, 2013; Kavurmaci et al., 2022; Stegen & Wankier, 2018; Wiklund Gustin et al., 2020).

Table 2. Deductive analysis of the occupational well-being studies (n=43) of nurse educators.

Characteristics	Authors
OCCUPATIONAL WELL-BEING STUDIES OF PERSONAL RESOURCES AND WORKLOAD	
• **Personal mental and physical resources at work**	
exhaustion, feelings of work stress, burnout	Dugger, 2023; Farber et al., 2020, 2023; Hosseini et al., 2022; Melnyk et al., 2023; Moyer, 2022; Owens, 2017; Riess et al., 2023; Rothacker-Peyton et al., 2022; Ruth-Sahd & Grim, 2021; Sacco & Kelly, 2021; Sarmiento et al., 2004; Singh et al., 2020; Watson, 2023; Zangaro et al., 2023
positive affective feelings towards work	Arian et al., 2018; Baker et al., 2011; Kippenbrock et al., 2022; Lane et al., 2010; Owens, 2017; Sapkota et al., 2019; Sarmiento et al., 2004; Stamnes, 2000
resilience	Hampton et al., 2022; Keener et al., 2021; Nurse-Clarke & Sockol, 2022; Orth & Evanson, 2023; Rothacker-Peyton et al., 2022; Stephens & Layne, 2023
empowerment, self-confidence	Arian et al., 2018; Baker et al., 2011; Owens, 2017; Riess et al., 2023; Sarmiento et al., 2004
physical health, physical activity	Main et al., 2017; Riess et al., 2023; Sturgeon et al., 2017
physical vigor, fatigue	Poole & Spies, 2022
• **Personal physical and mental workload**	
workload factors, work demands	Bittner & Bechtel, 2017; Boamah et al., 2023; Crawford et al., 2023; Dugger, 2023; Farber et al., 2023; Hamlin, 2021; Ludwig-Beymer et al., 2022; Moyer, 2022; Owens, 2017; Riess et al., 2023; Saaranen et al., 2020; Sacco & Kelly, 2021; Stamnes, 2000; Vauhkonen, Saaranen, et al., 2023
• **Resource-workload-balance**	
the balance between personal resources and workload	Boamah et al., 2023; Dugger, 2023; Moyer, 2022; Orth & Evanson, 2023; Poole & Spies, 2022; Riess et al., 2023; Saaranen et al., 2020; Sessions et al., 2023; Stephens & Layne, 2023; Thomas et al., 2019
• **Associating factors**	
workplace support	Arian et al., 2018; Crawford et al., 2023; Lane et al., 2010; Melnyk et al., 2023; Moyer, 2022; Rothacker-Peyton et al., 2022; Saaranen et al., 2020; Sacco & Kelly, 2021; Sarmiento et al., 2004; Sessions et al., 2023; Stamnes, 2000
work & personal life attributes, remote work	Boamah et al., 2022; Farber et al., 2020; Kippenbrock et al., 2022; Moyer, 2022; Owens, 2017; Riess et al., 2023; Sessions et al., 2023; Singh et al., 2020; Thomas et al., 2019
age	Arian et al., 2018; Bittner & Bechtel, 2017; Nurse-Clarke & Sockol, 2022; Saaranen et al., 2020; Watson, 2023; Zangaro et al., 2023
employment status	Arian et al., 2018; Kippenbrock et al., 2022; Melnyk et al., 2023; Rothacker-Peyton et al., 2022; Zangaro et al., 2023
work experience as a nurse educator	Arian et al., 2018; Crawford, 2021; Rothacker-Peyton et al., 2022
work autonomy	Baker et al., 2011; Crawford, 2021; Moyer, 2022
overall occupational well-being	Vauhkonen, Saaranen, et al., 2023
OCCUPATIONAL WELL-BEING INTERVENTIONS	
recovery, work satisfaction, physical fitness	Bentley, 2013; Kavurmaci et al., 2022; Stegen & Wankier, 2018; Wiklund Gustin et al., 2020

2.2.2 Occupational well-being studies of personal resources and workload

In this literature review, the occupational well-being of nurse educators investigated was related to the chosen occupational well-being model's aspect of worker's resources and work. The associating factors with personal resources, workload or the resource-workload-balance are presented, and the promotive interventions described.

Personal resources at work

This literature review found studies investigating the personal, mental and physical resources of nurse educators (Table 2). Most of the selected studies investigated nurse educators' **mental resources at work**. In this study, the personal mental resources at work are defined as health (e.g. emotional regulation and optimism), fitness (e.g. self-efficacy and resilience) and vigor (e.g. mental energy and creativity). This literature review found mostly negative indicators of mental health, such as mental exhaustion, stress and burnout. Nurse educators were reported as experiencing both low ratings of burnout (Owens, 2017; Ruth-Sahd & Grim, 2021) and the prevalence of a moderate to high work related stress (Moyer, 2022; Owens, 2017; Singh et al., 2020); burnout was defined as emotional exhaustion and feelings of lacking accomplishment (Dugger, 2023; Farber et al., 2020; Hosseini et al., 2022; Melnyk et al., 2023; Rothacker-Peyton et al., 2022; Sarmiento et al., 2004; Watson, 2023; Zangaro et al., 2023). There were also the experiences of dissatisfaction at work (Sapkota et al., 2019).

There were also positive mental resource indicators used which were comparable with mental health and fitness. The favourable levels of positive affective feelings towards work were experiencing work as meaningful and satisfactory (Arian et al., 2018; Baker et al., 2011; Kippenbrock et al., 2022; Lane et al., 2010; Owens, 2017; John H. Stamnes, 2000), Educators have shown to feel empowered and experiencing professional self-esteem, a sense of meaning and confidence in their work (Arian et al., 2018; Baker et al., 2011; Owens, 2017; Riess et al., 2023; Sarmiento et al., 2004). Educators were seen to experience moderately to high levels of resilience, and a mental fitness able to adapt to changes and challenges in everyday working life (Hampton et al., 2022; Keener et al., 2021; Nurse-Clarke & Sockol, 2022; Stephens & Layne, 2023). However, low resilience scores were also found (Rothacker-Peyton et al., 2022). During the COVID-19 pandemic, the mental resources of nurse educators decreased, studies reported increased anxiety and stress levels and the prevalence of mental exhaustion (Farber et al., 2023; Riess et al., 2023; Sacco & Kelly, 2021).

There were less studies investigating educators' **physical resources at work**, physical health (e.g. voice and cardiovascular functioning), fitness (e.g. flexibility and movement) and vigor (e.g. energy/fatigue). Educators were shown to have challenges in meeting the demands of physical activity at work and leisure time due to increased emphasis on technology use and online-teaching (Main et al., 2017; Riess et al., 2023; Sturgeon et al., 2017). There are indications of educators experiencing a moderate level of physical fatigue (Poole & Spies, 2022). Associations was reported between prolonged sitting time during workdays and a negative affect on educators' cardiovascular health (Main et al., 2017).

Associating factors with personal resources were found (Table 2). **Workplace support** was shown to have great importance towards improving mental resources of educators (Arian et al., 2018; Lane et al., 2010; Melnyk et al., 2023; Sarmiento et al., 2004; Sessions et al., 2023). The experiences of support towards educators' mental resources was experienced as inadequate (Melnyk et al., 2023; Rothacker-Peyton et al., 2022; Saaranen et al., 2020).

Personal life attributes, the balance between work and personal life, was shown to increase mental resources (Farber et al., 2020; Kippenbrock et al., 2022; Moyer, 2022; Owens, 2017). This implies that vice versa, where an imbalance of work and personal life exists these decreases mental resources (Boamah et al., 2022). For example, remote working during the pandemic caused an imbalance in work and personal life (e.g. taking care of children at home while working) and lead to decreased mental resources (Riess et al., 2023; Sessions et al., 2023).

Age was found to be an associating factor. Middle aged educators (30-50 years) were seen to experience their personal life interference as having a negative affect on their mental resources at work and needing more support from the managers (Boamah et al., 2022). The young age of an educator had positive associations with better mental resources at work than older educators (Arian et al., 2018; Zangaro et al., 2023). However, educators over 50 years of age had better mental resources and resilience than their younger colleagues (Nurse-Clarke & Sockol, 2022).

The stable employment status (e.g. having tenure, full-time work contract) had associations with better mental resources seen as less burnout or mental exhaustion and anxiety (Arian et al., 2018; Zangaro et al., 2023). There were also results arguing that there was more prevalence of burnout in those with tenure or full-time work contract (Rothacker-Peyton et al., 2022). **Work experience** was seen to have associations with personal resources. For those educators who had more work experience, less mental resources were experienced compared with those who had less work experience (Rothacker-Peyton et al., 2022). However, there were arguing results, where those educators who had less than three years of work experience had lower perceived mental resource (Arian et al., 2018). High **work autonomy** was shown to have positive associations on mental resources (Baker et al., 2011).

Personal workload

In this study, the educator's personal workload consists of **physical and mental workload factors**, such as time pressure, backlog situations at work, having time for breaks or having musculoskeletal symptoms. This literature review found studies investigating nurse educator's workload (Table 2). Recent studies show that nurse educators in four European countries (including Finland) experienced their mental workload as moderately balanced (Vauhkonen, Saaranen, et al., 2023). However, many studies have reported high workloads including long working hours, continuous work and constant connection due to digital working environments (Boamah et al., 2023; Crawford et al., 2023; Dugger, 2023; Moyer, 2022; Saaranen et al., 2020). There are recognized workload issues caused by challenging student interactions and digitalization (Owens, 2017).

Over 20 years ago, educators were reported as experiencing excessive workloads due to constant changes in educational reforms (Stamnes, 2000). During the COVID-19 pandemic, nurse educators experienced severely high workloads due to changes in the pedagogical environment and their physical workload such as an increase in sedentary behaviors (Farber et al., 2023; Riess et al., 2023). An increased need to provide emotional support for students was perceived, and a reduced ability to meet the demands of students with learning difficulties thus creating the experience of an increased workload (Sacco & Kelly, 2021).

Barriers have been identified when measuring and identifying the high workload of nurse educators (Bittner & Bechtel, 2017). Among the selected studies, there were identified models assessing nurse educators' workload (course load expectations, clinical supervision, coordination, academic advising, variance based on class size, etc.), where workplace team effort including both educators and administrators having same goals and vision is needed (Hamlin, 2021; Ludwig-Beymer et al., 2022).

Associating factors with workload were found (Table 2). There were associations with **workplace support**. The workplace and management support as regards workload issues (e.g. manageable class sizes, teaching hours, and research and development work) were reported to be inadequate (Crawford, 2021; Moyer, 2022). The experienced adequate workplace support decreases workload experiences (Sacco & Kelly, 2021).

Associations of **personal life attributes were reported**, where a high workload challenged the personal and work life balance and generated difficulties finding time to take part in self-care activities when working (e.g. planning breaks in the work schedule) and after work (e.g. not responding to work e-mails at home)(Moyer, 2022; Thomas et al., 2019).

Aging nursing educators experienced more difficulties with an increased and variable workload than their younger colleagues (Bittner & Bechtel, 2017; Saaranen

et al., 2020). There were positive associations between workload and **work autonomy**. When there was work autonomy and the flexibility to arrange the workload (e.g. having underage children or parents or spouses needing taking care of) there was less experience of a high workload among nurse educators (Crawford, 2021; Moyer, 2022).

Longer **work experience** as an educator was associated with more readiness to face the workload at the beginning of the school semester than those with less work experience (Crawford, 2021). Less experienced educators reported more inadequate support for workload than educators with more experience (Crawford, 2021). A balanced mental workload is associated with better **overall personal occupational well-being** (Vauhkonen, Saaranen, et al., 2023).

Resource-workload-balance

This literature review found a connection between personal resources at work and workload factors (Table 2). The studies indicated that the balance between personal resources and workload is a key to occupational well-being success in the aspect of worker's resources and work, and the term resource-workload-balance is used in this study. Mental resources were seen as important for overcoming challenges associated with the workload factors, where affective feelings towards work decreases the feelings of negativity for the workload (Moyer, 2022). Experience s of a high workload have associations with decreasing mental resources (e.g. prevalence of burnout, fatigue) (Boamah et al., 2023; Dugger, 2023; Poole & Spies, 2022; Sessions et al., 2023; Watson, 2023). Good mental resources and resilience were associated with the capacity to deal with high workload factors and as also increasing the experience of occupational well-being (Orth & Evanson, 2023; Riess et al., 2023; Sessions et al., 2023; Stephens & Layne, 2023). Continuous work demands can reduce mental resources and cause a decreased tolerance for students, a tired appearance and difficulty sleeping (Thomas et al., 2019).

Associating factors were found with resource-workload-balance (Table 2). **Workplace support** was seen to be an important associating factor in resource-workload-balance. Where nurse educators experienced the imbalance between resources and mental workload, there was need for workplace support (Saaranen et al., 2020). Workplace support (e.g. feedback from the managers) was seen as important to balancing workload and personal resources at work (Stamnes, 2000). In general, there is strong evidence of the importance of resource-workload-balance to gaining occupational well-being; however, there is a lack of evidence for the promoting of interventions as creating a research gap.

2.2.3 Occupational well-being interventions

This literate search found only a few intervention studies aiming to promote occupational well-being of nurse educators (Table 2). The country, aim, methodology, content, execution and the outcomes of these interventions are described.

The **8-week yoga-intervention** (randomized controlled trial) conducted in Turkey aimed to promote mental resources, to reduce burnout and increase positive affective feelings towards work (Kavurmaci et al., 2022). **The Cognitive Relational Group Programme (CRGP) intervention**, with one group post testing conducted in Sweden, investigated the experiences of this program aiming to promote recovery from the perspective of nurse educators having work-related stress (Wiklund Gustin et al., 2020). **The one-school year lasting gratitude intervention** with one group pre-post testing design conducted in USA, aimed to evaluate the effectiveness of the intervention on promoting mental resources (Stegen & Wankier, 2018). **There was a 4-week fit-ness pilot-intervention** study conducted in the USA, investigating a 4-week fitness training program aiming to improve the physical resources and knowledge of physical fitness among nurse educators (Bentley, 2013).

According to the **content and execution** of these interventions, there were different activities included, some needing constant facilitators. The 8-week yoga intervention included a twice weekly yoga session (60-90 minutes per session) held by a certified yoga instructor in a prepared yoga room at school (Kavurmaci et al., 2022). The Cognitive Relational Group Programme (CRGP) intervention was held by a group leader at the school and included twelve 90 minutes CRGP sessions addressing stress management (e.g. being an active agent, reflecting on life and develop adaptive coping strategies) including breathing exercises in each session (Wiklund Gustin et al., 2020). The gratitude intervention included distributed gratitude books explaining the gratitude aims, optional gratitude themed lunch sessions for discussion, gratitude moments in meetings, private gratitude themed social media group website for discussions and gratitude bulletin board in break room to give notes of thanks (Stegen & Wankier, 2018). The 4-week fitness intervention included activities provided by the researcher: comprehensive cardiovascular physical examination, three hour lectures on fitness training health benefits and fitness assessments and a twice a week 60 minute exercise training session (cardiovascular warm-up, walk/jog/run session and different muscle groups exercises and stretching) (Bentley, 2013).

The outcomes of these interventions were promising. The 8-week yoga intervention promoted the personal resources of the nurse educators (e.g. mental health: satisfaction towards work and less burnout) (Kavurmaci et al., 2022). The Cognitive Relational Group Programme (CRGP) intervention generated improvements in personal resources (e.g. mental fitness: positive coping strategies) and self-regulation of

personal resources (e.g. knowledge and understanding about psychological processes increasing self-awareness, self-compassionate) (Wiklund Gustin et al., 2020). The gratitude intervention improved mental health (e.g. positive affective feelings towards work (Stegen & Wankier, 2018). The 4-week fitness pilot intervention engendered positive experiences of the program's ability to provoke and improve an interest in physical fitness and being able to manage the educators' own exercise programs and sharing with students, but no actual improvements were found for physical resources (e.g. health and fit-ness) (Bentley, 2013).

All these interventions aimed to promote personal resources at work and are relevant to this study. However, there is a need to further investigate the possibilities to support the occupational well-being of nurse educators during working hours.

2.2.4 Summary of the occupational well-being studies

The wide range of different concepts used in the occupational well-being studies challenged the synthetization of the previous research. As personal resources at work, nurse educators have found the experiences of self-confidence, resilience and positive affective feelings towards work helpful, but there are also negative indicators such as exhaustion, stress, burnout and fatigue. Educators have found to experience a moderate to high workload. The work description also included positive workload indicators such as autonomous, flexible, interesting and meaningful. Associated factors found were workplace support, work and personal life attributes, remote work, age, employment status, work experience, work autonomy and overall occupational well-being.

Connections with personal resources at work and workload are described in this study as resource-workload-balance. Previous studies indicated the importance of personal resources at work for managing workload factors, where workplace support is an important associated factor. Only a few occupational well-being intervention studies were found. These interventions aimed to promote personal resources at work but mainly after work, only one intervention used exercises during working hours.

Consequently, there is a research gap concerning occupational well-being intervention studies in the working life of nurse educators for supporting the resource-workload-balance addressed in this study. There was only one study conducted during working hours among the nurse educators; therefore, more investigation is needed from other educational sectors of what interventions could be beneficial to support occupational well-being. Moreover, the process evaluation of these intervention studies was lacking, but the experiences reported in the interventions were found positive and encourage further investigation.

3 Aims of the study

In this chapter, the study aims are presented. The main aim of this two-phased study was to develop and evaluate a self-conductive digital occupational well-being intervention focusing on personal resources and the workload of nurse educators. The goal was to support the occupational well-being of nurse educators by producing an effective, usable and useful intervention in their daily working life (Figure 2).

In the development PHASE I, the aim was to develop and implement a Self-Help Intervention for Educators (SHINE) to identify the key issues concerning the occupational well-being among educators working in health and social care education (Paper I) and to identify self-conducted interventions during working hours that would be beneficial for the occupational well-being of educators (Paper II).

In the evaluation PHASE II, the aim was to evaluate the SHINE for its effectiveness (Paper III) and its process assessing the usability and utility (Paper IV).

The research questions addressed were as follows:

1. What is the experience of occupational well-being as regards resources and workload among educators working in health and social care education in Finland? (PHASE I, Paper I)
2. What self-conducted interventions have been carried out during working hours aiming to promote occupational well-being among educators in general? (PHASE I, Paper II)
3. What is the effectiveness of SHINE on the resource-workload-balance (self-reported and HRV), overall occupational and general well-being, physical activity, recovery experiences, self-regulation and workplace support among nurse educators? (PHASE II, Paper III).
4. What is the usability and utility of SHINE in the daily working life from the perspective of nurse educators? (PHASE II, Paper IV)

Hypotheses: Nurse educators receiving SHINE will improve their

a. resource-workload-balance (primary outcome),
b. overall and general well-being (secondary outcomes, referred also as associating factors for resource-workload-balance),
c. physical activity, recovery experiences, self-regulation of personal resources and workplace support (condition outcomes, referred also as promoting factors for resource-workload-balance)

within and between the group comparisons, at both the post (after 8-workweeks) and one-month follow-up (after 12-workweeks) time points.

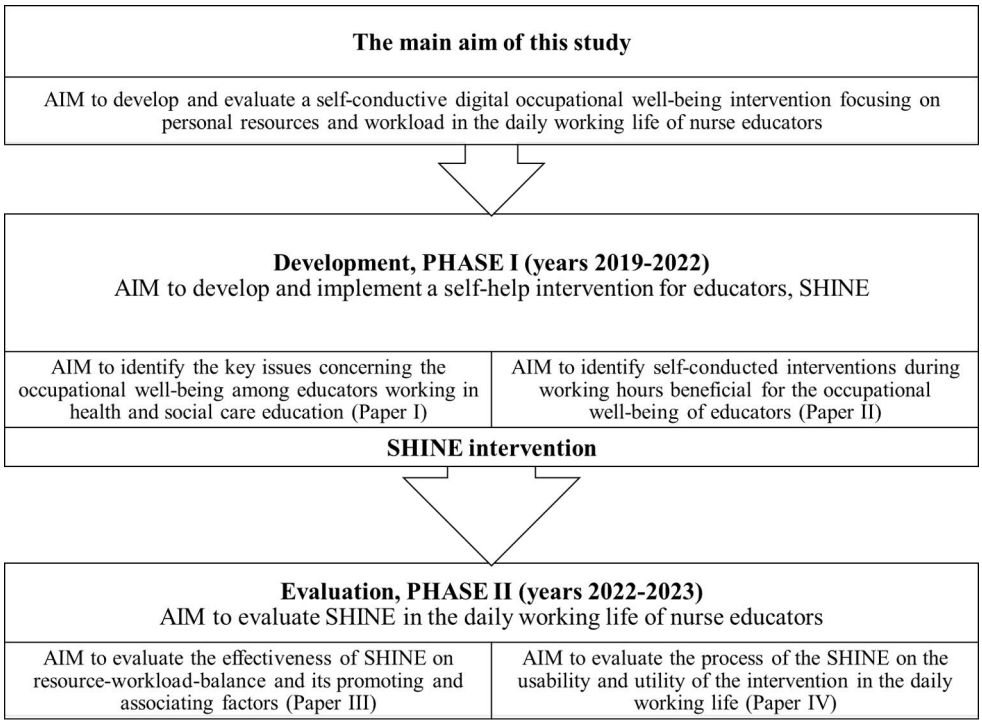


Figure 2. Study aims.

4 Materials and Methods

In this chapter, the materials and methods of this study are described: the study design, setting and samples (4.1), the description of the developed and tested intervention (4.2), data collection (4.3), data analysis (4.4) and ethical issues (4.5). Different research methods and study designs were utilized dividing the study into two phases: 1) development PHASE I and 2) evaluation PHASE II (Table 3; Figure 3).

Table 3. Summary of the materials and methods in Papers I-IV.

PHASE; YEARS	DESIGN; PAPER	SAMPLE; SETTING; TIME	DATA COLLECTION	DATA ANALYSIS
PHASE I; 2019–2022	Cross-sectional survey study; Paper I	Health and social care educators (n=552); Vocational secondary (VET) and upper health and social care schools; 2020	Data 1. Questionnaire (Webropol): OWESoHeT-instrument = Occupational well-being of social and health care teachers –index questionnaire (reporting 27 items).	Statistical analysis
	Systematic review; Paper II	Empirical studies (n=13); interventions done during working hours in educational organizations; 2020	Data 2. Systematic literature search from five databases (CINAHL, COCHRANE LIBRARY, ERIC, PsycINFO and Medline/PubMed)	Numerical charting, narrative analysis
	SHINE intervention			
PHASE II; 2022–2023	Controlled quasi-experimental study; Paper III	Nurse educators (intervention group, n=37; control group, n=40); Vocational nursing schools providing practical nurse program; 2022	Data 3. 1) Heart rate variability (HRV): Polar heart rate sensor 2) Digital questionnaire (RedCap): Resource based occupational well-being questionnaire: seven subscales + background variables (45 items)	Statistical analysis
	Cross-sectional survey study with process evaluation; Paper IV	Nurse educators completed SHINE (n=37); Vocational nursing schools providing practical nurse program; 2022	Data 4. Digital questionnaire (RedCap): SHINE feedback questionnaire: three subscales (21 items)	Statistical analysis, content analysis

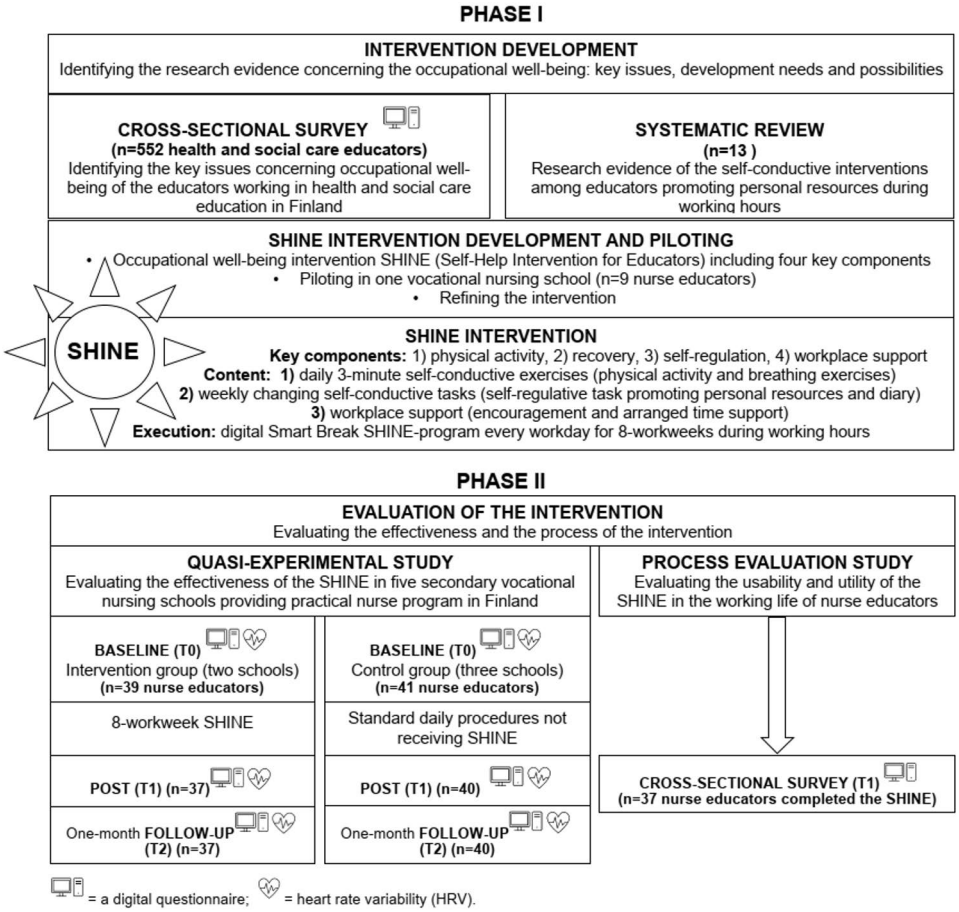


Figure 3. Summary of the study designs and methods.

4.1 Study design, setting and sample

PHASE I

In PHASE I, the aim was to develop and implement a digital intervention for nurse educators, entitled SHINE. To reach the aim, the key issues were identified concerning both the occupational well-being among educators working in health and social care education and the benefits of self-conducted occupational well-being interventions in the daily working life of educators. The study was based on two different study designs using a cross-sectional survey design (Paper I) and a systematic review design (Paper II) (Figure 3).

In the first paper, the occupational well-being aspect of worker's resources and work (Figure 1) and its associating factors were described among educators in health

and social care education in Finland. In the second paper, the characteristics and outcomes of the self-conducted occupational well-being interventions were described from a systematic search in the previous literature in order to better understand the possibilities of strengthening educator's personal resources during working hours. These two study designs justified the content and the delivery of the Self-Help Intervention for Educators (SHINE) developed to function/operate in the daily working life of nurse educators.

The sample in the cross-sectional survey study (Paper I) consisted of educators that were working either in the secondary (vocational education and trainee, VET) or in the upper (university of applied sciences) health and social schools in Finland. The clustered sample (n=552, response rate 31 %, Table 4) were recruited from the labour union, the Trade Union of Education in Finland (OAJ/AO ry), which includes approximately 70 percent (N=1772, OAJ statistics) of the total national study population of educators in health and social care education; the majority of them being nurse educators (Paper I).

The systematic review design (Paper II) followed the "Preferred Reporting Items for Systematic Reviews and Meta-analyses" (PRISMA) guidelines (Shamseer et al., 2015). There were strict inclusion and exclusion criteria made by the PICOS statement for conducting a structured literature search (Amir-Behghadami & Janati, 2020; Eriksen & Frandsen, 2018); these criteria created the selected sample of the research articles on the self-conductive interventions among educators (n=13) from five different databases (Table 3, Paper II).

The sample included 13 studies (limits: English-language) which were published between 1999–2018 and implemented in Hong Kong (n=3), the USA (n=2), Brazil (n=1), China (n=1), Iran (n=1), the Netherlands (n=1), the UK (n=1), and Taiwan (n=1). The eligibility criteria for the interventions in the selected studies were having been conducted during working hours among professional educators (included all the educational settings) with the aim of promoting personal resources at work.

Table 4. Characteristics of the participants (n=552) in the survey study in PHASE I (modified from Table 1 in Paper I).

Background variables		n (%)
Gender (n=550)	female male other/prefer not to say	509 (92) 36 (7) 5 (1)
Age (n=549) in years	≤ 39 40–49 50–59 ≥ 60	56 (10) 161 (29) 227 (42) 103 (19)
Marital status (n=552)	married/co-habiting in a relationship single/widowed other	422 (77) 39 (7) 78 (14) 9 (2)
Having children under 18-year-old (n=548)	yes no	210 (38) 338 (62)
Taking care of another person (not related to my job) needing help due to advanced age, illness, or disability (n=548)	yes no	193 (35) 355 (65)
Remote working (n=548)	yes no	308 (56) 240 (44)
Work experience as an educator in health and social care education (n=548) in years	<10 10–20 > 20	181 (33) 255 (46) 112 (21)
Current employment contract (n=548)	permanent temporary	499 (91) 49 (9)
Other additional work (n=547)	yes no	106 (19) 441 (81)

PHASE II

In PHASE II, the aim was to evaluate the developed SHINE intervention among nurse educators (Figure 3; Figure 4). In the third paper, the effectiveness of SHINE on resource-workload-balance (primary outcome: self-evaluated resource-workload-balance, and heart rate variability, HRV) and its associating factors (secondary outcomes: overall occupational well-being and general well-being) and promoting factors (condition outcomes: physical activity, recovery, self-regulation and workplace support) were evaluated using a controlled quasi-experimental study design. In the fourth paper, the evaluation of the process was conducted focusing on the usability and utility outcomes of SHINE in the daily working life surroundings of educators with a process evaluation design.

The sample in the controlled quasi-experimental study (Paper III) was confirmed by calculating the power analysis with an established α level of .05 and the power of 0.80 for the primary outcome (self-reported resource-workload-balance) indicating the need of 37 educators in both groups to show a 0.5-point difference within the IG and the CG with an effect size of 0.6 (Bagiella & Chang, 2019). The

voluntary response sample consisted of nurse educators working in vocational nursing schools educating practical nurses. These participants were either placed in the intervention group receiving SHINE (IG, N=39) or in the control group not having the intervention (CG, N=41). The participants (Table 5) were recruited from five previously chosen nursing schools (e.g. management, region, and study programs) who had agreed to provide the workplace support needed in the intervention. These schools were in the southern part of Finland and were randomly assigned either into the IG (n= two schools) or into the CG (n= three schools).

The inclusion criteria for these enrolled nurse educators were: having full-time work contracts (working at least over 50 % of the minimum working hours, full working hours being approximately 38 hours per week), being professional specialized educators, not having a pacemaker or being pregnant (because of the study heart rate measurements). There were three dropouts during the study leaving a final sample of 77 nurse educators (IG=37 and CG=40, Table 5).

The sample in the process evaluation study (Paper IV) included all the educators that completed the SHINE intervention (n=37). The SHINE usage profiles (Table 5) were calculated according to the participant's completion of the daily 3-min exercises where 70 % of the educators were considered as active users completing both the daily 3-min exercises 3–5 times/workweek, and having completed 41–75 of the maximum of 80 exercises during the previous eight workweeks.

Table 5. Characteristics of the participants in PHASE II (modified from supplementary material Table 1 in Paper III).

Background variables	Intervention group (IG, n=37) n (%)	Control group (CG, n=40) n (%)
Age in years:		
≤ 40	6 (16)	4 (10)
41–50	16 (43)	14 (35)
> 50	15 (41)	22 (55)
In a relationship:		
yes	28 (76)	33 (82)
no	8 (21)	7 (18)
unknown	1 (3)	-
Having children under 18-year-old:		
yes	17 (46)	20 (50)
no	20 (54)	20 (50)
The support from friends/family in daily life:		
weekly	33 (89)	33 (83)
rarely or never	4 (11)	7 (17)
Work experience as a nurse educator in years:		
≤ 5	9 (24)	7 (18)
6–15	20 (54)	23 (58)
> 15	8 (22)	10 (25)
Remote working:		
weekly	23 (62)	28 (70)
rarely or never	14 (38)	12 (30)
Experienced current work autonomy:		
high experienced	28 (76)	30 (75)
neutral	5 (13)	5 (12.5)
low experienced	4 (11)	5 (12.5)
SHINE usage profile (calculated):		
active (usage 3–5 workdays/week)	26 (70)	not applicable
less active (usage 1–2 workdays/week)	11 (30)	
Weekly working time (hours/week):	**Mean (SD)**	**Mean (SD)**
baseline (T0=baseline)	37.03 (6.25)	40.48 (6.10)
post (T1=post after 8-workweeks)	35.86 (7.40)	37.53 (10.43)
follow-up (T2=one-month follow-up)	37.86 (6.09)	34.63 (13.80)

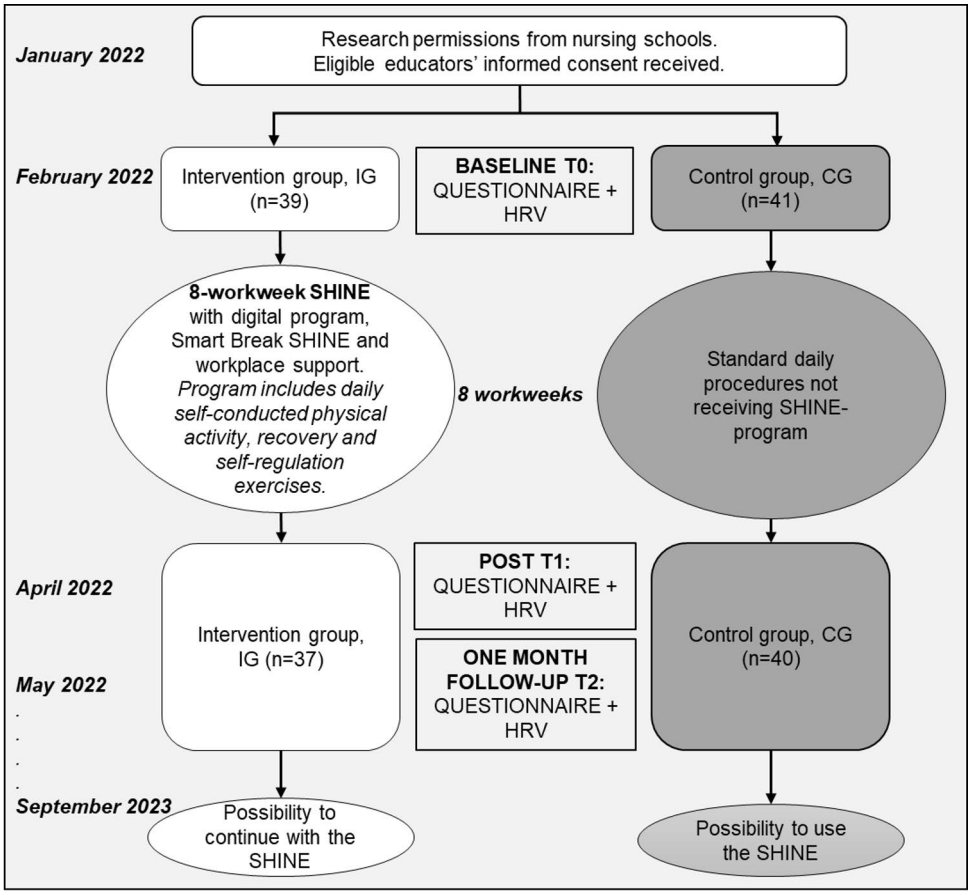


Figure 4. Intervention study design (modified from supplementary material Figure 2 in Paper III).

4.2 The description of SHINE

The Self-Help Intervention for Educators (SHINE) was developed to support occupational well-being of nurse educators, the need being justified in the previous literature and this study PHASE I (further described in the results). SHINE was based on the idea that occupational well-being is constructed when working, and as a shared responsibility between the workplace and the educators themselves. The UK Medical Research Council (MRC) framework on developing and evaluating complex interventions was utilized throughout the SHINE development and evaluation process (Skivington et al., 2021). SHINE development and evaluation had eight steps starting with identifying the occupational well-being development needs and ending with the evaluation of the intervention (Figure 5).

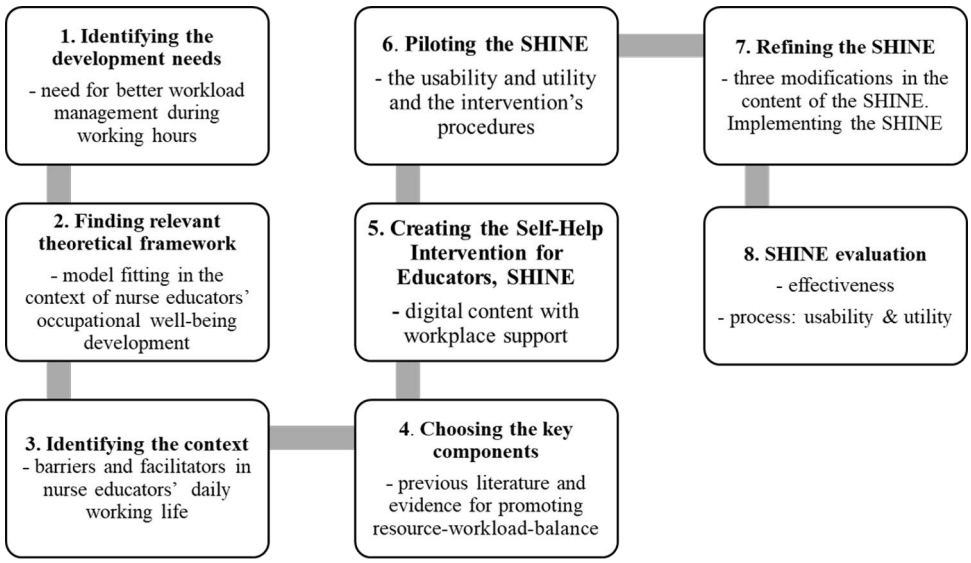


Figure 5. The development of SHINE (modified from Skivington et al., 2021; supplementary material in Paper IV).

The first, second and third steps were to identify the development needs, finding a relevant theoretical framework and identifying the educational context (Paper I). **In step four**, the key components to promoting personal resource-workload-balance were identified from reviewing the previous literature (Paper II). The key components chosen were: (1) physical activity at work; (2) recovery activities at work; (3) self-regulation development activities at work; and (4) workplace support for personal resources promoting activities at work. In addition to Papers I and II, additional literature was also used for justifying the use of these components to promote resource-workload-balance.

Physical activity at work, has been shown to increase educators' resource-workload-balance as indicated by their improved heart rate variability values (Liu et al., 2015); meaning the number of heart beats per minute reflecting regulation of the autonomic balance of the human body (Shaffer & Ginsberg, 2017). To consider increasing physical activity at work (e.g. walking) is important. The global recommendations of the WHO for daily physical activity for healthy adults (18–64 years) is engaging in moderate intensity physical activity (e.g. walking) for at least 150 min per week (22min per day) in order to gain well-being benefits (WHO, 2010).

Recovery activities at work (e.g. breaks, breathing exercises) have shown to have benefits for increasing personal mental resources (Anderson et al., 1999; Bennett et al., 2019; Chan, 2010; Tsang et al., 2015), as well as physical resources, voice health management and workload factors (Faham et al., 2016). Recovery experiences

(this study investigated psychological detachment and relaxation), especially psychological detachment from work, decreases the feelings of fatigue at work and generates a better resource-workload-balance (Kinnunen et al., 2011).

Self-regulation development activities at work (e.g. self-reflecting coping strategies at work, focusing on good things and goal setting), have been shown to promote personal resources affecting the resource-workload-balance at work, reducing stress and improving positive affective feelings and emotional regulation among educators (Morgan & Atkin, 2016; Stegen & Wankier, 2018). Self-regulation has an important role in health behavior change leading to positive health related outcomes (Hennessy et al., 2020; Ryan, 2009).

Workplace support for personal resource promoting activities at work is essential for allowing OW promotive actions to be carried out during working hours. Management and collegial support (Bennett et al., 2017) has been shown to have an important role in resource-workload-balance of nurse educators (Arian et al., 2018; Melnyk et al., 2023). This social facilitation of the intervention is seen important for gaining individual health behavior change in addition to self-regulative activities (Ryan, 2009).

All four selected key components worked as promotive factors towards resource-workload-balance and therefore were considered as conditions for the outcomes in the SHINE model. Balance in the aspect of worker's resources and work in the study occupational well-being content model (Figure 1) was shown to have associations with improving overall occupational well-being (Saaranen et al., 2007, 2020) and general well-being (Weziak-Bialowolska et al., 2020). Therefore, overall occupational well-being and general well-being were considered as associated factors (i.e. secondary outcomes) to the resource-workload-balance (Figure 6).

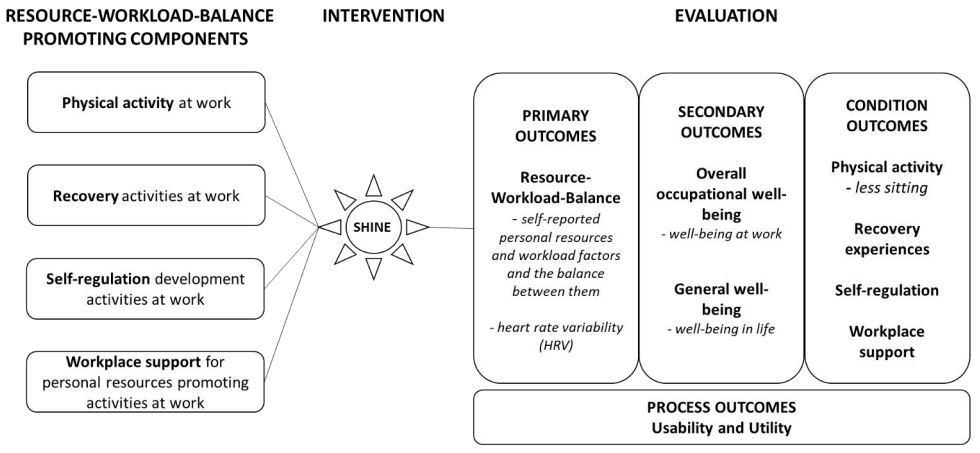


Figure 6. SHINE model (modified from supplementary material Figure 1 in Paper III).

In step five, the SHINE intervention was developed. **The content** of SHINE (Figure 7) in the digital Smart Break SHINE-program had short 3-minute instructed videos including physical activity and breathing with body movements recovery exercises and self-regulative weekly tasks and a diary. The program gathered information on the number of conducted exercises for the fidelity evaluation (e.g. how many exercises there were conducted). The Smart Break SHINE-program was modified from the original Smart Break-program (https://www.smart-break.com), which also included the 3-minute instruction video for the physical activity exercises which was used in this study program. The content included workplace support arranged by the educational organizations and consisted of weekly encouragement and reminders from the managers to the educators to complete all the SHINE activities and included SHINE as part of the educators in-service training giving them time during working hours.

The execution of SHINE (Figure 7) was designed early on as a self-conductive digital 8-workweek intervention in the daily working life of nurse educators. Previous research indicates positive well-being outcomes from digital interventions delivered during working hours (Howarth et al., 2018). The self-conductive intervention was designed with the possibility to be executed wherever the educators' work took place in the changing work environments (e.g. remote work) and needed no external facilitators or instructors. The eight-workweek delivery was based on the assumption of a habituation of the daily occupational well-being activities eight weeks repetition in a framed context (Gardner & Rebar, 2019). The digital Smart Break SHINE-program was developed to deliver three of the four developed components (physical activity, recovery and self-regulation), while the fourth developed component, workplace support, was arranged with the managers in the educational organizations

In step six, the feasibility of SHINE was piloted in the daily working life of nurse educators regarding the usability and utility of the intervention. The usability and utility were considered as process outcomes in the SHINE model (Figure 6). The 4-weeks piloting was done in Autumn 2021 with a one-group post-test design among nurse educators (n=9) educating in practical nurse program. SHINE was found usable and useful, and especially useful for promoting physical activity.

In step seven, the SHINE intervention was reframed according to the suggestions given in the piloting phase: 1) adding more reminders, 2) checking and improving the technical issues with video loadings, and 3) adding nature pictures into the program. In addition, the study procedures (e.g. Bluetooth heart rate sensor, the instructions for the program usage and the informed consent) were found feasible creating the final content and execution of SHINE ready for the implementation. **In step eight**, SHINE intervention using self-conductive activities during working hours with workplace support was evaluated according to the study design.

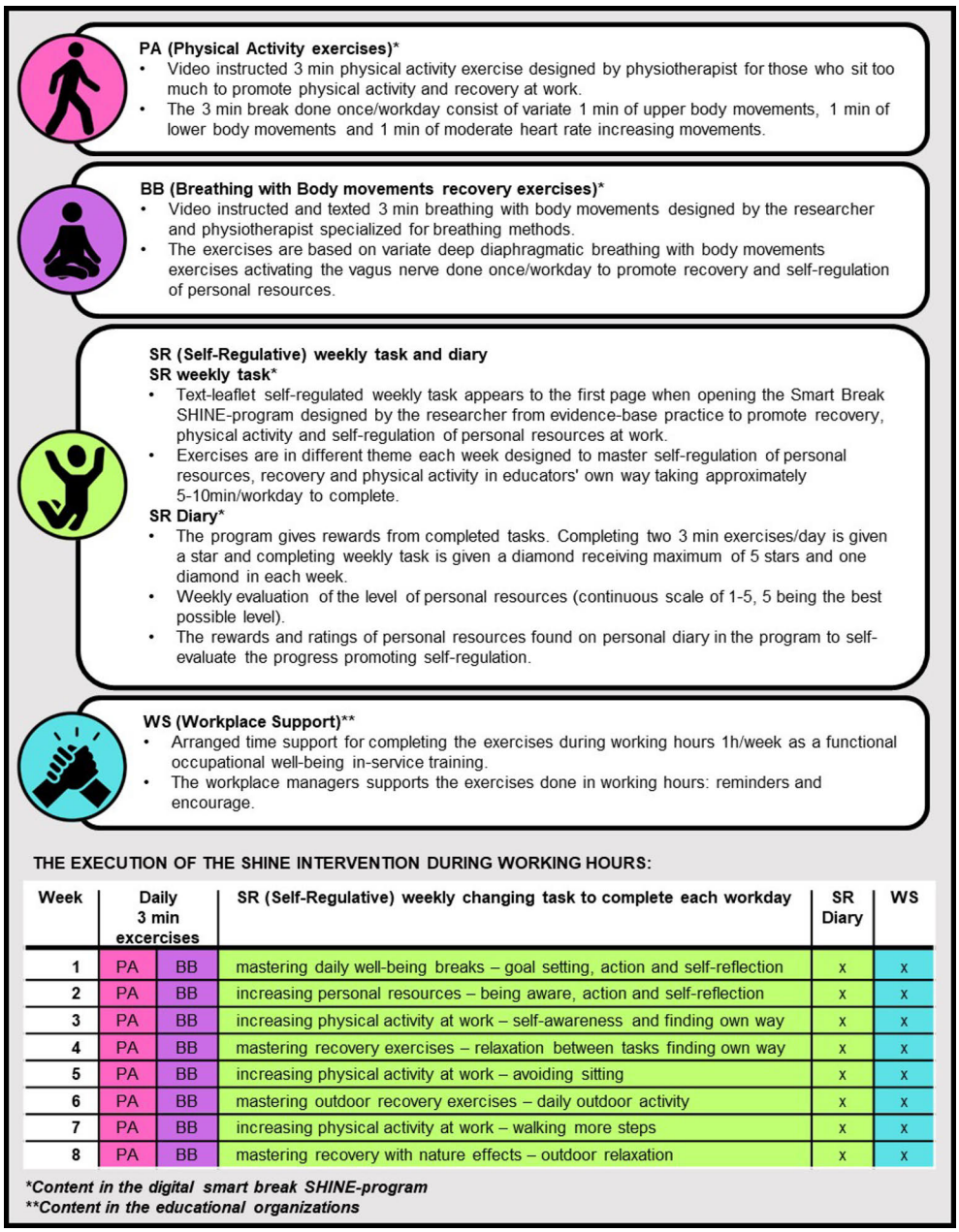


Figure 7. SHINE intervention: content and execution (modified from the supplementary material Figure 3 in Paper III).

4.3 Data collection

PHASE I

In PHASE I, two data collections were conducted. The first data (Paper I) were collected in September 2020 using an electronic questionnaire, the Finnish "Occupational Well-Being of Social and Health Care Teachers Index Questionnaire" (OWESoHeT) (Rautiainen et al., 2023; Saaranen et al., 2020, 2021; Vauhkonen, Honkalampi, et al., 2023). This questionnaire was developed from the "The Well-being at Your Work -instrument" used to evaluate occupational well-being in action research projects in the basic education (Laine et al., 2018; Saaranen et al., 2006, 2015). Further development of the instrument for health care educators was conducted in the years 2011, 2017, this process involved educators and researchers of health and social care education (Hyvärinen, 2017; Saaranen et al., 2020, 2021). For this study project, the wording of several items was updated and modified, and those instruments needing further structural validity testing for the modified and developed items are presented in the data analysis section.

The focus of this study was on the of occupational well-being aspect, worker's resources and work (WRW). The 15-item WRW and 4-item overall occupational-wellbeing (OW) variables and nine background variables of the OWESoHeT-instrument were used (Table 6). The questionnaire was sent from the Trade Union of Education (OAJ/AO ry) to the health and social care educators in Finland in September 2020. The eligible participants (N = 1772) received an email with an invitation to participate in the study with a link to the electronic questionnaire. Three email reminders were sent within the one-month data collection period.

The second data collection in PHASE I (Paper II) was collected from five databases in September 2020: 1) CINAHL, 2) COCHRANE LIBRARY, 3) ERIC, 4) PsycINFO and 5) MEDLINE/PubMed limiting the search to peer-review English research articles. The main search terms were occupational well-being, educator and intervention, producing the total sample of records after removing the duplicates (N= 2732). The records were screened by two researchers independently using the eligibility criteria created from PICOS (Murad et al., 2014) these were the following: population of qualified professional educators, interventions using self-conductive exercises during working hours, no comparisons needed, the outcome being the individual occupational well-being and including all intervention study designs; this resulted in 13 studies being included in the literature review.

Table 6. Study variables and instruments used in the survey in PHASE I.

Variables	Instrument (scale)	Content	Items	Examples for items
Overall occupational well-being (overall OW)	OWESoHeT© (continuous 0–5)	personal OW, communal OW, satisfaction with OW promotive activities	4	I feel that my personal occupational well-being in this profession compared to the best possible level is I think the general occupational well-being of teachers in my work community is My satisfaction with the activities promoting occupational well-being provided by my employer in my working community is
Background	OWESoHeT©	Gender, age, family relations and work	9	There are underaged (under 18 years) children in my family My age is
Worker's Resources and Work subscale (WRW)	OWESoHeT© (Likert 1–5)	Resources and mental workload	4	The mental workload of my work is appropriate My workload is divided evenly, and backlog can be avoided
		Resources and physical workload	3	The physical workload of my work is appropriate My working postures and movements are ergonomic and cause no musculoskeletal symptoms
		Workplace support	4	My workplace has provided enough activities to support my coping at work and my mental resources My workplace has provided enough activities that have encouraged me to promote my occupational well-being during my working hours (e.g. taking breaks to exercise, relaxation techniques).
		Occupational health care services	4	Health examinations have supported my health I have received support, advice and guidance from occupational health care services to maintain and promote my occupational well-being

PHASE II

In PHASE II, two data collections were conducted. The third data collection (Paper III) was collected with an electronic self-reported "Resource based occupational well-being questionnaire" and heart rate sensor administered at three time points (T0=baseline, T1=post and T2=one-month follow-up) in a period from February to May 2022 (Figure 3).

The used 45-item questionnaire consisted of background variables and seven subscales: 1) resource-workload-balance (Saaranen et al., 2020, 2021; Vauhkonen,

Honkalampi, et al., 2023, Paper I and III), 2) overall occupational well-being (Saaranen et al., 2020, 2021; Vauhkonen, Honkalampi, et al., 2023, Paper I), 3) general well-being (Topp et al., 2015), 4) physical activity at work (Chau et al., 2012), 5) recovery experiences at work (Kinnunen et al., 2019; Sonnentag & Fritz, 2007), 6) self-regulation of personal resources at work (Hennessy et al., 2020; Mezo, 2009) and 7) workplace support for personal resources at work (Saaranen et al., 2020, Paper I) (Table 7). The questionnaire consisted of items developed for this study (n=17) and items obtained from other instruments (n=20) (Table 7). The questionnaire was sent from the Research Electronic Data Capture (REDCap)-program to the participants (N=80) as a personal link via email. Two reminder emails were sent automatically to non-corresponding educators at each time point (T0–T2).

In addition to the self-reported questionnaire, each participant was given a Polar H7 or H10 heart rate sensor (Polar Electro Oy, Finland) to measure heart rate variability (HRV) which was collected every workday morning during a one workweek period at each time point (T0–T2). Measurements were taken lying down in a resting position for three minutes after wake-up by connecting the sensor via Bluetooth with the Kubios HRV application (Kubios Oy, Finland). Kubios HRV is a commonly used HRV analysis application (Tarvainen et al., 2014, 2008).

The fourth data collection was conducted in PHASE II (Paper IV) with a 21-item self-reported electronic "SHINE feedback questionnaire" (Table 7). The questionnaire consisted of three sections: 1) 10-item "System Usability Scale, SUS-scale"(Brooke, 1996), 2) 7-item Utility-scale and 3) four open-ended questions developed for this study. The data collection was conducted among the intervention group that completed SHINE (n=37) in Spring 2022 by sending a personal link from REDCap to the educators' email accompanied by three remainders to non-corresponding educators within two weeks.

Table 7. Study variables and instruments in PHASE II.

Variables	Instrument (scale)	Content	Items	Examples for items
RESOURCE BASED OCCUPATIONAL WELL-BEING QUESTIONNAIRE				
Back-ground	OWESoHeT©	Personal and work related	8	Being in a relationship Remote working
Heart rate variability (HRV)	Heart rate sensor, Polar® H7/H10 (ms, ratio)	Mean RR (ms)	-	Average time interval between successive heartbeats
		RMSSD (ms)	-	Root mean square of the successive RR interval differences
		SD1/SD2 ratio	-	Poincaré plot standard deviation ratio
Resource-Workload-Balance (RWB)	OWESoHeT© (Continuous 1–5)	Workload	7	The appropriateness of my mental workload My workload is divided evenly, and backlog can be avoided
	Study developed (Continuous 1–5)	Personal resources	6	My mental fitness (e.g., self-efficacy, resilience) in my work is My mental health (e.g., emotional regulation and the stableness of the mind) in my work is
		The balance	3	The balance between my resources and workload comparing the best level possible in my current job is
Overall OW	OWESoHeT© (Continuous 0–5)	Personal OW	1	I feel that my personal occupational well-being in this profession compared to the best possible level is
General well-being (GW)	WHO5© well-being index-questionnaire (Ordinal 0–5)	Feelings of well-being in everyday life	5	I have felt active and vigorous I woke up feeling fresh and rested I have felt calm and relaxed
Physical activity	OSPAQ©, occupational sitting and physical activity questionnaire (%)	working hours, days, activity (100 % total activity)	3	How would you describe your typical workday in the last 7 days? sitting, standing, walking and heavy labour
Recovery experiences (RE)	Recovery experience questionnaire© (Likert 1–5)	Relaxation, psychological detachment at work	4	I distance myself from my work during my breaks I use my time to relax during my breaks
Self-regulation (SR)	Study developed (Continuous 1–5)	Self-regulation of personal resources	6	I am aware of my personal resources at my work I set goals to promote my personal resources at work
Workplace support (WS)	Study developed (Continuous 1–5)	Support for personal resources	2	My workplace supports my personal resources at work
SHINE FEEDBACK QUESTIONNAIRE				
Usability and utility evaluation	SUS-scale© (Likert 1–5)	System usability (learnability, easy usage)	10	I think that I would like to use this system frequently I thought the system was easy to use
	Study developed (Likert 1–5)	The utility of the program	7	The program was useful for promoting my recovery at work The program was useful for promoting my physical activity at work
	Study developed (Open-ended)	Usability, utility	4	What were the most useful qualities in the program?

4.4 Data analysis

PHASE I

In PHASE I, the first and second data were analyzed (Table 3, Figure 3). The first data, the cross-sectional survey study was analyzed using statistical methods. The OWESoHET-instrument for worker's resources and work (WRW) subscale, the overall occupational well-being (overall OW) variables and background variables were analyzed. The SPSS statistics version 27 was used in this three-phase analysis.

First the descriptive statistics were calculated, reporting frequencies and percentages for each item. Second, the explorative factor analysis (EFA) was conducted having updated the questions (Paper I). The EFA, using the principal axis factoring extraction method (Promax), was used to identify the factor structure of the set variables in the WRW (Watkins, 2018). The Bartlett's test and the Kaiser–Meyer–Olkin Measure both found the data to be appropriate for extracting the EFA variables with the Kaiser rule (Howard, 2016). One developed item was excluded based on the low correlations, the communality, and factor loadings; the remaining three items with low communality values remained (0.16–0.26) due to reasonable loadings and being theoretically plausible (Howard, 2016), reporting the four found factors including altogether 15 items. Third, the Pearson's correlation coefficient (r) was used to measure linear correlation finding the data being normally distributed to assess the associations between the WRW subscale and its four sum variables and between the WRW subscale and the overall OW variables (Mukaka, 2012; Rovetta, 2020). The associations of the independent demographical and overall OW variables (11 items) with four dependent WRW sum variables were analyzed using linear regression analysis (Arkes, 2019). The main findings of the associations are reported in Figure 8.

The second data collection, the systematic literature review (Paper II, Table 3, Figure 3), was analyzed by conducting a systematic descriptive summary and narrative analysis. The descriptive summary of the included studies (n=13) was conducted using the same information from the interventions and employing the TIDieR checklist (Hoffmann et al., 2016). This extraction process was conducted by the first author consulting with the second author who checked the process. The narrative analysis of the data was conducted by using textual descriptions and grouping the interventions' self-conducted elements and occupational well-being outcomes and describing their similarities and differences (Popay et al., 2006). The report of the main findings of this analysis can be found in Figure 9. The meta-analysis was not applicable due to the heterogeneity of the study intervention to the use of instruments and outcomes (Crocetti, 2016).

PHASE II

In PHASE II, two data collections were analyzed. The third data from the controlled quasi-experimental study (Paper III, Table 3, Figure 3), were analyzed using statistical methods concerning the self-reported questionnaire and heart rate variability (HRV). The HRV data were preprocessed by applying beat correction (Lipponen & Tarvainen, 2019) and by removing very low frequency trends from the HRV data (Tarvainen et al., 2002) and then analyzed with Kubios HRV software (Tarvainen et al., 2014).

The data consisted of three measurement points (T0–T2), where the mean of the two or more weekly HRV parameter values of each participant were analyzed and reported as descriptive values for that time point. Three HRV parameters were chosen for analyses (see Table 7): 1) Mean RR (inversely related to resting heart rate), 2) RMSSD (reflecting parasympathetic nervous activity), and 3) Poincaré plot ratio SD1/SD2 (reflecting balance between parasympathetic and sympathetic branches) (Järvelin-Pasanen et al., 2018; Shaffer & Ginsberg, 2017). The final HRV data and the data from the questionnaire were analyzed using two different statistical programs, SPSS version 27 and R version 4.0.2. The descriptive statistics were calculated, the mean and standard deviation values are presented in this study (Table 8).

The changes in the three timepoints (T0–T2) of each of the variables under investigation were analyzed using a linear mixed model (LMM) as this model is applicable when assessing changes at several time points within two groups (Magezi, 2015). LMM (using lmer function) considers the random effects within a specific time calculated from the estimates (β) within or between groups (Bates et al., 2014). The within- group effect sizes (LMM's equivalent Cohen's d with 95% CI) were calculated using an R package emmeans version 1.6.1. Between-group effect sizes were calculated with emmeans version 1.8.6 according to LMM values. The results from the LMM are presented with estimated coefficients (β) accompanied with the equivalent Cohen's d value in this study (Table 8). The P value was calculated setting the significance at .05. (Norman & Streiner, 2008) and presented when significant in this study.

The fourth data collection, from the process evaluation study (Paper IV, Table 3, Figure 3), was analyzed statistically using SPSS 27, Excel-program, and R version 4.0.2. The open-ended questions were analyzed using deductive-inductive content analysis. Descriptive statistics were calculated and presented in this study as mean and standard deviation values (Table 9). The answers to the open-ended questions were analyzed using content analysis creating sub-, upper and main categories for the expressions (Erlingsson & Brysiewicz, 2017); the summary of these findings are presented in this study. First the original expressions were downloaded to an Excel-program. Secondly the expressions were coded deductively either into utility or usability experiences, each experience having an individual code excluding any other

expressions. Third, these included expressions were categorized inductively by two researchers by discussions together in order to reach a consensus for the final categories (Figure 10).

The associations of usability (SUS total) and utility (utility for SHINE resource-workload-balance promotive components: physical activity, recovery, self-regulation and workplace support) with the background variables (age, work experience, remote work, SHINE usage profile) were tested first using the Kruskal Wallis test and the Mann Whitney U-test and secondly using Pairwise testing using the Dunn's test with Bonferroni correction (Norman & Streiner, 2008). These non-parametric tests were applicable to use on this data as it had a nominal scale and the data did not indicate a convincingly normal distribution (Van Buren & Herring, 2020). This study presents the summary of the significant findings of these associations.

4.5 Ethical considerations

Good scientific practice and research ethics were followed in all phases of the research process in both study phases based on the Declaration of Helsinki, the Finnish advisory board on research integrity with human subjects and the general data protection regulations for responsible research (GDPR, 2016; TENK, 2023 updated from the year 2019; World Medical Association, 2013).

PHASE I

The ethical approval concerning the survey study (Paper I) was granted by the Ethical committee of the University of Eastern Finland [10/2020]. This research was conducted as a co-operating partner reporting one of the occupational well-being aspects of the national survey. The permission for data collection via the Trade Union of Education was obtained in the Spring of 2020 [OAJ/AO ry, 2020]. Permission to use and modify the instrument (OWESoHET©) in PHASE I was obtained from the copyright holder who was also a part of the research project. The email link to the questionnaire was distributed from AO ry, where the participants contact information remained secured from the researchers. The participants were not able to proceed with the questionnaire without giving their informed consent for voluntary participation and acknowledging the privacy policy stated at the beginning of the participation.

The data is stored in a secure location in the University of Eastern Finland according to the data management agreement. The ethical conduct in the systematic literature review (Paper II) included protocol reporting before the systematic literature search [PROSPERO CRD42020161387] and having two researchers (J.R. & S.K.) screen the literature independently with transparent PICOS criteria (Amir-

Behghadami & Janati, 2020) following the Prisma-guidelines (Shamseer et al., 2015).

PHASE II

The ethical approval for the quasi-experimental and process evaluation study in PHASE II (Paper III and Paper IV) was obtained from The Ethics Committee for Human Sciences at the University of Turku, Health Care Division [11/2021] and the study protocol was registered in the ClinicalTrials.gov database [NCT05307107] for providing transparent information of this study. The permissions to use the items from the other instruments (Table 7) were obtained from the copyright holders. The research permissions were obtained from all five participating vocational nursing schools according to their research permission procedures in Spring 2022. The schools were chosen according to the correspondence the agreement of their management system, region, and study programs to provide the workplace support needed in the intervention.

The voluntarily participating nurse educators gave their informed consent after all receiving oral and written study information. The data privacy policy was given to the participants with the understanding that they could withdraw from the research without any reason and the data reaming private because of the collected health information. Participants were given the opportunity to ask questions (written or face to face) about any concerns before and during the study. In the data collection, there were heart rate variability measurements which the educators could perform by themselves with their personal heart rate measurement device, without intervening in the physical integrity of the educators (TENK 2023). Participants were given the opportunity to receive the results after the intervention and obtain an oral presentation of the general study results.

The data is stored in a secured location in the University of Turku server according to data protection program stated in the ethical approval. The data is not available for public use.

5 Results

In this chapter, the main results answering the four research questions (Chapter 4) are presented. In PHASE I, the occupational well-being results are reported concerning the aspect worker's resources and the work of health and social care educators (5.1; Paper I). The results of the systematic review on personal resource promoting occupational well-being interventions among educators are reported (5.2.; Paper II). Based on the results in PHASE I of the study, SHINE intervention was developed and implemented described in previous chapter (4.2). In PHASE II, the evaluation of SHINE is reported (5.3). The effectiveness of SHINE is reported on the resource-workload-balance, overall occupational well-being and general well-being, physical activity, recovery experiences, self-regulation and workplace support (5.3.1, Paper III). The results of the usability and utility of SHINE in the daily working life of nurse educators (5.3.2., Paper IV). The detailed results are presented in the original publications I–IV.

5.1 Occupational well-being of health and social care educators

In PHASE I, the aim was to identify the key issues concerning the occupational well-being of educators working in health and social care education in Finland in Autumn 2020. This study investigated the overall occupational well-being variables, worker's resources and work (WRW).

The overall occupational well-being (OW) of educators (n=552) was described with four overall OW variables: personal and communal OW and satisfaction with the OW promotive actions at work and in leisure time. Educators assessed their personal overall occupational well-being as being higher (3.19, SD 1.14) than the overall occupational well-being in their working community (2.61, SD 0.96). Educators were not as satisfied with the occupational well-being promotive actions at work (2.27, SD 1.30) as they were with the supportive actions (e.g. gym and culture benefits) in their leisure time (3.31, SD 1.07).

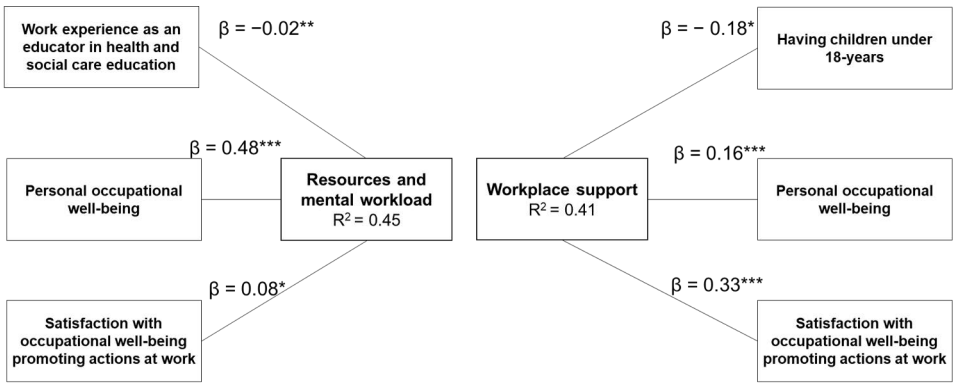
The occupational well-being in the aspect of worker's resources and work (WRW) was investigated with the WRW subscale of the OWESoHET-instrument which found four sum variables: 1. resources and mental workload, 2. resources and physical workload, 3. workplace support and 4. occupational health care services.

The resources for managing mental workload were quite poor (2.41, SD 0.98), where the backlog situations and having time to take breaks when working were assessed the lowest. The resources to manage physical workloads (e.g. vocal strain) were assessed as moderate (3.49, SD 0.83). The workplace support (e.g. support for mental resources and coping at work) was experienced as being quite poor (2.37, SD 0.88), but the occupational health care services (e.g. health examinations) for physical and mental resources at work were considered moderate (3.03, SD 1.04).

The WRW subscale and its four sum variables had positive statistically significant ($p < 0.01$) correlations ($r = 0.62–0.80$) indicating the sum variables as all having positive associations with promoting worker's resources and work. There were also positive statistically significant ($p < 0.01$) correlations between the WRW subscale and the overall OW variables where the strongest correlation were with the overall OW variables: personal OW ($r = 0.53$) and satisfaction towards actions promoting OW at work ($r = 0.58$).

The linear regression analysis was used to investigate the associations of each of the four WRW sum variables with the independent background and overall OW variables (n=11). These variables explained 41–45% of the variability of the two sum variables each presenting an individual model: resources and mental workload ($R^2 = 0.45$) and workplace support ($R^2 = 0.41$) reporting the main findings (Figure 8). The other two sum variables, resources and physical workload ($R^2 = 0.16$) and occupational health services ($R^2 = 0.09$) both had lower explained variances (Paper I, Table 4).

In general, the overall occupational well-being of educators was found to be at a moderate level. The resources for managing mental workload and the workplace support for occupational well-being were assessed as being quite poor. The more experienced educators expressed more dissatisfaction with the resources available for mental workload factors. Those educators having underaged children were more dissatisfied with the workplace support for occupational well-being.



Note: Presenting two models' statistically significant results. R^2 = R-squared, β = unstandardized coefficient, *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$. The models included 11 independent variables: age, marital status, having children under 18-years, caring for another person (due to illness/disability), remote working, additional job, work experience, personal and communal occupational well-being and satisfaction with occupational well-being promoting actions at work (during working hours) and during leisure time.

Figure 8. Associations of resources and mental workload and workplace support with independent variables (see also Table 4 in Paper I).

5.2 Occupational well-being interventions promoting personal resources of educators

In the systematic literature review (Paper II), 13 empirical studies were found that used self-conductive occupational well-being interventions aiming to promote the personal resources of educators during working hours (including all the professional educators at different levels of education). Self-conductive interventions were chosen because of their possibility to be executed using worker's personal resources wherever the work took place in the changing work environments of the educators (e.g. remote work).

The interventions found promoted either physical or mental resources during working hours and used various self-conductive exercises (Figure 9), however, only one was conducted among nurse educators (Stegen & Wankier, 2018). There were various outcome measuring instruments including mostly self-reported questionnaires measuring generally negative responses to resources (e.g. burnout and exhaustion); but there were also instruments used to measure physical body-responses (e.g. pedometers, voice parameters, heart rate variability -meters). The intervention implementations primarily consisted of a training period for the intervention's procedures at baseline, although the training period lasted throughout the intervention in few of the studies. The duration of the interventions varied from one day to one school year, with the majority lasting from four to twelve weeks.

The studies were categorized according to the exercises used in the interventions, i.e., either self-conducted physical or psychological exercises. In addition, the studies were categorized according to the achieved outcomes, either promoting personal

physical or mental resources. The intervention studies (n=7) using self-conductive physical exercises during working hours included activities such as stretching, walking, voice hydration and posture improving (Cheung et al., 2008; de Oliveira Bastos & Hermes, 2018; Faham et al., 2016; Liu et al., 2015; Masson & de Araujo, 2018; Shuai et al., 2014). The intervention studies (n=6) using psychological exercises used activities such as meditation, gratitude expressions and mind and body relaxation (Anderson et al., 1999; Chan, 2010; Morgan & Atkin, 2016; Stegen & Wankier, 2018; Tsang et al., 2015; Van Wingerden et al., 2017).

The occupational well-being outcomes of these exercises were the relief of mental loads, stress management, positive affective feelings towards work and life in general, increased physical activity at work, improved physical activity, musculoskeletal health improving behavior and improved vocal health. Overall, applicable exercises were found that could be conducted during working hours and that were beneficial to educators' occupational well-being, considering the aspect of worker's resources and work.

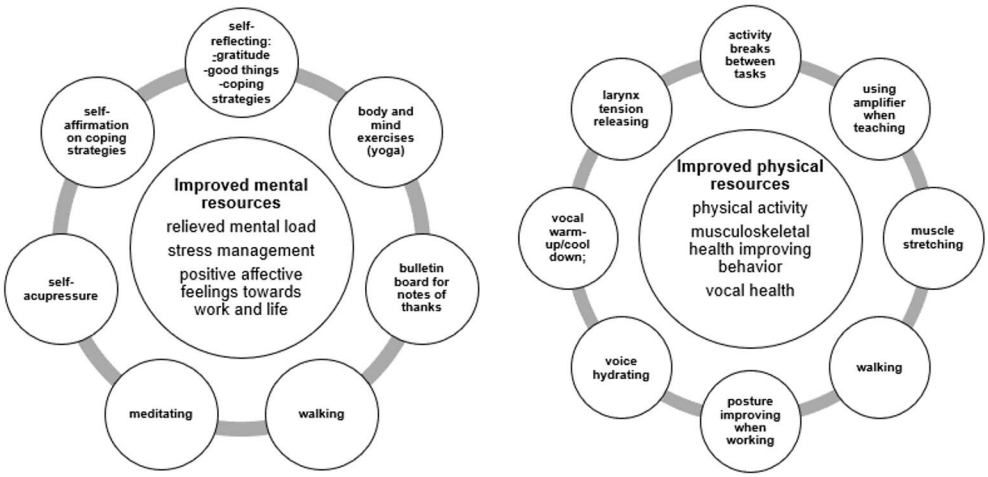


Figure 9. The outcomes and the used exercises in the self-conducted occupational well-being interventions (n=13).

5.3 The evaluation of SHINE

The justification for the SHINE intervention relies on the results in study PHASE I. The need to support the occupational well-being were ascertained as regards the personal resources necessary to manage mental workload factors and the workplace support needed for mental resources during working hours (Paper I). The beneficial self-conductive exercises promoting personal resources were determined and focus on exercises promoting self-regulation skills, physical activity and recovery (Paper

II). Altogether, four key components were identified to promote resource-workload-balance. These components were evaluated as condition outcomes in this study, along with an evaluation of SHINE effectiveness on resource-workload-balance, and overall and general well-being (Figure 6). The components that follow created the content of the SHINE intervention (Figure 7):

(1) physical activity at work
(2) recovery activities at work
(3) self-regulation development activities at work
(4) workplace support for personal resource promoting activities at work.

Prior to the evaluation of the effectiveness and the process of SHINE, the fidelity (e.g. dosage and responsiveness) of the intervention needs to be investigated (An et al., 2020). The fidelity of SHINE also comprises adherence (the delivery of key components in the intervention) and the quality of the intervention delivery (An et al., 2020). The fidelity of SHINE can be considered sufficient. There was high engagement and responsiveness by the participants in the intervention and a low dropout/ withdrawal rate in the study (n=3). Of the educators who completed SHINE, 81% completed 6–8 of the weekly changing self-regulative tasks, 70% completed both the daily 3-minute exercises 3–5 times per workweek and 95 % self-evaluated their weekly personal resources in the Smart Break SHINE-program. The calculated usage profile (Table 5) considered 70 % of the educators as active users of the program during the 8-workweek period.

5.3.1 The effectiveness of SHINE

The effectiveness of SHINE answers the research question three and the stated hypothesis (Paper III). The stated hypothesis of SHINE was, that the intervention will improve the resource-workload-balance, overall occupational and general well-being, and the SHINE components: physical activity, recovery experiences, self-regulation of personal resources and workplace support within and between group comparison, both at the post (after 8-workweeks) and one-month follow up (after 12 workweeks).

Resource-workload-balance

The stated primary outcome, the resource-workload-balance (self-reported) was considered moderately good in both groups at baseline and stayed approximately the same during the study. In the comparison, the change between the groups should no

significant effects for SHINE on the resource-workload-balance. However, the physiological measure for the resource-workload-balance (heart rate variability, HRV) had statistically significant negative changes within the control group (CG) showing worsening HRV values (resting heart rate increased) at the 12-workweek post testing, but no significance in the intervention group (Table 8).

Overall and general well-being

The secondary outcomes, overall occupational well-being (OW) and general well-being, were both at a moderately good level within both groups at baseline. There were statistically significant positive changes in the general well-being values within the intervention group (IG) and the between group comparison seen in the follow-up period indicated positive SHINE effects. The overall OW values increased in the IG and decreased in the CG in the follow-up measurement point, although showing no statistically significant changes (Table 8).

SHINE components

The condition outcomes, recovery experiences and self-regulation of personal resources at work, had statistically significant positive changes within the IG. Recovery experiences had a strong significance difference in the between group comparison indicating SHINE as effective at promoting recovery experiences at work; thus supporting the stated hypothesis. Physical activity was quite low in both groups before the intervention (≈50% of sitting for the total workweek). Physical activity was significantly better within CG in the post measurement but did not have any significance in the between groups comparison. Workplace support showed no statistically significant changes, as the support remained at a moderately good level in both groups throughout the study.

Summary of the effectiveness

Altogether, no significant effects were found for the SHINE intervention on the primary outcome resource-workload-balance. However, SHINE had statistically positive effects for improving recovery experiences at work and general well-being in the between groups comparison and the self-regulation of personal resources at work within the intervention group (Table 8). Although the primary outcome, resource-workload-balance, had no statistically significant improvements in the IG, there were significant negative changes within the CG, where worsening HRV values were observed; the IG group values had no statistically significant changes in either direction.

Table 8. The outcomes of SHINE evaluating the effectiveness.

Variables (scale)	Time point	IG Mean (SD)	CG Mean (SD)	Time point	IG β (SE) *d*	CG β (SE) *d*	CG-IG β (SE) *d*
PRIMARY OUTCOMES							
HRV: Mean R-R (ms)	T0 T1 T2	945.1(101.0) 923.1 (83.5) 933.4 (86.4)	968.6(125.1) 957.6 (96.1) 946.1(103.1)	T1-T0 T2-T0	-22.0 (10.7) *-0.53* -9.2 (10.9) *-0.22*	-11.0 (10.5) *-0.27* **-27.5 (10.8)** ***-0.66*** *	11.0 (15.0) *0.27* -18.3 (15.3) *-0.44*
HRV: RMSSD (ms)	T0 T1 T2	28.8 (17.7) 26.3 (13.7) 29.4 (14.1)	36.8 (28.2) 34.0 (17.9) 33.8 (17.5)	T1-T0 T2-T0	-2.5 (2.3) *-0.28* 0.6 (2.3) *0.06*	-2.8 (2.3) *-0.31* -3.5 (2.3) *-0.39*	-0.3 (3.2) -0.03 -4.1 (3.3) -0.46
HRV: SD2/SD1 (range)	T0 T1 T2	2.35 (0.59) 2.30 (0.59) 2.23 (0.57)	2.03 (0.45) 1.97 (0.42) 2.01 (0.50)	T1-T0 T2-T0	-0.1 (0.1) *-0.19* -0.1 (0.1) *-0.51*	-0.1 (0.1) *-0.23* -0.0 (0.1) *-0.08*	-0.01 (0.1) *-0.04* 0.1 (0.1) *0.44*
Resource-Workload-Balance (1–5)	T0 T1 T2	3.45 (0.65) 3.46 (0.64) 3.47 (0.69)	3.44 (0.57) 3.45 (0.63) 3.40 (0.67)	T1-T0 T2-T0	0.01 (0.06) *0.05* 0.02 (0.06) *0.07*	0.01 (0.06) *0.04* -0.04 (0.06) *-0,15*	-0.00 (0.08) *-0.01* -0.06 (0.08) *-0.22*
SECONDARY OUTCOMES							
Overall OW (0–5)	T0 T1 T2	3.22 (1.02) 3.37 (0.98) 3.39 (1.05)	3.15 (1.15) 3.16 (1.12) 3.03 (1.23)	T1-T0 T2-T0	0.16 (0.12) *0.33* 0.17 (0.11) *0.36*	0.01 (0.10) *0.02* -0.12 (0.10) *-0.26*	-0.15 (0.15) *-0.31* -0.29 (0.15) ***-0.62***
General well-being (0–5)	T0 T1 T2	3.90 (0.80) 3.99 (0.89) 4.17 (0.76)	3.82 (0.77) 3.74 (0.91) 3.74 (0.85)	T1-T0 T2-T0	0.09 (0.10) *0.22* **0.27 (0.10)** ***0.63*** *	-0.08 (0.09) *-0.18* -0.07(0.09) - *0.17*	-0.17(0.14) *-0.40* **-0.34(0.14)** ***-0.79*** *
SHINE COMPONENTS: CONDITION OUTCOMES							
Physical activity (sitting %)	T0 T1 T2	55.22(22.94) 54.46(25.02) 53.51(25.00)	54.55(22.99) 45.62(24.44) 48.30(22.44)	T1-T0 T2-T0	-0.76 (3.24) *-0.05* -1.70 (3.24) *-0.12*	**-8.93 (3.12)** ***-0.64*** * -6.25(3.12) - *0.45*	-8.17 (4.45) *-0.59* -4.55 (4.45) *-0.33*
Recovery experiences (1–5)	T0 T1 T2	2.34 (0.96) 2.94 (1.00) 2.82 (0.99)	2.16 (0.82) 2.27 (0.85) 2.19 (0.83)	T1-T0 T2-T0	**0.60 (0.12)** ***1.16*** *** 0.48 (0.12) ***0.92*** ***	0.11 (0.12) *0.20* 0.03 (0.12) *0.06*	**-0.50 (0.17)** ***-0.95*** ** **-0.45 (0.17)** ***-0.86*** **
Self-regulation (1–5)	T0 T1 T2	3.39 (0.51) 3.48 (0.56) 3.57 (0.58)	3.33 (0.47) 3.45 (0.48) 3.39 (0.58)	T1-T0 T2-T0	0.09 (0.07) *0.30* **0.17 (0.07)** ***0.59*** *	0.12 (0.07, *0.41* 0.06 (0.07) *0.21*	0.03 (0.10) *0.11* -0.11 (0.10) *-0.38*
Workplace support (1–5)	T0 T1 T2	3.15 (0.84) 3.29 (0.86) 3.31 (0.88)	3.23 (0.79) 3.36 (0.79) 3.23 (0.73)	T1-T0 T2-T0	0.14 (0.11) *0.29* 0.16 (0.11) *0.34*	0.12 (0.11) *0.25* -0.01 (0.11) *-0.01*	-0.02 (0.16) *-0.03* -0.17 (0.16) *-0.35*

IG=intervention group (n=37); CG= control group (n=40); HRV= heart rate variability (n (T0-T1) IG/CG =30/31, (T2)=29/29); OW= Occupational well-being; Timepoints: T0=baseline, T1=post, T2=one-month follow-up; SD= standard deviation, β=estimate, SE=standard error, *d*= LMM's Cohen's *d*, *= p < 0.05, **= p < 0.01,*** = p < 0.001. Scale 0 or 1–5, where 0 or 1 indicates the worse possible score and 5 the best possible score.

5.3.2 The usability and utility of SHINE

The evaluation of the process was conducted focusing on the usability and utility of the SHINE intervention answering the stated research question four (Paper IV). SHINE using the Smart Break-SHINE program with workplace support was considered usable in the daily working life of nurse educators. The total System Usability Score (SUS) was 76.35 (SD 14.45), where a score of 68 represents the average SUS score (Brooke, 2013). The SUS values are presented in the order of the best values within the positive and negative SUS statements, with the best scores being easy usage and learnability (Table 9). SHINE was considered moderately useful. The best utility of the SHINE was experienced in promoting physical activity (Table 9).

Table 9. Usability and utility experiences of nurse educators completed the SHINE (n=37).

USABILITY (sus-items, Brooke, 1996)	**Mean (SD)**
Positive statements (scale 1–5, 5 being the best possible score)	
People would learn to use this program quickly	4.22 (0.63)
Program was easy to use	4.08 (0.83)
Program's various functions were well integrated	3.70 (0.97)
Feeling confident when using this program	3.70 (0.88)
Would like to use this program frequently	3.51 (1.02)
Negative statements (scale 1–5, 5 being the worst possible score)	
Program was very cumbersome to use	1.49 (0.69)
Would need the support of a technical person to use this program	1.57 (0.90)
Needed to learn a lot before using this program	1.59 (0.72)
Found the program unnecessarily complex	1.97 (0.93)
Program was too inconsistent	2.05 (0.94)
TOTAL SUS-score (calculated, Brooke, 2013)	76.35 (14.45)
UTILITY (study developed, scale 1–5, 5 being the best possible score)	**Mean (SD)**
Promotes physical activity at work	3.54 (1.04)
Promotes personal resources at work	3.30 (1.05)
Promotes recovery experiences during working hours	3.30 (1.05)
Promotes self-regulation of personal resources at work	3.16 (1.24)
Promotes the resource-workload-balance	3.14 (1.16)
Promotes workplace support for personal resources	3.00 (1.13)
Degreases personal workload	2.92 (1.12)

Open-ended questions were asked about the experiences of the usability and utility (Figure 10). There were four main categories found, 10 upper categories and several subcategories. Positive usability experiences related to the good qualities, usage supporters and communal approach of the program. Also found collegial support being the reason to implement SHINE. Positive utility experiences related to SHINE being a well-being and a break promoter at work. The experienced usability barriers concerned work related obstacles, implementation limitations and the program's technical problems. The utility barriers were related to the unmet needs for break preferences and having no workload impact.

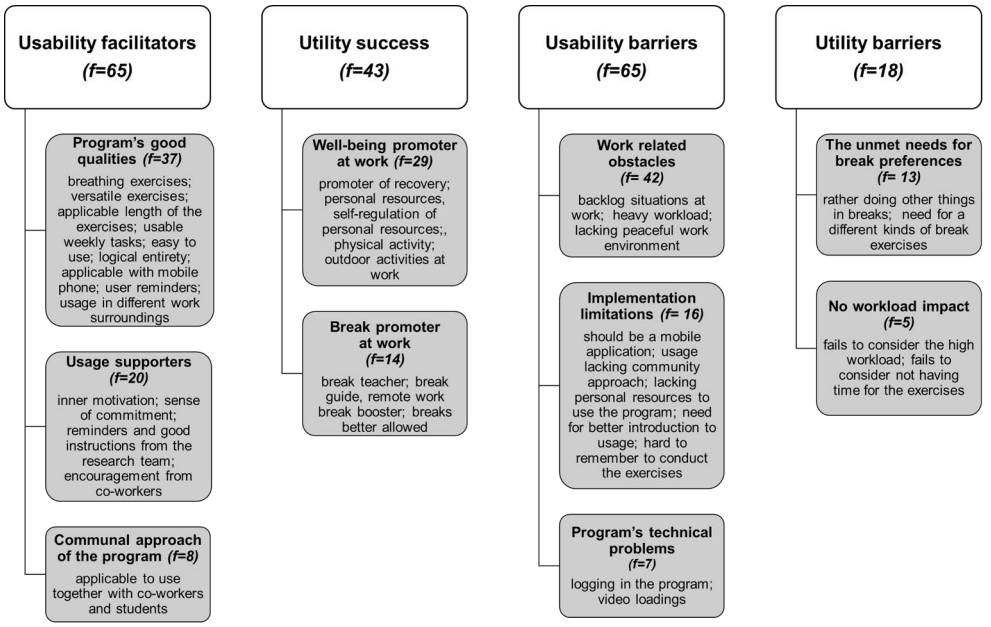


Figure 10. Main, upper and subcategories of the usability and utility expressions (f) of SHINE.

The associations were investigated for the usability and utility with work experience, remote work, age and the SHINE usage profile of nurse educators. There were statistically significant positive associations between the work experience of a nurse educator and the experienced utility. Educators having less than five years of work experience as a nurse educator considered the SHINE intervention more useful for promoting their physical activity ($p = 0.005$) and recovery experiences ($p= 0.018$) than those with over 15 years of work experience.

Overall, SHINE was found usable and useful for promoting well-being breaks in the daily working life. Barriers were especially found as regards the high workload and having no time to conduct the intervention's exercises.

6 Discussion

In this chapter, the main results of this study are discussed (6.1). The validity and reliability of the study are presented and discussed (6.2). Suggestions for future research and implications for the practises are provided (6.3). More detailed discussions have been presented in the original study papers (I–IV).

6.1 The discussion of the results

The main aim of this this two-phased study was to develop and evaluate a self-conductive digital occupational well-being intervention focusing on personal resources and workload in the daily working life of nurse educators. The main goal was to support the occupational well-being of nurse educators by producing an effective, usable and useful intervention in their daily working life. This study provided answers to the four stated research questions (Chapter 4). In study PHASE I, the key issues of occupational well-being among health and social care educators were described (Paper 1) and beneficial self-conductive occupational well-being interventions for educators were investigated (Paper II). Based on these research results, the SHINE intervention was developed and implemented completing the first phase of this study. In study PHASE II, SHINE was evaluated for its effectiveness to promote resource-workload-balance, occupational and general well-being, physical activity, recovery, self-regulation and workplace support. In addition, the process of the intervention was evaluated for its usability and utility from the perspective of the nurse educator who completed the SHINE intervention.

Considering the impact of this research where SHINE was not found effective to as hypothesized, there were new method developed and tested to support occupational well-being of nurse educators during working hours experienced as usable and useful. This evidence is needed for educational organizations considering nurse educators future competence areas; these areas should include occupational well-being management and enhancing the student ability to reflect on their own well-being to face the well-being challenges in their future work as health care professionals (National Academy of Medicine, 2022; Salminen et al., 2023).

SHINE was found beneficial for promoting recovery experiences at work, which is seen as an important factor for gaining a resource-workload-balance (Kinnunen et

al., 2011). However, this study showed no effects on resource-workload-balance. This leads to consider if the right outcomes were chosen and whether there was a need for further development of the SHINE model testing for the possible moderators and mediators (Skivington et al., 2021).

SHINE included activities supporting recovery, physical activity and self-regulation of personal resources at work. These activities, where educators integrate well-being activities when working, needed approximately 15 minutes per day to execute and did not need constant external facilitators or circumstances. This could possibly have a financial impact needing further investigation, where previous studies have shown savings when supporting the occupational well-being actions of workers by decreasing medical and absenteeism costs, the sum estimated to be twice the amount spent on well-being actions (Baicker et al., 2010).

This study was conducted between the years 2020–2022, where the global COVID-19 pandemic situation changed the working culture of educators in general. Among nurse educators, challenges were experienced in managing occupational well-being due to the changes in working life and teaching in new pedagogical environments (Farber et al., 2023; Riess et al., 2023; Sacco & Kelly, 2021). The increased remote working made this study intervention more essential, as the digital intervention allowed access to the intervention wherever the work took place (Thai et al., 2023).

Resource-workload-balance

This study hypothesized the SHINE intervention would improve the personal-resource-workload-balance (self-evaluated and heart rate variability, HRV), however it showed no effects. In PHASE I, this study found nurse educators' occupational well-being needing improvements towards their resources for managing workload factors (Paper I). These findings are in line with previous studies addressing the high workload experienced by nurse educators, especially concerning the long working hours and work demands (Boamah et al., 2023; Owens, 2017) and the lack of personal resources to address these workload issues (e.g. Dugger, 2023; Hosseini et al., 2022; Watson, 2023; Zangaro et al., 2023). Previous studies have identified models for assessing nurse educators' yearly workload (Hamlin, 2021; Ludwig-Beymer et al., 2022), however, the backlog situations in everyday working life are also in need of more investigation to find better beneficial methods.

SHINE consisted of activities designed to improve the resource-workload-balance, addressing the need to support resources for managing the workload as described in previous studies (e.g. Dugger, 2023; Farber et al., 2020, 2023; Riess et al., 2023; Sturgeon et al., 2017). In previous intervention studies among nurse educators,

yoga exercises were found to have positive effects towards promoting personal resources (Kavurmaci et al., 2022), SHINE also uses similar recovery exercises: breathing with body movements during working hours. However, SHINE was not found to be statistically effective as regards the balance between resources and workload as the stated hypothesis. SHINE was experienced as useful for promoting the educators' personal resources in their everyday working life, it was not effective towards the resource-workload-balance. However, the SHINE intervention could at least have a possible supporting role for occupational well-being, where the resource-workload-balance stayed approximately at the same level before and after the SHINE. In future, the factors explaining the resource-workload-balance should be further investigated, especially their interconnections, and potential missing factors.

There is a need to develop the self-reported resource-workload-balance measurement to be more accurate when measuring personal resources and workload, since similar challenges were indicated in previous studies concerning measuring workload (Bittner & Bechtel, 2017). In addition, there is a reason to critically reflect whether the chosen occupational well-being model, "Content Model for the Promotion of School Community Staff's Occupational Well-being" (Saaranen et al., 2007, 2015), was sensitive enough to detect intervention changes at least in this short time and having challenges to specifically define the personal resources. In addition to the self-reported questionnaire, this study used HRV measurements. Other objective measurements (e.g. pedometers and health examinations) could possibly provide knowledge of the resource-workload-balance also used during working hours when educators performed the activities and this needing further investigation.

The barriers of the delivery of the intervention also needs to be considered. There is a possibility that the length of the intervention was not long enough to have revealed a change in either the educators' experiences of their resource-workload-balance or their physiological HRV and therefore more investigation is needed. Consequently, there are no valid results that warrant the long-term effectiveness needing further investigation in future studies or planning an intervention that possibly lasts throughout the whole academic year taking account the variations during that year.

Overall occupational and general well-being

Positive effects were observed supporting the stated study hypothesis for the general well-being. In the development phase, associations were found between increased subjective feelings about everyday life and mental resource promoting actions during working hours (Paper II), the results of the SHINE supporting these findings.

SHINE aimed at promoting resource-workload-balance. In this study, the effects were not found in the balance, but were found in the educators' general well-being;

occupational well-being programs should also promote this aspect (Weziak-Bialowolska et al., 2020). General well-being increased in the intervention group showing statistically significant effects in the one-month follow-up period compared with the control group. This could indicate that the SHINE activities conducted during working hours were beneficial for well-being in general and the possible need for other activities targeted more on the workload issues to detect work related well-being outcomes. Although, there were increased experiences of overall occupational well-being in the intervention group in the one-month follow-up period, it was without statistical significance.

Previous studies have argued that results depend on the duration of the intervention w regard to achieving health-related outcomes (Gardner & Rebar, 2019); this was also mentioned in the systematic review in PHASE I. Therefore, there is need for critical reflection on the SHINE components, their effectiveness in the daily working life of nurse educator.

Nurse educators performing SHINE activities

Four components in SHINE were developed to promote the personal resource-workload-balance: (1) physical activity at work, (2) recovery activities at work, (3) self-regulation development activities at work, (4) workplace support for personal resources promoting activities at work. These components were the conditions used to promote a good resource-workload-balance (measured as condition outcomes) (Figure 6). These conditions were hypothesized to increase when receiving SHINE from this study PHASE and the previous literature. However, the promotive associations of these conditions towards resource-workload-balance were not tested in this study needing further investigation.

Physical activity at work, was designed as one key component in this study. This study found physical activity exercises beneficial for promoting physical, as well as mental resources (e.g. walking and stretching), therefore these exercises were integrated into the SHINE intervention (Paper II). Previous literature has shown the need of nurse educators to partake in physical resources due to prolonged sitting time (Main et al., 2017; Riess et al., 2023; Sturgeon et al., 2017) and physical fatigue (Poole & Spies, 2022).

Nurse educators in the intervention group experienced SHINE as being most useful for promoting their physical activity at work, though again no statistical significance of this effect was found. However, the control group had a statistically significant decrease in their sitting time in the post-measurement, but not in the one-month follow up. There are no direct explanations for the statistically decreased sitting time at work among the control group, perhaps they had more practical teaching and less computer-based work, but this result remains under speculation. There

might be a need to include a pedometer or other objective measurement tool to assess the physical activity and to discover if there is an association between experienced and actual physical activity (Maes et al., 2020). Previously conducted physical fitness intervention have increased physical activity (Bentley, 2013), but do not meet the demand of being applicable to conduct during working hours. Overall, during the SHINE intervention the sitting time degreased and SHINE was considered useful for promoting physical activity, which is an extremely important benefit for the well-being of the educators (WHO, 2010).

The recovery activities at work were designed as key component in the SHINE intervention, as previous study findings showed the experienced backlog situations at work to be the most problematic factor for managing mental workload in addition to not having time for breaks or moments of rest at work (Paper I). Moreover, activity breaks have shown to be beneficial for promoting personal resources at work (Paper II). The recovery, relaxation and psychological detachment activities during breaks (e.g. deep breathing with body movements and self-reflective tasks in outdoors), were experienced as useful. The outdoor activities were especially mentioned for being useful exercises for promoting well-being benefits, confirming the similar results found among office workers (Sianoja et al., 2018).

The SHINE intervention had statistical positive effect on the experienced recovery during working hours which was also considered useful for promoting recovery and breaks. Recovery is a pathway for promoting personal resources (Hobfoll et al., 2018; Kinnunen et al., 2011), and SHINE intervention's activities were seen as beneficial in this sense. Previous intervention studies among nurse educators aimed to promote recovery with cognitive relational group programmes were found to have beneficial results towards recovery (Wiklund Gustin et al., 2020).

The SHINE intervention adds an important factor within recovery research through the execution of rather short usable activities during working hours which obtained statistically significant results towards promoting psychological detachment and relaxation at work. This could be considered as a benefit that meets the demands of increasing breaks and moments of rest at work found in this study in PHASE I (Paper I). There were also experiences related by the participants, that these short moments were not enough to restore the energy lost during stressful situations at work, and therefore more investigation is needed in future studies. Previous studies have shown that break detachment lowered the need for recovery after work especially among older educators compared to their younger colleagues (Kinnunen et al., 2019). This study managed to increase recovery during working hours (e.g. break detachment and relaxation) and is thus a possibly effective method in occupational management for the ageing educational workforce and requires more investigation.

Self-regulation development activities at work were designed as key component of SHINE, as these activities (e.g. self-awareness and goal setting) have been

shown to be beneficial for promoting personal resources at work (Paper II). Self-regulation is also an important part of health behavior change (Hennessy et al., 2020; Ryan, 2009). In previous interventions among nurse educators, self-awareness, self-compassion (Wiklund Gustin et al., 2020) and reflecting and expressing gratitude (Stegen & Wankier, 2018) were found beneficial for promoting occupational well-being. The SHINE intervention was effective in promoting self-regulation of personal resources as seen in one-month follow-up within the intervention group; it was therefore experienced as useful component. This could be considered one of the main results of this studies success in promoting self-regulation of personal resources and important for health-related outcomes (Hennessy et al., 2020; Ryan, 2009). The SHINE intervention supported the educator's own personal resources to find suitable ways to execute the SHINE activities and possibly gaining more awareness of one's own possibilities and preferences.

Workplace support for personal resources promoting activities at work were one key component of SHINE, and this was the only component outside of the digital Smart-Break SHINE-program. This component was designed as a result of it being seen as important for promoting resource-workload-balance in previous interventions (Paper II) and the need for support to be given during working hours (Paper I). Furthermore, the previous literature indicated that nurse educators experiencing an imbalance between resources and mental workload need workplace support (e.g. Arian et al., 2018; Crawford et al., 2023; Lane et al., 2010; Melnyk et al., 2023; Moyer, 2022; Rothacker-Peyton et al., 2022; Saaranen et al., 2020; Sessions et al., 2023). However, there is lack of demand for detailed workplace support for personal resources or workload factors; more demand could help to address this important factor in the future.

The SHINE intervention's effect on promoting workplace support for educators' resources found no statistically significant effects, but the results were slightly better compared to the control group. Although, the managers supported the intervention and gave encouragement, as well as reminders and time to conduct the SHINE activities, there were still usability barriers related to workload issues and a lack in the utility experience of the support given. This barrier is an essential development need for this intervention, where the workplace support should be a part of a detailed described implementation strategy rather than a key component. Also, other educators in the working community could be considered as a supportive party by doing these exercises together in the program; this is one of the development needs perceived by a few of the participators. In addition, support should be considered not only towards personal resources promoting activities, but also directly towards the workload issues addressed in this study literature review which were associated with the regulations of workload (Boamah et al., 2023; Crawford et al., 2023; Dugger, 2023; Moyer, 2022; Saaranen et al., 2020).

The usability of SHINE in the working life of nurse educators

It is necessary to discuss the intervention's usability as this will influence its sustainability (Skivington et al., 2021) and addressing the main goals of this study to support the occupational well-being of nurse educators in their daily working life. Due to a variation in the work of nurse educators (Campos Silva et al., 2022), it was important to carefully analyse the usability of the SHINE intervention. There is a lack of intervention studies of supporting occupational well-being among nurse educators, only four previous studies were found. In addition, no process evaluations of these intervention studies were found and there was a lack of discussion on their acceptability and sustainability – which is important for their usage.

In previous occupational well-being intervention studies among nurse educators, the outcomes of these occupational well-being interventions were the following: improved coping strategies for workloads, less experienced burnout, more experienced positive affective feelings towards work and improvements in knowledge of physical health issues (Bentley, 2013; Kavurmaci et al., 2022; Stegen & Wankier, 2018; Wiklund Gustin et al., 2020). Where these interventions found positive results, most of the interventions were conducted outside of working hours and needed constant facilitators (e.g. instructor or group leader) both of which challenge their sustainability being a methodological issue. Only one of the interventions had exercises applicable to being conducted while at work (Stegen & Wankier, 2018) addressing this study found need of the occupational support during working hours (Paper I).

This study was based on the idea that occupational well-being should be constructed when working, and a shared responsibility between the workplace and the educators themselves. SHINE was designed so as not to need a constant facilitator and had eight weeks of digital guidance with workplace support, and the possibility to continue the exercises after the intervention – although this needs further investigation. Digital occupational well-being interventions are considered especially applicable for remote working conditions (Howarth et al., 2018; Thai et al., 2023). This study it was considered usable (e.g. easy to use and good learnability) and applicable to use in different work surroundings.

This study found usability facilitators and barriers, which can be used to further develop SHINE, content and the delivery of the intervention (Skivington et al., 2021). Usability facilitators were the following: the program itself was acceptable for usage, the educators' own inner motivation and commitment, the support and reminders given from the program and by the working community. The usability barriers found in this study concerned mainly the high workload issues which were problematic when managing occupational well-being; this confirmed the earlier discussed need to address workplace support towards regulation of work. This result is in line, with previous studies conducted using a digital occupational well-being intervention especially those addressing the workplace support for the adaption of the

intervention and finding time to conduct these exercises during working hours (Macdonald et al., 2020; Muuraiskangas et al., 2016).

The need to address the occupational well-being in the educational curricula of student nurses is one important part of the educators' competence area (National Academy of Medicine, 2022; Salminen et al., 2023). This study found usability factor related to student nurses. Some educators addressed the exercises as being applicable to conduct with students during classes. This could be one method to be considered when starting to develop programs addressing the whole school community. Future studies could consider what associations could be found between the occupational competence of nurse educators and the experienced occupational well-being management skills of the student nurses; similar associations have been found in previous studies (Aldrup et al., 2020; Klusmann et al., 2008).

The different career stages of nurse educators could be one mediator for SHINE needing further investigation. The updated law on occupational safety (738/2002) and the Finnish institute of occupational health (Finnish institute of occupational health, 2023) states the different career stages and life situations should be recognized when supporting the occupational well-being of workers. Career stages are related to work experience and during these stages educators tend to have had negative and positive indications of personal resources at work (e.g. Arian et al., 2018; Rothacker-Peyton et al., 2022). In this study, work experience was associated with the experiences of SHINE's utility and seen as more positive by those having less than five years of work experience, than those with over 15-years of work experience. In addition, those with more work experience expressed more dissatisfaction with the resources provided to manage mental workload. Therefore, there could be a reason to consider if the usage of SHINE could partly answer the occupational well-being management issues for early career nurse educators who are learning to self-regulate their personal resources at work. Support for the occupational well-being of later career educators should be further investigated, as many educators are due to retire in Finland (KEVA, 2024).

Consequently, the findings of this study showed the need to support the occupational well-being during working hours. SHINE was considered usable as it did not need constant facilitators. The usage barriers of SHINE are related to high workloads and not having time for breaks as this is an overall occupational management issue. The usage facilitators are related to inner motivation, workplace support and the easy usage of SHINE. There were possibilities to use the SHINE together with the student nurses during classroom teaching, going outdoors between lessons and discussing the self-regulation of personal resources at work. There is a reason to consider the career stage when implementing occupational a well-being intervention, as in this study early career educators (having under five years of work experience) benefitted

and were more motivated by the SHINE intervention as regards learning to take recovery moments and having breaks at work.

6.2 Validity and reliability of the study

In this section, the validity and reliability of this two-phased study is discussed considering the justification of this study design, the data collection together with the instruments used and the interpretation of the results. The validity, the extent to which the results accurately measure what they are supposed to measure (e.g. content validity and structural validity), and the reliability, the extent to which the results can be reproduced when the research is repeated and the internal consistency of the instrument are discussed (Mokkink et al., 2019; Polit & Beck 2021).

6.2.1 The validity and reliability of the study design, data collection and instruments

PHASE I

In PHASE I, a cross-sectional survey study was conducted (Paper I) and a systematic review (Paper II) including two data collections (Table 3).

The cross-sectional survey design (Paper I) was justified for the purpose of discovering the national perspective on the current occupational well-being situation and its associating factors. The main strength of this data collection was reaching a large population in Finland (approximately 70 % of the total educational health and social care workforce) and having the possibility to study occupational well-being prevalence and the associations while sustaining anonymity (Wang & Cheng, 2020).

The OWESoHeT instrument were used in the data collection PHASE I (Paper I) including all the aspects of the content model for the promotion of school community staff's occupational well-being (Rautiainen et al., 2023; Saaranen et al., 2007, 2015, 2020). Three other subscales and overall occupational well-being items were included. There were 73 items to be answered (Rautiainen et al., 2023) in addition to background and open-ended questions, which might have led to the non-response error, the response rate was 31% (Ponto, 2015). It is, however, important to remember, that the views of 70 % of the sample is unknown. There can be different reasons for the low response rate, but due to the numbers of respondents the sample was relevant for the purpose of this study (Holtom et al., 2022; Wu et al., 2022).

This study was reported using the OWESoHeT instrument's subscale, 15-item "Worker's resources and work (WRW)", which has also been used in previous study among health care educators (Saaranen et al., 2020). Explorative factor analysis (EFA) of this subscale was conducted because the WRW was updated and further

developed for this study project new questions of which one item was excluded after EFA (Paper I). The 15-item WRW was found to be acceptable as regards validity and reliability (Paper I), but also needs further development due to one factor of the worker's resources and work having a Cronbach Alpha below 0.6 indicating relatively low internal consistency (Field, 2018) (Table 10).

Consequently, the instrument requires further development and psychometric testing for confirmation of the validity (e.g. content validity and possibly revising some items), this project had the first data collection using this developed instrument.

The systematic review (Paper II) was a justifiable study design to find occupational well-being supportive intervention studies conducted during working hours among educators using suitable databases according to the study aim. As a data collection method, the systematic review is valid due to transparency, replicability, and having a clear inclusion criterion (Belur et al., 2021). The systematic review was registered for the transparency before the search in the international prospective register of systematic reviews [CRD42020161387] (Rinne et al., 2020). The systematic literature search was carried out with an information specialist (i.e. professional librarian) and no unnecessary limitations were used in the databases. In the data collection, a strict PICO's criteria for eligibility was used (Amir-Behghadami & Janati, 2020). There were two researchers to conduct the study selection which involved independent screening and a quality assessment using critical appraisal tools (Porritt et al., 2014; Tufanaru et al., 2017). Transparent reporting method were used including selection exclusion with reasons (Shamseer et al., 2015). However, more attention should have been paid to reporting the details of the discussions carried out by the two independent researchers regarding the eligibility and data extraction thus ensuring consistency (Belur et al., 2021).

Consequently, there were difficulties defining and organizing the knowledge from the occupational well-being research, and there is no specific definition of occupational well-being. The term occupational well-being is not always used in many cases, and the researcher is obliged to use several associated terms to find relevant studies from the databases. This factor may cause some relevant studies to be excluded from the literature review.

PHASE II

PHASE II included a quasi-experimental intervention study design (Paper III) and a cross-sectional process evaluation study (Paper IV). PHASE II includes two data collections (Table 3).

The quasi-experimental study (Paper III) was justified method to address the occupational well-being support in the working life of nurse educators. The study needed specific organizations to be comparable and the educators in the intervention

and control groups to be in different schools. Randomization of the participants was not possible weakening the results (Handley et al., 2018). If a randomization design had been chosen the approximate 50–100 educators in the Finnish nursing schools would have led to concerns of sample contamination due to the intervention and comparison groups being in the same school (Miller et al., 2020). This intervention design was justified by the need to support occupational well-being during working hours (Paper I and literature review), although it was time consuming and included the costs for the spent working hours; however, the early expressed feedback to the research team from the educational organizations was positive.

With this study design (Paper III), it was possible to evaluate the effectiveness of the intervention in working life conditions by having a control group (could also be rather addressed as a comparison group, it not being a randomized design). All the participating five schools had corresponding nationally regulated practical nurse programs, location was in Southern Finland and the school managers had corresponding number of employees in their workplace. However, it should be recognized that there is a possibility that the managers and collegial support for SHINE could differ to some extent. The demographic background of educators was seemed to correspond (Table 5).

There were two questionnaires and heart rate variability measurements (HRV) used in this study PHASE II (Table 7; Table 10). . HRV and the "Resource based occupational well-being questionnaire" were used in the quasi-experimental study (Paper III) and the "SHINE feedback questionnaire" was used in the cross-sectional process evaluation study (Paper IV).

HRV data (Paper III) were measured with valid high quality Polar H7 or H10 heart rate sensors connected via Bluetooth with the Kubios HRV mobile application (Tarvainen et al., 2014). The Kubios HRV application is a validated tool for assessing heart rate variability (Lipponen & Tarvainen, 2019). The participants were given oral and written information on the usage of the heart rate sensor and the Bluetooth connection. At each measuring point (T0–T2) there were a few measurements with low frequency trends seen in Kubios program and these needed to be excluded from the analysis, but the remaining reliable data was sufficient for reporting (Paper III). The participants contacted the researcher about the HRV measurements confirming the reliable measuring methods, however, future studies should include a live demonstration of the heart rate sensor measurement which was now excluded because of the COVID-19-pandemic. In addition, other HRV measurement tools should be considered (e.g. a smart ring).

The resource based occupational well-being questionnaire (Paper III) and the SHINE feedback questionnaire (Paper IV) was used in PHASE II in addition to the HRV measurements. (Table 7). These questionnaires included developed items for this study and items obtained from other instruments, which affected the validity and

reliability of the used questionnaires. There were no suitable items found to answer the stated research questions, therefore these needed to be developed for this study. The validity of the developed items was examined using an expert panel including nurse educators with special expertise from the field of occupational well-being, instrument development or research (n=6). The panel was asked to comment on the questions relevance and understandability and suggest modifications to the questions. The content validity index (CVI) for individual items and for the scale was calculated (Almanasreh et al., 2019; Polit & Beck, 2006; 2021). The CVI for the relevance and understandability was found to be acceptable, each of the developed items of the CVI being above 0.70 (Polit & Beck, 2006) (Table 10).

After the expert panel, the questionnaires were piloted because of the developed items in the questionnaires. The resource based occupational well-being questionnaire was piloted with nurse educators (n=26) and the SHINE feedback questionnaire with nurse educators (n=9) who also piloted the SHINE intervention. The pilot participants were asked to give feedback on the developed items and whether the length of the questionnaire was acceptable. The Cronbach's alpha for was calculated for the consistency of the questionnaire sub-scales (if applicable) combining the questionnaire's piloting data (n=26 or n=9) and the baseline data of this study (n=80) (Table 10). Altogether, these chosen study items seemed applicable in this study. However, these developed items were lacking a further validity analysis due to the need of a larger sample size (Gunawan et al., 2021); this is therefore one validity issue of this study . The resource-workload-balance especially, needs more investigation and further instrument development.

In the process evaluation study (Paper IV) using the SHINE feedback questionnaire, it would have been also justified to use other data collection methods (e.g. interviews) to enrich the data (Skivington et al., 2021), as the responses in the open ended question were rather short. The questionnaire had three sections of which one included a valid system usability instrument (Brooke, 2013) and other two studies had developed sections. The reliability of these developed items can be considered acceptable as they were utilized in this study as separate items including the previously stated CVI calculations (Table 10).

Table 10. The reliability and validity of the used study instruments.

Variable, items (Instrument)	**Reliability (consistency) and Validity (CVI)**
PHASE I	
WRW, 15 (OWESoHeT©)	Worker's resources and work (WRW) subscale: α=.84 - Resources and mental workload, 4: α=.85 - Resources and physical workload, 3: α=.58 - Workplace support, 4: α=.71 - Occupational health care services, 4: α=.83
PHASE II	
HRV (Heart rate sensor, Polar® H7/H10)/ Kubios HRV software)	- Polar: technology has widely been applied in research of heart rate variability (HRV) (https://www.polar.com/en/science/research-tools/). - Kubios: a validated HRV analysis software designed for scientific research and professional use (https://www.kubios.com/publications/).
RWB, 16 (OWESoHeT© + study developed)	16-item Resource-workload-balance (RWB): α=.92 - 7-item Workload: (α=.82), combining two factors from WRW (1.resources and mental workload and 2. resources and physical workload) (PAPER I) - 6-item Personal resources: α =.88, CVI-S = 0.94 relevance, 0.78 understandability (PAPER III) - 3-item the balance: α=.79, CVI-S = 0.92 relevance, 0.83 understandability (PAPER III)
Overall OW, 1 (OWESoHeT©)	One item Overall occupational well-being (OW). Measuring overall personal occupational well-being (PAPER I) (Laine et al., 2018; Saaranen et al., 2007).
GW, 5 (WHO-5© well-being index-questionnaire)	5-item General well-being (GW) measurement scale: WHO-5: α = .85. A short questionnaire of the subjective well-being applied successfully across a wide range of study fields (Topp et al., 2015).
PA, 3 (OSPAQ©)	3-item Physical activity (PA),"Occupational sitting and physical activity questionnaire (OSPAQ)" (Chau et al., 2012). Found acceptable for assessing sitting and standing, where accelerometer for measuring walking and heavy labour is recommended (Maes et al., 2020).
RE, 4 (The Recovery experience questionnaire©)	4-item Recovery experiences (RE): α = .89. Found valid to measure recovery, also used to measure recovery when working, using psychological detachment and relaxation items in this study. (Kinnunen et al., 2019; Sianoja et al., 2018; Sonnentag & Fritz, 2007).
SR, 6 (study developed)	Self-reflection of personal resources (SR): α =. 75, CVI-S =0.97 relevance, 0.88 understandability.
WS, 2 (study developed)	Workplace support (WS): α = .83, CVI-S =1.00 relevance, 0.92 understandability.
Usability and utility, 21: (System usability scale©, SUS + study developed)	- 10-item SUS: α=.87 valid instrument to measure usability of an program (Bangor et al., 2009; Brooke, 1996, 2013) - 7-item Utility questions: α=.95, related to the outcomes measured. CVI-S= 1.00 relevance and 0.92 understandability. - Four open-ended questions coded and analysed by two researchers for the validity of the data collection.

α= Cronbach's Alpha; CVI-S= Content validity index-scale.

6.2.2 The validity and reliability of the results

The concept occupational well-being has multiple definitions challenging the interpretation of the results related to the previous literature (Hascher & Waber, 2021). This study used one theoretical occupational well-being framework (Saaranen et al., 2007, 2015) throughout the study phases (Figure 1) focusing on personal resources and workload in nurse educators' work. Other more common occupational well-being models presented in this study background could have been considered for use. The work ability model (Ilmarinen, 2006, 2009) and job demands and resources model (Bakker & Demerouti, 2007, 2017) especially could have been suitable for investigating the personal resources and workload of nurse educators. The chosen model is lacking a specific definition for the personal resources and the balance between resources and workload factors and therefore needs further development to address the issues challenging the validity of the results. However, there model has strengths where each aspect of the occupational well-being can be investigated separately, where in intervention study not all can be promoted at once.

This study was conducted within the Finnish population without randomization, therefore the generalizability or transferability of the results with other countries (e.g. not western countries) must be considered carefully (Polit & Beck, 2021), also due to variation of the job descriptions of nurse educators (Campos Silva et al., 2022). However, the transferability of the results to another environment (Polit & Beck, 2021) was confirmed by describing the study settings and the characteristics of the participants so that the readers can make their own assumptions as to whether the results are suitable in their educational context.

Cross- sectional survey study (Paper I, PHASE I) included large number of participants, and though the response rate was relatively low, the sample size was considered adequate for the analysis, though the justification for the adequate sample size should have been made before the data collection, and as such is a validity issue in this study (Holtom et al., 2022; Jenkins & Quintana-Ascencio, 2020; Mundfrom et al., 2005). In addition, there is always the possibility of a selection bias when participation is voluntary and those with a particular interest have the energy to participate in surveys (Wang & Cheng, 2020). However, the study sample was from the Finnish perspective quite large (n=552) and included diverse opinions (standard deviation was high in many questions), meaning that at least different perspectives were obtained.

There was no possibility to identify the percentual share of those health and social care educators educating nurses from all respondents thus limiting the interpretation towards nurse educators. In general, this is a larger global challenge when studying nurse educators, as the definition used from those educating nurses varies between countries (Campos Silva et al., 2022).

In the systematic literature review (Paper II, PHASE I) various terms used in occupational well-being studies made the synthesis of the intervention studies challenging. A wide range of terminology, conceptual heterogeneity and instruments, made the synthesizing of the results challenging and restricted the meta-analysis (Crocetti, 2016; Shamseer et al., 2015). The systematic review found 13 studies for which the quality was found acceptable. There is a risk of bias due to adopting a textual approach to the process of the synthesis of the findings in the literature review, and this was intended to be overcome with the transparent reporting of the interventions making the results more reliable (Hoffmann et al., 2016; Popay et al., 2006). In addition, two researchers (J.R. & S.K.; Paper II) screened the literature independently with transparent PICOS criteria (Amir-Behghadami & Janati, 2020).

In the quasi-experimental and cross-sectional process evaluation study of the intervention (Paper III and IV, PHASE II), the participants' responsiveness in SHINE intervention can be considered as a success having only two drop-outs during the intervention (also considering selection bias) and 70 percent of the participants were active users (Handley et al., 2018). The number of participating educators was sufficient to demonstrate the effectiveness of SHINE, where the calculated power analysis for resource-workload-balance indicated that a group of 37 was needed to show a 0.5-point difference within groups with an effect size of 0.6 (Bagiella & Chang, 2019; Jenkins & Quintana-Ascencio, 2020). There could have been more considered given to a further investigation of those 30 percent with a less active usage profile, e.g. what reasons did they have for not using SHINE actively. This would have provided valuable information for interpreting the results, as this study found no associations between usage profile and perceived utility of SHINE.

There were four key components implemented in SHINE, and one component, workplace support for personal resources promoting activities at work, lacked a strict fidelity assessment which is important when interpreting the results (An et al., 2020). This might have led the intervention groups from two nursing schools to differ in the workplace support they receives, creating uncertainty when interpreting the results of this component. In addition to the fidelity measurement, adding the views of the managers as regards the usability of SHINE in the working life of their employees could have enriched the data resulting in more insight into the workplace support.

The process evaluation study (Paper IV) used open-ended questions analyzed using content analysis. The associations between the background variables and the usability and utility in the process evaluation study (Paper IV) should be interpret with caution, due to the unplanned sample size for this analysis (Happ et al., 2019). The educators participated in the study voluntarily and the participants may have already been motivated to promoting their occupational well-being and thus may not reflect the real study population leaving this issue under speculation.

6.3 Suggestions for future research and implications for educational organizations

Suggestions for future research

A need for further research was found during this study addressed detailed in the discussion section and are presented in the original study papers (I–IV).

Suggestions for methodological issues:

- Research PHASE I used the instrument (OWESoHeT), which needs further development to provide stronger psychometrical properties and to be more user friendly by having possibly less items. This study provides insights into the relevant background variables identified as being related to personal and working life among nurse educators.
- This study found challenges in synthesizing occupational well-being literature, where there is a lack of mutual understanding. This should be further researched in health sciences (e.g. nursing science) focusing more on the definitions used in occupational well-being studies.
- This study used heart rate variability measurements in addition to surveys. The use of other measurements was also considered e.g. pedometers, health examinations, diaries and work absentee statistics as these could provide more insight along with surveys or interviews. Diverse data collection methods involving stakeholders (e.g. nurse educators, students and managers) early in the research planning process could enrich the data when evaluating occupational well-being interventions.

Suggestions for the development of SHINE:

- This study created a SHINE model based on the evidence of previous literature. This study omitted testing the associations between the outcome variables which will need further research considering also whether the outcomes were specific enough for SHINE. The associations of SHINE components and the outcomes could provide valuable information on what components were the most important for the possible gained results as well as finding the moderators and mediators (Skivington et. al, 2021).
- There is a need for further development of SHINE components:
    - including a high workload decreasing component addressing the backlog situations in everyday working life.

    - excluding the workplace support from the components and adding the support part as an implementation strategy.
- This study lacked long-term follow-up of the SHINE. It would be interesting to know what activities of the SHINE intervention are still being used after the guided digital program ended and an evaluation of the sustainability of the intervention with long-term follow-up.

Suggestions from the perspective of the educational organizations:

- This study found that inner motivation along with collegiality support was a usability facilitator of SHINE. In future intervention studies, there should assess the motivation of the organization and the individual occupational well-being actions during working hours.
- This study found the possibilities to conduct occupational well-being activities during working hours appliable to conduct with student nurses. This would mean that addressing the need for society to support the occupational well-being of students needs further investigation, also addressing the students becoming future nurse educators.
- This study found possible associations of different career stages and the personal life situations with the needs of occupational well-being supporting activities needing more investigation in future studies.

Implications for educational organizations

- Integration of SHINE into the working life could benefit recovery experiences of nurse educators and succeeded to support the occupational well-being activities and experiences break promoter at work. Therefore, it should be considered a part of everyday working life.
- SHINE found possible methods to integrate occupational well-being activities into the working life of educational organizations. Occupational well-being supportive activities should be included as part of nurse educators' competence area enhancing the well-being of the student nurses (National Academy of Medicine, 2022; Salminen et al., 2023).
- The nursing school managers should address the workload issues (e.g. not having time for breaks, backlog situations at work) found in this study and in previous literature as they are the main barrier to support occupational well-being during working hours. The support needed is collegial encouragement, time support from managers creating a culture in the workplace where these occupational well-being activities are recommended.

7 Conclusions

Occupational well-being is an investment not only for the individual, but also for the whole school community and society in general, as indicated in the previous studies. To support occupational well-being includes challenges related to maintaining and promoting personal resources at work and workload issues to be addressed among nurse educators. This study found possibilities to promote educators' personal resources during working hours with self-conductive exercises that also required workplace support. This study was one step towards an evidence-based, occupational well-being promoting workplace culture, including well-being actions suitable for different working surroundings (e.g. remote working) which were lacking in previous intervention studies. This study intervention, SHINE, applied applicable self-conductive activities during working and reported promising methods for promoting and maintaining the occupational well-being of nurse educators that were also found to promote recovery experiences at work. Conducting SHINE intervention in working life needs constant workplace support but does not need other facilitators outside of the organization. This factor strengthens the sustainability of the intervention together with the use of easy self-conductive activities that are possible to implement as part of everyday working life.

Acknowledgements

"What a ride!", what comes to my mind when looking back for these five past years: Thank you all, who have been a part of my doctoral dissertation journey, supporting me to accomplish something I never could have done myself. Thank you!

There are no words to describe my gratitude towards my supervisors, Professor Leena Salminen and Professor emerita Helena Leino-Kilpi. I could try to describe the meaning of the support that I have received quoting the words from the song "Bridge over troubled waters", where you both have built the bridges throughout my journey. When everything was unclear and the doubt came into my mind, you gave me advice and encouragement, which made me to believe in myself and move forward. Helena, you have inspired me and challenged me to achieve things I never knew I could. Leena, you have supported me, given me valuable advice, and lived alongside throughout my journey and made me feel safe along the way. Thank you!

I would like to express my gratitude to the Department of Nursing Science at the University of Turku and the Doctoral Programme in Nursing Science for giving me the opportunity to pursue the doctoral studies in such a supportive and innovative educational environment. Thank you for the opportunity to participate in the European Academy of Nursing Science, where I received valuable knowledge of developing and evaluating complex interventions. Special thanks to Professor Anna Axelin for being an inspirational role model to pursue my doctoral studies and to Professor Riitta Suhonen for guiding and supporting me through my studies. I would also like to thank statistician Miko Pasanen, whom I had the most privilege to collaborate in the University of Turku and the University librarian giving me valuable advice concerning systematic reviews.

I extend my gratitude to Professor Terhi Saaranen, Docent Heli Virtanen and Occupational health nurse (PhD) Anne Heikkinen for your role on the follow-up committee giving me valuable advice along with my supervisors. Special acknowledgement for Professor Terhi Saaranen and the Department of Nursing Science in the University of Eastern Finland for taking me as part of "Social and health care teachers' occupational well-being in Finland -research and development project, 2020-2023" and being the best possible party to conduct a research project with.

Thank you, Docent Mika Tarvainen in the University of Eastern Finland for your valuable insights and knowledge concerning the heart…well heart rate variability.

I would like to express my sincere gratitude towards Docent Satu Elo and Professor emerita Ulla Kinnunen, who served as the official pre-examiners of my dissertation giving insightful and constructive feedback. Your contribution is greatly appreciated. Thank you, Professor Stephen Tee for agreeing to serve as the official opponent for my defense.

I am most grateful towards my employer The City of Turku, Kalle Ojanen as my manager in my work as a nurse educator and Caj Karlsson as my manager in my current work as an occupational health and safety representative. Your support has extent beyond your duties, of which I am most grateful. I would also like to thank Päivi Lehtinen the Headmaster in Turku Vocational Institute, of whose appreciation for science and occupational well-being development is inspirational.

Thank you, my fellow colleagues in my doctoral research journey: Anneli Vauhkonen, Riitta Rosio and Imane Elonen. You have been my backbone when mine was momentarily broken. Special thanks to Mika Alhonkoski, my best man, who I have had the privilege to share my dissertation journey with. I would like to reach my special thanks to my fellow nurse educators Marja-Liisa Gustafsson, Tarja Kanerva and Petteri Johansson for all the support and true friendship.

I have received funding and support from various parties enabling me to pursue my endeavors throughout my doctoral research-project. I want to acknowledge The Finnish Nursing Education Foundation, OAJ's Occupational Wellbeing Fund and Labor union OAJ's AO ry, the Finnish Work environment Fund, The Foundation for Municipal Development and The OKKA Foundation. Sincere acknowledgements to Johan Boholm Director of Communications in Vitec Raisoft Oy for giving me the opportunity to develop the Smart Break SHINE-program in such supportive and innovative company. I owe a sincere gratitude to all educators and their managers who participated in the different phases of the study.

I am most grateful to my family and friends. Special thanks to my lifelong friends Mona, Tiia, Tuija, Sini and Minttu for your constant support. Special thanks to my mother and father, being there when I needed you the most. I am most grateful to my children Iida and Onni, you are the love of my life giving me a reason to be the better version of myself every day. Thank you Onni for asking me how many teeth shark has when I was too preoccupied and Iida for the relaxing piano music. I want to express the sincerest gratitude towards my husband Risto, whom without I wouldn't be here today as proud of myself as I am. Your support, love and comfort are beyond imaginable. Thank you for sharing this journey with me, now it's time for new adventures…together.

Kaarina, May 3rd, 2024

Jenni Rinne

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TURUN
YLIOPISTO
UNIVERSITY
OF TURKU

Painosalama, Turku, Finland 2024

ISBN 978-951-29-9739-8 (PRINT)
ISBN 978-951-29-9740-4 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)