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Competence Development Needs of Health Sciences Teacher Candidates and the Factors Connected to Those Needs

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Abstract

Health science teacher candidates should acquire skills for professional development during their education as teachers, both to ensure their professional competence and improve the quality of learning. This study aimed to identify the competence levels and competence development needs of health science teacher candidates, and the factors associated with those needs. The research applied cross-sectional design and was conducted in winter 2018–2019 in Finland. The Health and Social Care Educator's Competence instrument and the Educators' Professional Development instrument were used to collect data. Teacher candidates evaluated their competence as good into all areas of competence. Candidates' level of need to develop pedagogical competence related to their level of competence in leadership and management, subject and curriculum, and digital collaborative learning. Candidates with a higher level of collaboration and societal competence needed less development to manage challenging situations in teaching. Candidates with more work experience as an educator needed less competence development in managing challenging situations and leadership support. Based on the results, micro level competence should be developed from the start of health science teaching studies, and the latter stages of their studies should develop their macro level competence.

Introduction

Health science educators have expressed a need for more continuous competence development, particularly around building the digital pedagogy skills required to deliver hybrid teaching and use technology efficiently as a tool for teaching (Ryhtä et al., 2020). They have also suggested that continuing education should be planned and organised consistently and, where appropriate, follow an effective individual continuous professional development programme which is meticulously designed and evaluated (Koskimäki et al., 2021). Previous research has already explored some aspects of the educational needs of health science teacher candidates (Salminen et al., 2009), including building their competencies for simulation-based teaching (Topping et al., 2015) and digital methods (Saaranen et al., 2021; Salminen at al., 2016), and teacher candidates' own perceptions of their competence (Kuivila et al., 2020).However, this has not generated a full understanding of continuing educational needs throughout teacher training in health sciences. Teacher training for health science educators

needs further development to ensure high standards in the health care professions (Salminen et al., 2021).

Health science educators include faculty members in higher education institutions (National League for Nursing, 2021; University of Applied Science Act and its later amendments A1129/2014), clinical teachers in health care organizations such as hospitals (Finish Ministry of Social Affairs and Health, 2022; Jayasekara et al., 2018), and researchers and developers (Booth et al., 2016). The training required for working as a health science educator varies internationally. In many countries, health science educators are required to have a masters degree or doctorate as well as specified work experience in health care (Lahtinen et al., 2014; National League for Nursing, 2021; Oprescu et al., 2017; Paul, 2015). For example, in Finland, health sciences educators are educated in master's degree of universities and vocational teacher training schools. In universities, their training covers both science (60 ECTS credits) and pedagogical studies (60 ECTS credits). Similarly, vocational teacher training includes education science (15 -25 ECTS credits) and pedagogical studies (30- 45 ECTS credits). The qualifications required by educators varies depending on whether they teach in a vocational school, university of applied sciences, or other universities, and are regulated by law (Government Decree on the Qualification of Teachers of Vocational Qualifications in Social Welfare and Health Care 2017/1150 13a §; Mikkonen et al., 2019a).

The competence of a health sciences educator can be divided into macro and micro levels, where the macro level means educators' competence from a larger perspective, in society and in developing education, while the micro level relates directly to teaching and relating to students. At the macro level, health science educators must be able to utilize, produce, and evaluate evidence-based work on healthcare (Mikkonen et al., 2018; World Health Organization (WHO), 2016). They also need to understand theories of education, and the principles and models of teaching appropriate to health and adult education. Educators must be able to consider legal, ethical, and professional values in their work, and be able to develop healthcare education policies, practices, and approaches to decision-making. Health science educators must be able to guide, lead, and create educational programs which consider current societal needs (Kuivila et al., 2020; Mikkonen et al., 2018; WHO, 2016). Educators also need to be competent in foresight so that they can innovate and support future developments in light of changes in the workplace and dynamic social influences. In addition, educators must be future-oriented and proactively develop their own competence (Mikkonen et al., 2019b; Parker et al., 2020).

At the micro level, health science educators need to be able to evaluate students' learning, curricula, and the effectiveness of the education provided. Educators also need to know how to apply creative teaching methods, and be capable of using digital solutions in their work (Mikkonen et al., 2018; Mikkonen et al., 2019b; WHO 2016). Educators must be able to foster equality among students and colleagues, to act in challenging situations, and make ethically sustainable decisions in their work. They must also be able to communicate effectively and work collaboratively with clinical practice professionals (Kuivila et al., 2020; Mikkonen et al., 2018; Mikkonen et al., 2019b; WHO, 2016). Health science educators must be able to work in their current context at international, national and community levels. They must be culturally aware and culturally sensitive, know how to create a safe atmosphere, and communicate across cultures. Educators also need to be administratively competent, both in terms of education and finances, and to support occupational well-being by applying management and coaching

competencies. Educators must know how to lead projects, people, and themselves, and maintain and develop both their own well-being and that of the work community (Mikkonen et al., 2019b).

Training of health science educators plays an important role in supporting their ability to continue developing their competence. Their education needs to be forward-looking and future oriented, and the content and priorities within teacher education should evolve according to the needs of society. This means that health education organizations must continuously review, evaluate, and reform curricula, continuously updating the education they provide (Kavanaah, 2021; Kotilainen et al., 2020). Skills for continuous professional development should be fostered during teacher training, as this has been shown to ensure the professional competence, well-being and job satisfaction of health educators, and to improve the efficiency and competitiveness of the organizations they work for. (Dymoc and Tyler, 2018; Huang et al., 2019; McMahon, 2017).

In health care, educators are a role model for, among other things, the provision of quality clinical care, professional development and growth, the use and production of evidence-based practice, and research (Godwin et al., 2021). Recognizing the need for competence development, and planning learning accordingly, should be a continuous process throughout the educator's career (Cooley and De Gagne, 2016; Koskimäki et al., 2021; Summers, 2017). The process of becoming and being an educator is lifelong (Avalos, 2011), and competence development should not end with the award of an educator's pedagogical license. The aim of education is to produce experts for future needs, and it is appropriate to assess the competence needs of health science teacher candidates who are already being educated. By doing this we are able to identify where there is greatest need for improvement in competence development at the teacher training stage of becoming a health science educator.

Method

Research Aim

This research aimed to describe the competence levels and competence development needs of health science teacher candidates and explore the competence levels and factors associated with those needs. The research was guided by the following questions:

1) What level of competence do teacher candidates in health science education have?
2) What needs for competence development education do teacher candidates in health sciences education have?
3) What factors are associated with teacher candidates' competence development needs?

Research Design

A national cross-sectional research design was used to collect data in Finland, between Autumn 2018 and Spring 2019.

Participants

All health science teacher candidates who were majoring in nursing or rehabilitation (N=315), at six universities in Finland offering master's degrees in health sciences, were invited to participate in the study. Participation in the study was voluntary. Teacher candidates were recruited by a university contact person nominated by each of the participating organizations. The sample size was determined by the total number of teacher candidates, and was sufficient, when compared to previous studies of health science educators (Cohen, 1992; Gicnac & Szodorai, 2016; Mikkonen et al., 2022b), to achieve the required effect size with a moderate Cohen's d (d=0.5, 1-Beta err prob, two tailed-test, $p<0.05$) for this study. Achieving that effect required data from n=50 participants.

Instruments

The Health and Social Care Educator's Competence (HeSoEduCo) instrument, which includes eight latent variables and 43 items (Mikkonen et al., 2020), and the Educators' Professional Development (EduProDe) instrument, which includes six latent variables and 22 items (Koskimäki et al., 2020), were used to collect data for this study. HeSoEduCo is a self-assessment instrument which measures various competence areas in health and social care education, namely: competence evidence-based practice (8 items), competence in digital collaborative learning (5 items), competence in student-centered pedagogy (8 items), competence in collaboration and societal issues (5 items), competence in leadership and management (6 items), competence in cultural & linguistic diversity (4 items), competence in mentoring students in professional competence development (4 items), and competence in subject & curriculum (3 items). Respondents grade the items using a four-point Likert scale (1-fully disagree, 2-disagree to some extent, 3-agree to some extent, and 4-fully agree).

EduProDe is a self-assessment instrument that measures six elements of social and health care educators' continuing professional development, namely: the need to develop pedagogical competence (7 items); the need to manage challenging situations in teaching (3 items); leadership competence (3 items); self- directed learning (3 items); the need to develop clinical competence (3 items); and the benefits of continuing professional development (3 items). In both instruments respondents grade the items using a four-point Likert scale (1 – fully disagree, 2 – disagree to some extent, 3 – agree to some extent, and 4 – fully agree).

These instruments have previously been validated in agreement with health and social care educators, and the content and structure of the instruments has been shown to be valid and reliable. The HeSoEduCo instrument showed high reliability, as demonstrated by Cronbach's alpha values ranging from 0.75-0.90, and for EduProDe instrument the Cronbach's alpha varied between 0.70 and 0.89. Because these instruments have not been used previously with teacher candidates, four experts evaluated their face and content validity. Both health science teacher candidates and educators acted as experts. The questions and content of the instruments were found to be clear and relevant. The instruments were further pilot tested on four more teacher candidates. The instruments showed high reliability in this study, as demonstrated by Cronbach's alpha values ranging from 0,70-0,90. No changes to the instruments were required, and pilot data were included in the total sample.

Data Collection

The data was collected via a contact person in each organization. Teacher candidates received an e-mail from the contact person which included an information letter and a Webropol link to the survey. The invitation itself was sent once, with four reminders issued every other week during the data collection period. At two universities the survey was also conducted as a paper survey, because of low response rates to the online survey. The questionnaire included 11 background questions in addition to the HeSoEduCo and EduProDe instruments (see Table 1).

Data Analysis

The data were analyzed by two researchers (Authors blinded) using SPSS Statistics (version 25.0; IBM Corporation, Armonk, NY). Candidates' socio-demographic and background data were analyzed using descriptive statistics presented as frequency and percentage distributions, means, and standard deviations. Missing data were assessed with Missing at Random (MAR), Missing Completely at Random (MCAR) and Missing Not at Random (MNAR) tests. There were no instances in which a survey included more than 5% missing data per variable. The competence levels of teacher candidates were divided into low (Likert scale score <2.49), intermediate (2.50-3.49), and high (> 3.50) categories. These three levels have been tested using non-parametric outcome measurements including the Kruskal-Wallis and Mann-Whitney tests. Chi-Squared and one-way ANOVA tests were used to determine whether participants differed significantly in terms of their background information. The threshold for statistical significance was set as p-value < 0.05 (Munro, 2005).

Logistic regression was used to identify significant factors from candidates' socio-demographic and background information in relation to their competence needs. All factors that correlated significantly with the latent variables of the HeSoEduCo and EduProDe scales were tested by building binary logistic regression models with a forced entry method. The outcome variables were transformed into dichotomous variables (0 = 1–3.4–disagree; 1 = 3.5–5–agree). The log of likelihood−2 times (−2LL) was used to estimate fitness for each model. The goodness of model fit was examined by the Omnibus test of model coefficients, and the Cox & Snell and Nagelkerke square tests. The results were presented as odds ratios (OR) with confidence intervals of 95% and statistical significance set at $p<0.05$. The effect size was measured using OR outcomes in the models, and interpreted according to the effect size estimates 1.5–small, 2.5–moderate, 4–large and 10–very large (Cohen, 1992).

Ethical Issues

The study was conducted in accordance with ethical principles (Helsinki Declaration, 2013) and in accordance with legislation regarding personal data protection (General Data protection Regulation (GDPR), 2018). The instruments used have been developed by the researcher group involved in the study. Research permission was obtained from all six participating universities according to the Finnish ethical practices and regulations (Medical Research Act 488/1999, 295/2004, 794/2010; Personal Data Act 523/1999). Teacher candidates were informed about the study and assured that their participation was voluntary. Responding to the questionnaire was taken to indicate their informed consent.

Results

Participant Characteristics

101 teacher candidates participated in the study, a response rate of 32% of those invited, from six Finnish universities. Most of the participants were women (92.1%), with a median age of 34 years and a BA degree (26.0 %) from a university of applied sciences. The median start year of candidates' health sciences degree studies was 2016, with completion of their BA in 2017. Most candidates (92.1 %) had studied nursing science as their major subject (see Table1). Candidates had an average (median) of seven and a half years' work experience in the health care field, and four months' work experience as an educator. A majority of candidates (79.2 %) were not in employment as an educator.

Table 1. Teacher Candidates' Background Information (n=101)

Background information	Values
Age in years, median (min-max)	34 (23-66)
Gender, n (%)	
Female	93 (92.1)
Male	8 (7.9)
Previous education, n (%)	
University of applied sciences	26 (25.7)
University Bachelor's degree	65 (64.4)
University Master's degree	10 (9.9)
Year of completion of the highest degree, median (min-max)	2017 (1989-2019)
Work experience in corresponding field, median (years, min-max)	7.49 (7.78)
Starting year of health science degree, median (min-max)	2016 (2009-2018)
Current teacher training, n (%)	
Vocational teacher training	1 (1.0)
Teacher training in health sciences	99 (98.0)
Teacher training in educational sciences	1 (1.0)
Area of current health sciences degree, n (%)	
Nursing sciences	93 (92.1)
Rehabilitation	5 (5.0)
Physiotherapy	1 (1.0)
Combination of social services, healthcare, and/or rehabilitation	2 (2.0)
Work experience as an educator, months, mean (SD)	4.36 (10.77)
Current employment, n (%)	
Part-time educator	15 (14.9)
Full-time educator	6 (5.9)
No employment as educator	80 (79.2)

Health Science Teacher Candidate's Competence Levels

The teacher candidates were divided into three competence levels (Levels 1, 2 and 3) based on their self-assessment scores (low= < 2.49; intermediate= 2.5–3.49; and high= > 3.5). 22.7% of candidates scored as low (beginner competence); 48.5% as intermediate (good competence); and 28.7% as high (advanced competence), with a significance level of $p<0.001$ across all competence areas (see Table 2 and Figure 1).

Table 2. Teacher Candidates' Self-evaluated Competence Areas among the Levels (n=101).

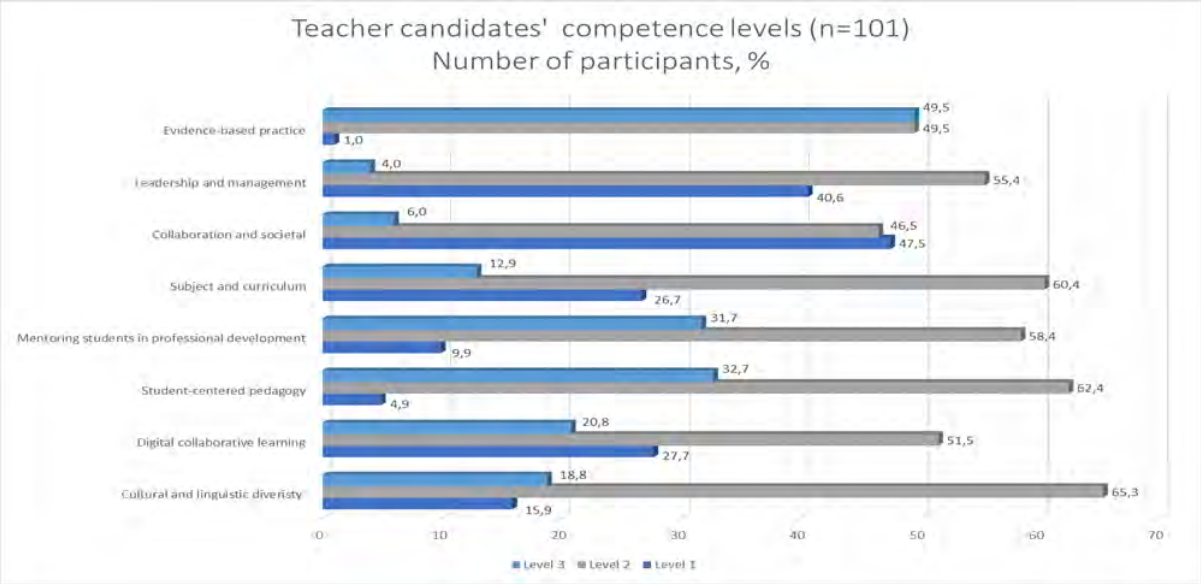
Competence area	Level 1 22.7%	Level 2 48.5%	Level 3 28.7%	p-value
Competence in evidence-based practice	2.97 (0.37)	3.42 (0.35)	3.68 (0.27)	0.001*
Competence in leadership and management	2.23 (0.38)	2.60 (0.33)	3.21 (0.27)	0.001
Competence in collaboration and societal issues	1.86 (0.34)	2.50 (0.31)	3.23 (0.43)	0.001
Competence in subject and curriculum	2.14 (0.55)	2.80 (0.34)	3.42 (0.42)	0.001
Competence in mentoring students in professional development	2.41 (0.45)	3.10 (0.31)	3.68 (0.29)	0.001
Competence in student-centred pedagogy	2.58 (0.43)	3.16 (0.23)	3.74 (0.18)	0.001
Competence in digital collaborative learning	2.06 (0.55)	2.77 (0.52)	3.28 (0.50)	0.001
Competence in cultural and linguistic diversity	2.42 (0.55)	2.90 (0.41)	3.28 (0.49)	0.001

Likert Scale 1-4 (1 - fully disagree, 2 - disagree to some extent, 3 - agree to some extent, and 4 - fully agree)

^ M: mean (SD: standard deviation); * Kruskal-Walli's test.

$p < 0.05$

Competence levels: low= < 2.49; intermediate= 2.5–3.49; and high= > 3.5



Competence level interpretation: Level 1. low - (< 2.49), Level 2. moderate (2.5-3.49), Level 3. high (> 3.5)

Figure 1. Teacher Candidates' Self -evaluated Competence Levels

Teacher candidates evaluated their competence in evidence -based practice as moderate (49.5%) or high (49.5%). Candidates evaluated their leadership and management competence as low (40.6%). Collaboration and societal competence were mainly evaluated as low (47.5%) or moderate (46.5%). The other competences concerning Subject and curriculum (60.4%), Mentoring students in professional development (58.4%), Student-centered pedagogy (62.4%), Digital collaborative learning (51.5%) and Cultural and linguistic diversity (65.3%) were generally evaluated as moderate.

Competence Development Needs

Teacher candidates reported the benefits of continuing professional development as their area of greatest need (mean 3.64, SD 0.50), with leadership competence (mean 3.51, SD 0.53) as the next priority for development (see Table 3). In leadership competence, organizational atmosphere was considered to be the most important factor (mean 3.60), followed by discussions with superiors (mean 3.49) and having a personal development plan (mean 3.45). Clinical competence (mean 3.20, SD 0.66) and pedagogical competence (mean 3.21, SD 0.61) were next in terms of the self-reported level of need. In particular, teacher candidates identified the need to improve clinical competence in networking (mean 3.37), participating in developmental projects (mean 3.20), and working in clinical environments (mean 3.04). In pedagogical competence, teacher candidates reported that they have the greatest needs for competence to carry out development projects (mean 3.37) and simulation teaching (mean 3.35). They also needed education in competence-based student evaluation (mean 3.28), using digital technology in a pedagogically relevant way (mean 3.21), using teaching methods in versatile ways (mean 3.18), work life-oriented learning (mean 3.14), and student-centered teaching (mean 3.01).

Candidates reported a need to have more education to manage challenging situations in teaching (mean 3.23, SD 0.66). They felt the most need for education in teaching culturally diverse students (mean 3.31), solving conflict situations in teaching (3.20), and dealing with students´ problems related to their studies (mean 3.20). Candidates felt that, to some extent, they should develop their self -directed learning (mean 2.72, SD0.61). This was explained as relating to their participation in international cooperation (mean 2.83), or seeking to develop their competence by improving their language skills (mean 2.15).

Table 3. Health Sciences Teacher Candidates' Self-Reported Continuing Educational Needs (n=101)

Continuing educational needs	mean	SD
Teacher candidates' need to development their clinical competence	*3.20*	*0.66*
I need networking to develop my subject competence	3.37	0.70
I need to participate in developmental projects to maintain my subject competence	3.20	0.72
I need to work in a clinical environment to update my subject competence	3.04	0.90
Teacher candidates' need to develop pedagogical competence	*3.21*	*0.61*
I need more competence in using teaching methods in versatile ways	3.18	0.72

Continuing educational needs	mean	SD
I need more competence in student-centred teaching	3.01	0.84
I need more competence in using digital technology in a pedagogically relevant way	3.21	0.77
I need more competence in simulation teaching	3.35	0.79
I need to develop my competence-based student evaluation	3.28	0.72
I need more competence in work life-oriented learning	3.14	0.82
I need more competence to carry out development projects	3.37	0.68
Teacher candidates' need to manage challenging situations in teaching	*3.23*	*0.66*
I need more skills to solve conflict situations in teaching	3.20	0.73
I need more competence to deal with students´ problems related to their studies	3.20	0.82
I need more competence in teaching culturally diverse students	3.31	0.70
Teacher candidates' need to develop leadership competence	*3.51*	*0.53*
Discussions with my superior support my professional development	3.49	0.610
Organisational atmosphere supports my professional development	3.60	0.60
The personal development plan supports my professional development	3.45	0.60
Teacher candidates' need to develop their self -directed learning	*2.72*	*0.61*
I develop my competence through international collaboration	2.83	0.80
I actively develop my language skills	2.15	0.83
Participating in conferences helps me update my competence	3.19	0.65
Teacher candidates' evaluation of benefits of continuing professional development	*3.64*	*0.50*
Continuing competence development promotes my work well-being	3.64	0.57
Regular updates to subject competence improve my teaching	3.66	0.55
Pedagogical continuing education improves my teaching skills	3.62	0.58

Factors Associating with Teacher Candidates' Competence Development Needs

Binary regression analysis revealed that candidates' need to develop pedagogical competence related to competence in leadership and management, subject and curriculum, and digital collaborative learning (see Table 4). Candidates who rated their leadership and management competence at level 3 needed 0.046 times (OR, CI 95% 0.01-0.53, p=0.01) less development in pedagogical competence than those candidates who rated their leadership and management competence at level 1. Candidates at level 3 of subject and curriculum competence needed 0.045 times (OR, CI 95% (0.01-0.43), p=0.08) less development of their pedagogical competence than candidates who rated their competence at level 1. Candidates who assessed their digital collaborative learning

competence at level 2 needed 4.7 times (OR, CI 95% 1.28-17.13, p=0.019) more development to improve their pedagogical competence than students who assessed themselves at level 3. Candidates at lev-el 3 of collaboration and societal competence needed 0.067 times (OR, CI 95% 0.01-0.48, p=0.07) less development of to manage challenging situations in teaching than those candidates who rated themselves at level 1.

Table 4. Candidates Needs for Continuing Education, by Self-assessed Level of Competence

Independent variable	Outcome variable	
	Educators' need to develop pedagogical competence	Educators' need to manage challenging situations in teaching
	OR (CI 95%), p-value Omnibus Cox&Snell, Nagelkerke R Square	OR (CI 95%), p-value Omnibus Cox&Snell, Nagelkerke R Square
Leadership and management		
Level 1 (ref)	0.046 (0.01-0.53), 0.014	
Level 2	0.007	
Level 3	9.4%-18.1%	
Collaboration and societal		
Level 1 (ref.)		0.067 (0.01-0.48), 0.007
Level 2		0.031
Level 3		6.7%-12.9%
Subject and curriculum		
Level 1 (ref.)	0.045 (0.01-0.43), 0.008	
Level 2	0.002	
Level 3	11.7%-22.6%	
Digital collaborative learning		
Level 1	4.70 (1.28-17.13), 0.019	
Level 2	0.001	
Level 3 (ref.)	12.9%-25.0%	

Competence level interpretation: Level 1. low - (< 2.49), Level 2. moderate (2.5-3.49), Level 3. high (> 3.5)

Looking at the association between participants' socio-demographic characteristics and their need to develop competence, it was found that women reported that they benefited from continuing professional development significantly more than did men (mean 3.67 vs. 3.29, p=0.03). Candidates with more work experience as an educator needed less competence development education in managing challenging situations (p=0.02) and leadership support (p=0.03).

Discussion

This research aimed to describe the competence levels and competence development needs of health science teacher candidates and explore the competence level and factors associated with these needs. The results show that there is a need for health science teacher candidates to develop their competence, and that it is essential to provide opportunities for personal competence development to strengthen educators' professional identity and skills (Koskimäki et al., 2021; Nokelainen et al., 2019). Most of the teacher candidates evaluated their current competence as moderate (level 2 as defined here), with a good level of competence in all areas required of an educator. However, they also reported that they need more education in all competence areas.

Teacher candidates evaluated themselves to have the highest levels of competence in evidence-based practice. Through their previous clinical work in health care environments teacher candidates have learned that evidence-based practice, and its application in their work, plays an important role in providing effective, safe, and evidence-based healthcare (WHO, 2016). Although candidates felt that they need more training in all areas of competence, they reported needing the least competence development education in relation to their clinical competence. Candidates' high levels of self-assessed clinical competence most likely reflects the fact that they have already worked as health care professionals (Taylor et al., 2021) and have accumulated both relevant education and clinical experience.

Candidates evaluated that they had the highest need for competence development in developing leadership competence. Leadership and management competence includes skills in coaching, mentoring, and supporting employees (Barton, et al., 2018; Mikkonen et al., 2018; Mikkonen et al., 2020). This study revealed that teacher candidates recognized the importance of an organization's atmosphere in supporting the development of leadership competence. In terms of both clinical and pedagogical competence, candidates reported that they needed more development in networking and carrying out projects. Involvement in national and international collaboration has become an important part of the health care field (Alderwick et al., 2021; Schot et al., 2020; Towe et al., 2016), and health science education (Haataja et al., 2021; Heide et al., 2019; Huisman, 2021; Mikkonen et al., 2018). Working in networks and projects also requires competence in collaboration and societal skills. Teacher candidates in this study rated collaboration and societal competence as one of their weakest areas. Teamwork and collaboration competence essential to the health care professions (Al Jabri et al., 2021) and needs to receive adequate attention in the training of future health care educators.

In terms of pedagogical competence, teacher candidates reported that they need better skills for simulation teaching. The use of simulation education in health care education has increased very rapidly and is widespread (Aebersold, 2018; Padilha et al., 2019). The design and implementation of simulations requires both technical know-how and the teaching skill to unpack simulations through debriefing, which is the essential point of the simulation learning process (Bogossian et al., 2018). Advanced technical tools are not, however, always available, and educators have to be innovative and imaginative to design, plan and deliver effective simulations. Hybrid education has become more common in recent years, and teacher candidates must be taught how to deliver teaching digitally to avoid creating a poor learning experience for students (Pramila-Savukoski et al., 2022).

According to our findings, candidates with more work experience as an educator needed less competence development in managing challenging situations and leadership support than did candidates with no or less such work experience. This finding is consistent with previous research which shows that novice educators need support, mentoring, orientation, and leadership resources to get established as teachers (Igraham et al., 2018; Sodidi et al., 2020). Teacher candidates' need to develop their pedagogical competence related to their self-assessed levels of leadership and management competence and subject and curriculum competence. When candidates evaluated these competences to be good they reported needing less education to improve their pedagogical competence. Further, those candidates who rated their digital collaboration skills as good reported needing less further support to develop their pedagogical competence. Previous research has suggested that leadership and management competence for health science educators should include education policy and legislation, management, self-management, and managing work well-being (Kuivila et al., 2020; Mikkonen et al., 2022a). Knowledge of the legal and political regulations that underpin one's work provides guidance and certainty which can be associated with educators' pedagogical competence. Management competence can be described as comprising an appropriate leadership style for self-management, marketing, and management of other people and issues (Mikkonen et al., 2022b). Managing oneself and one's own work means, for example, having the ability to manage what one is doing, doing the right things, and taking responsibility for one's own decisions (Breevaart et al., 2014; Neck & Manz 2007).

Candidates who evaluated their subject and curriculum competence to be high also needed less development in pedagogical competence. Knowledge of the curriculum and good competence in the subject to be taught gives teachers confidence with regards to their pedagogical competence, enabling them to be more confident in experimenting with and using different teaching methods. Good subject competence involves integrating evidence-based knowledge and theory with one's own expertise and professional experience (Mikkonen et al., 2019b). Once an educator's subject competence is good, they are able to respond to rapid changes in teaching and to take into account students' differing needs. Teaching today requires significant technical skills including knowledge of digital applications and the ability to use them in education (Bates, 2015). This may partly explain why pedagogical competence was perceived to be better amongst candidates with good levels of digital competence. Competence related to digital teaching skills also relates to the ability to build learning environments and teach online, with help of technical tools (Esteve-mon et al, 2020).

Teacher candidates had additional competence development needs around managing challenging situations in teaching, which is consistent with the finding that they rated their collaboration and societal competence as one of their weakest areas. They also rated their competence in teaching culturally diverse students as low. Candidates who rated their collaboration and societal competence as good felt that they could cope with challenging situations and needed less competence development in that area. Koskimäki et al. (2021) show in their empirical model of continuing professional development for social and health care educators, that the identification of pedagogical development needs leads to the need for better skills to manage challenging teaching situations.

Teacher candidates expressed the view that they should somewhat develop their self-directed learning, which aligns with other studies of social and health care educators (Koskimäki et al., 2021). Directing oneself includes

elements such as concentration and the ability to direct actions towards improved performance (Breevaart et al., 2014). It has previously been shown that providing professional development opportunities and mentoring programs is beneficial for novice educators (Sheppard et al., 2018). Continuing competence development and self-direction improves self-confidence and strengthens work ability (Nokelainen et al., 2019). As indicated in the framework for this study, and as Koskimäki et al. (2021) have also shown, continuous competence development should be planned and consistent. Assessing competence consistently and integrating development plans with personal study plans in teacher education could help education providers shape their teaching around students' actual competence needs, and also accustom trainee teachers to continuous competence development which can support them throughout their careers as educators.

Limitations

The research was carried out in Finland and therefore reflects the Finnish education system. It should be noted that education systems vary from country to country, and the results presented should be generalized to other educational contexts with due caution. However, the sample is representative of the Finnish population, with the Cohen's d effect ranging from large d=0.8 to very large d=3.45, indicating a sufficient sample size to generalize the results to the national scale. In reporting on the study the STROBE checklist was used to ensure its validity and transparency (von Elm et al., 2008).

Conclusion

Training leading to a degree as a health science teacher is an important part of training qualified future health teachers. The assessment of student teachers' competences during their training helps to map their skills. It also helps to identify challenging issues at curriculum level and to assess students' professional development at different stages of their studies. These assessments are one way of ensuring that health sciences develop the competences that professionals need for their roles in health service organizations. This study identified three different profiles of student teachers based on the self-assessed competences, stage of study and work experience of health science student teachers. The link between competences and skills development needs was reflected in the fact that candidates were less likely to need to develop their pedagogical competence if their competence in leadership and management, subject and curriculum, and digital collaborative learning were at a good level. Candidates with good level collaborative and social competence, or who already had work experience as a teacher, had less need for development in managing challenging situations in teaching. Although candidates reported a good level of competence, they felt that they needed to develop their competence in all competence areas.

Recommendations

Based on this study's outcomes, we recommend building curricula for teacher candidates on strengthening their competence at the micro level right from the start, developing their skills for student-centered learning, enhancing their digital collaborative learning abilities, and connecting these with in-depth understanding of their subject and curriculum development. Their education needs to emphasize developing their competence for collaboration,

being inclusive of diversity, and versatility as an educator. Later stages of their studies should build their macro level competence by addressing areas such as leadership, management, and advocating for evidence-based healthcare. We further recommend that teacher candidates spend time working with healthcare students in real life work experience situations, to put their learning into practice. Teacher candidates' education should be supported by experienced mentors who can focus on future educators' competence development both during their education, and after graduation.

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