Title: COMPETENCE AREAS OF HEALTH SCIENCE TEACHERS – A SYSTEMATIC REVIEW OF QUANTITATIVE STUDIES

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Abstract

Background: In the face of rapid digitalisation and ever-higher educational requirements for healthcare professionals, it is important that health science teachers possess the relevant core competences. The education of health science teachers varies internationally and there is no consensus about the minimum qualifications and experience they require.
Objective: The aim of this systematic review was to describe the health science teachers' competences and the factors related to it.
Design: Systematic review of original quantitative studies.
Data sources: Four databases were selected from which to retrieve original studies: Cinahl (Ebsco), PubMed, Medic, Eri (ProQuest).
Review methods: The systematic review used PICOS inclusion criteria. Original peer-reviewed quantitative studies published between 1/2007-1/2018 were identified. Screening was conducted by two researchers separately reading the 1885 titles, 600 abstracts, and 63 full-texts that were identified, and then agreed between them. Critical appraisal was performed using the JBI MAStARI evaluation tool. The data was extracted and then analysed narratively.
Results: The core competences of health science teachers include areas of knowledge, skills and attitudes. Health science teachers evaluate their own competence as high. Only in relation to entrepreneurship and leadership knowledge was evaluated to be average. The most common factors influencing competence were teachers' title/position, healthcare experience, research activities, age, academic degree and for which type of organisation they work.
Conclusion: It is important to identify the core competencies required by health science teachers in order to train highly competent healthcare professionals. Based on the findings of this systematic review we suggest that teachers should be encouraged to gain university education and actively participate in research, and that younger teachers should have opportunities to practice the relevant teaching skills to build competence.

Keywords: competence, education, healthcare, health science, systematic review, teacher

1. Introduction

Health science teachers are expected to have ample pedagogical and research competence, skills in international networking, leadership and management (McAllistair and Flynn, 2016) and wide-ranging knowledge (21st century skills, 2016). Teachers must master digital learning environments, professional co-operation, evidence-based practice, and be self-directed (Töytäri et al., 2016). Times of change call for the various stakeholders at the interface between learning and work in the arena of health science to use their knowledge to co-operate and adapt (Fowler et al., 2017; MacPhee et al., 2009; Saarikoski et al., 2009). The competence of health science teachers is a multidimensional phenomenon, and has been discussed for decades. Health science teachers' education varies internationally and there is no consensus on the minimum qualification and experience required (Salminen et al., 2010). However, healthcare is a complex area which requires that highly-educated experts and teachers prepare professionals for their working lives (NLN, 2013; Salminen et al., 2010; WHO, 2016) in an ever-changing field. Future healthcare professionals need high quality knowledge, problem-solving and self-directed learning skills, and the ability to transfer those competences into client care (Könings et al., 2005). The core competences required of health science teachers are understood in different ways in different countries, and there is no agreement even within the specific disciplinary area of healthcare education (Salminen et al., 2010). The competences required to teach health sciences have not been studied in a way that takes into account perspectives from different disciplines. We argue that these competences should be clearly defined, including identifying the core requirements which could establish a professional development pathway and even certification of health science teachers in future (NLN, 2013).

1.1. Background

In this systematic review a health science teacher is defined as a teacher with a professional qualification of their own in at least one of these healthcare classifications: dental hygienist, dental technician, medical technologist, midwife, naprapath, occupational therapist, optician, osteopath, paramedic, physical therapist, podiatrist, prosthetist, public health nurse, radiographer, rehabilitation counsellor, registered nurse, or social service worker (University of Applied Science Act 2014/932, A1129/2014, L2015/325). Professional recognition of health science teachers generally requires a teaching qualification, university degree at Master's and/or Doctoral level, and a number of years' experience of working in a healthcare-related field (Paul, 2015; University of Applied Science Act and the its later amendments A1129/2014). Teachers practice their profession within the higher

education institutions that educate healthcare students at various degree levels (University of Applied Science Act and the its later amendments (A1129/2014).

There is no widespread consensus regarding the concept of competence (Cowan, 2005; Pijl-Zieber, 2014; Smith, 2012). Previously teachers' abilities have been described in terms of characteristics (Mogan and Knox, 1987; Nehring, 1990), roles (Davis et al., 2005; Spitzer and Perrenoud, 2006), tasks (Kalb, 2008), skills (Johnsen et al., 2002), requirements (Salminen, 2000), competences (Green, 2006), and capabilities (McAllistair and Flynn, 2016). There are some common notions which aim to describe the complexity of the concept of competence. The main attributes are 'knowledge', 'skills' and 'attitudes' (including values), which interact and support each other in multiple ways. Le Deist (2005) describes knowledge as cognitive competence which is underpinned by understanding. Cognitive competence also includes informal tacit knowledge gained from experience. Skills are regarded as a functional competence or behavioural objective: knowing how to do a given task in a given occupational area (Le Deist, 2005; Cowan, 2005). Attitudes and their underlying values are the personal qualities which guide and underpin the performance of a job (Le Deist 2005). They may also be described as a psychological construct which includes cognitive and affective skills (Cowan, 2005). According to Gonczi (2013) there are both generic and specific aspects of competence. The specific aspects, such as specialised knowledge and individual characteristics, build on the more generic aspects such as ability to make judgements. Many people advocate a holistic approach to understanding the complexity of the notion of competence (Cowan, 2005; Le Deist, 2005). Integrated knowledge and the capability to use that knowledge seem to be the core of competence (Pijl-Zieber, 2014; Kulju, 2016; Smith, 2012). Competence also brings together complex combinations of knowledge, attitudes, values and skills, which help people to perform intelligently in specific situations (Meretoja, 2003).

According to the latest evidence, the professional competence of teachers who perform their duties in higher education include: curriculum planning, implementation and evaluation; having substantial theoretical and practical knowledge, and the skills that are relevant for working life; creating and applying evidence-based knowledge; management and leadership of people and organisational issues; pedagogical competence in theories of education, learning and evaluation; digital competence in varied teaching environments; generic skills including critical thinking, communication, collaboration and decision-making; ethical professional conduct; and continuous professional development. (University of Applied Sciences Act 2014/932, WHO 2016, European Commission 2017, Ethical Principles for the Teaching Profession 2017, OECD 2017, National Qualifications

Framework 2017). Teachers need to be able to use these competences internationally in global partnerships, sharing resources and making critical decisions (Witchger Hansen 2015).

2. Research aim

The aim of this systematic review was to describe the health science teachers' competences and the factors related to it.

The research questions were:

1) What are the competence areas of health science teachers?
2) What are health science teachers' own perceptions of their level of competence?
3) Which background factors appear to explain health science teachers' competence?

3. Methods

3.1. Search strategy

Our systematic review was conducted following the guidelines of the Centre for Review and Dissemination in Healthcare (Centre for Reviews and Dissemination, 2009). It has been assessed using the AMSTAR measurement tool which assesses the methodological quality of systematic reviews (Shea et al., 2007). The systematic review obtained full marks, showing that our study is valid. After identifying the aim of the study and research question we selected inclusion criteria (Aromataris and Pearson, 2014) using PICOS (P=population; C=context; O=outcomes; S=study design) (CRD, 2009; Stern and McArthur, 2014). The PICOS was modified excluding I=Interventions and C=comparators and replacing them with C=context, since no interventional studies were identified during the search (JBI, 2014). See Table 1.

Participants in the study included health science teachers from various healthcare backgrounds included in the University of Applied Science Act (2014/932, A1129/2014, L2015/325) and the context was health science education, including both theoretical and practical education. Teachers providing practical education had to be employed by a university, thus this category excluded healthcare staff undertaking a mentoring role. Medical science was excluded because of differences within length, curriculum and structure of degree programme compared to health sciences (WHO, 2013). We sought studies which reported on outcomes relating to teaching competence in this field. These had to be related to teachers' knowledge, skills and attitudes, and were not strictly defined in the inclusion criteria. The review looked at original, peer-reviewed, quantitative studies published in scientific journal from 2007 to 2018. Specific quantitative methodologies were not strictly defined in

the inclusion criteria, but studies were critically appraised for quality during the screening process. Qualitative studies, even where original and peer-reviewed, were excluded from this systematic review: these will be synthesized and reported on in a further publication. The language limitation was set to English, Finnish and Swedish. Grey literature was not included. The search terms used included synonyms of the PICOS keywords relevant to this study (Aromataris and Riitano, 2014). We consulted with a library to ensure that appropriate search terms and keywords were included, and relevant databases consulted, in order to enhance the validity of the information retrieved for the systematic review. Search terms were divided into three groups (1- area of healthcare; 2- outcome; 3- participants), which were used to retrieve information separately and then later combined (see Figure 1). Four databases were selected from which to retrieve original studies for the systematic review (Cinahl (Ebsco), PubMed, Medic, Eri (ProQuest)) (see Table 2).

3.2. Screening process and quality assessment

After 18 duplicate publications were removed the total number of studies was 1885 (see Figure 1). The studies chosen for the systematic review were screened by title (n=1885), abstract (n=600) and full-text (n=63), by two researchers working first separately and then reaching a consensus at each step of the screening process. Eventually, eleven studies were assessed as being of sufficient quality, using JBI (2014) MAStARI critical appraisal for descriptive studies. MAStARI critical appraisal includes nine evaluation criteria which examine sampling methods, descriptions of sample groups and outcomes, and use of objective criteria, measurement methods, and appropriate statistical analysis methods (JBI, 2014). Our systematic review included only articles which scored at least four points in MAStARI critical appraisal. This cut-off point was set in order to enhance the quality of subsequent interpretation of the review (Aromataris and Pearson, 2014; Porritt et al., 2014). The quality assessment was again conducted by two researchers working separately and then in agreement. As a result, four of these eleven articles were excluded. See Figure 1.

3.3. Data extraction and analysis

The seven original studies selected were set out by publication reference, country of origin, purpose, participants, methodology (study design, data collection and data analysis), and key findings (Munn et al., 2014) (see Table 3). The data was then analysed using a narrative analysis (Munn et al., 2014), identifying teacher competences by dividing data into the areas of teacher knowledge, skills and attitudes. Narrative analysis included transforming data into a common measure, tabulating the details of the selected studies' relevant results, and textual description of original studies (Centre for Reviews and Dissemination, 2009). Almost all of the original studies used their own validated instruments to measure teacher competence, with the exception of Salminen et al. (2013) who used a Tool for

Evaluation of Requirements of Nurse Teacher (ERNT) in their studies. The original studies reported their outcomes in various measurement units including percentages, mean and standard deviation values of sum-variables, or average mean values of sub-dimensions (see Table 3). None of the studies presented interval estimates (e.g. a confidence interval of 95-99%) for their data (Munn et al., 2014). For the purposes of interpreting the results, all values have been re-calculated and presented in this analysis as percentages (see Table 4). Additionally, in three original studies the factors relating most significantly to teacher competence outcomes have been identified and presented (see Table 5) but the others did not examine such factors in relation to the studied outcomes. It was not possible to carry out a meta-analysis, giving an overall summary of the effect of the results upon one specific outcome, because none of the original studies measured consistent factors relating to the outcomes (Munn et al., 2014).

4. Results

The original studies selected for the systematic review were conducted in the United States of America (Coplen et al., 2011), Wales (Kell and Jones, 2007), and Finland (Koivula et al., 2011; Numminen et al., 2011; Salminen et al., 2012; Salminen et al., 2013). The designs of the selected studies were cross sectional, descriptive and comparative, and used data collection methods including survey questionnaires and descriptive nonparametric analysis methods. Only Numminen et al. (2011) used the statistical parametric test, ANOVA. The systematic review sets out what each study found with regards to teacher competence, categorising the data under the headings of knowledge, skills and attitudes (see Table 4). We also present and discuss the characteristics which appear to impact on teacher competence (see Table 5).

4.1. Participants

Participants in the original studies were mostly teachers of nursing (Koivula et al., 2011; Numminen et al., 2011; Salminen et al., 2012; Salminen et al., 2013); then dental hygiene teachers, allied health teachers (Coplen et al., 2011) and physiotherapy placement teachers employed by a university (Kell and Jones, 2007). The number of participants varied from 111 to 631 (total n=2089). The average age was 50 years in the USA (Coplen et al., 2011) and 50-59 years in Finland (Koivula et al., 2011; Numminen et al., 2011, Salminen et al., 2013). The majority of participants (64%) were educated to Master's degree level. Most participants had 5-10 years' teaching experience: these made up from 53% of Coplen et al.'s (2011) sample to 62% of the sample in Koivula et al. (2011), Numminen et al. (2011) and Salminen et al. (2013).

4.2. Teacher competence

Various dimensions of teachers' knowledge were evaluated, including: subject knowledge (Kell and Jones, 2007); evidence-based teaching including teaching based on health science, research, ethics, traditional approach to teaching, and multidisciplinary (other science) teaching (Koivula et al., 2011); knowledge of the codes of ethics (Numminen et al., 2011); and knowledge about entrepreneurship (Salminen et al., 2012). Different aspects of teachers' skills that were evaluated include pedagogical skills (Coplen et al., 2011; Salminen et al., 2013) and specific interactive and facilitative teaching skills (Kell and Jones, 2007), and evaluation skills (Salminen et al., 2013). In addition, problem-solving skills (Kell and Jones, 2007), leadership skills (Salminen et al., 2012), research skills (Coplen et al., 2011), skills for acquiring and imparting knowledge (Kell and Jones, 2007; Koivula et al., 2011), technology skills (Coplen et al., 2011; Kell and Jones, 2007), clinical skills (Coplen et al., 2011), and training of specific job skills (Kell and Jones, 2007) were considered, along with personal supervisory skills which were addressed in terms of caring interest (Kell and Jones, 2007), motivating students (Kell and Jones, 2007), and relationship with students (Salminen et al., 2013). The relationship with students incorporates characteristics such as equality, honesty, encouraging mutual respect, and taking students seriously (Salminen et al., 2013). Teachers' attitudes were examined in terms of positive attitudes to research (Koivula et al., 2011) and to entrepreneurship (Salminen et al., 2012), and personality factors (Salminen et al., 2013). The latter included features such as consistency, admitting one's mistakes, open-mindedness and flexibility (Salminen et al., 2013).

In the seven original studies teachers generally evaluated their own competence as over 50% on the relevant scale. Teachers were particularly confident about their clinical skills (99% in Coplen et al., 2011), pedagogical skills (97% in Coplen et al., 2011), technology skills (94% in Coplen et al., 2011), relationship with students (93% in Salminen et al., 2013), showing caring interest (92%), and motiving students (91% in Kell and Jones, 2007). Leadership skills (58% in Salminen et al., 2012), research skills (53% in Coplen et al., 2011) and knowledge in entrepreneurship (46% in Salminen et al., 2012) were evaluated as average.

4.3. Factors relating to the teacher competence

Factors relating to teacher competence were explored in three of the original studies (Coplen et al., 2011; Koivula et al., 2011; Salminen et al., 2012) (see Table 5). Statistically significant factors relating to teacher competence were age (Coplen et al., 2011; Koivula et al., 2011), the type of organisation a teacher works in (Coplen et al., 2011), diploma (Koivula et al., 2011), degree and title (Coplen et al., 2011; Koivula et al., 2011), length of experience as a teacher, further education,

research and development activities, publication activities (Koivula et al., 2011); and experience, education and teaching of entrepreneurship (Salminen et al., 2012).

In Coplen et al. (2011) those teachers who were 60 years old and above evaluated their pedagogical skills most highly compared to younger teachers. In addition, those participants with a Master's degree in health sciences rated their clinical skills as highly important (Coplen et al., 2011). In Koivula et al. (2011), teachers aged 51-60 years ($p=0.01$) used sources from multidisciplinary scientific enquiry in their teaching. Teachers who were nurses, had a diploma in more than one discipline ($p=0.03$), more than 10 years of teaching experience ($p=0.01$) and who were active in publishing ($p=0.04$), also used such sources in their teaching (Koivula et al., 2011). In Coplen et al. (2011), teachers with Master's degree ($p=0.01$) and those working at university rather than college ($p<0.01$) attached the greatest importance to possessing research skills.

In Koivula et al. (2011), those teachers with a PhD ($p =0.01$), principal lecturers ($p=0.02$) and members of research teams, leaders of projects ($p<0.01$) and teachers who had published scientific papers ($p=0.02$) based their health science teaching on a larger range of scientific disciplines than did other participants. The use of research in teaching was most prevalent amongst principal lecturers ($p=0.01$) and teachers active in scientific publishing ($p=0.04$). The traditional approach was adopted primarily by full-time teachers ($p=0.06$) who had had no further education during the past year ($p=0.04$) and not carried out any research or development activities ($p=0.02$). A traditional approach to teaching was accounted for by teaching being based on the individual's own clinical experiences, text books, good nursing practice and medical knowledge (Koivula et al., 2011). Such teachers have mostly either published in non-scientific contexts or they have had no publications at all ($p=0.02$). Those teachers with a PhD ($p=0.02$) in principal lecturer positions ($p<0.01$), being members of a research team, taking part in a project ($p<0.01$) and producing scientific publications ($p<0.01$) had the highest score for adopting a broad approach to knowledge acquisition. Those teachers with non-scientific publications ($p=0.01$) had the most positive attitude to research (Koivula et al., 2011).

In Salminen et al. (2012), teachers with education ($p=0.03$) and work experience ($p=0.02$) in entrepreneurship had the best knowledge in that area. Teachers who taught entrepreneurship to students also had better knowledge on the subject (Salminen et al., 2012). Additionally, teachers in leadership positions considered technology skills to be significantly more important than did teachers in non-leadership positions (Coplen et al., 2011).

5. Discussion

In this systematic review, health science teachers' competence was divided into categories relating to knowledge, skills and attitudes. We found no studies which measured all three aspects. Most studies focused on measuring teacher skills. Salminen et al. (2013) looked at both teacher skills and personality factors, the latter of which is included under attitudes in this systematic review. Two studies (Kell and Jones, 2007, Koivula et al., 2011) strongly emphasised subject knowledge and evidence-based knowledge. Teachers with a higher university position based their teaching more on evidence-based knowledge than did other teachers. A traditional approach to teaching was used more by full-time teachers with little publication activity and no recent further professional education. More experienced teachers also used multi-disciplinary sources in their teaching. (Koivula et al., 2011).

Health science teachers carry responsibility for preparing future professionals for clinical practice. Delivering on this responsibility relies on professionals using evidence-based knowledge in their daily working environment. Future professionals need to be competent to integrate theory into practice. That is why those who teach healthcare professionals require such competence in the subject themselves. In addition, they need to provide students with learning skills such as creativity and innovation in the field of healthcare. Research competence is another essential area to build into the core competencies of health science teachers.

In this systematic review, ethics (Numminen et al., 2011) and leadership (Salminen et al., 2012) were highlighted as further important elements of health science teacher competence. Ethical principles and professionalism have for the first time been included in the World Health Organization's (2016) publication of Nurse Educator Competencies. In our review knowledge, skills and attitudes regarding leadership were shown to be important for the improvement of health science teachers' competence. Also, teachers' confidence in their own competence was associated with having experience of entrepreneurship and teaching it to students (Salminen et al., 2012).

In terms of teaching skills, older teachers were more confident in their educational and clinical skills (Coplen et al., 2011). Also, teachers working in universities rather than colleges evaluated their own research skills significantly more highly (Coplen et al., 2011). Two of the original studies showed contradictory evidence regarding teachers with Master's and other degrees. Koivula et al., (2011) found that teachers with a Doctoral degree demonstrated greater acquisition and imparting of knowledge in their teaching. Coplen et al. (2011), though, found that teachers with a Master's degree had better research skills than those with either a Bachelor's or a Doctoral degree. The contradiction may possibly be explained by the different education systems and accreditation methods in different

countries (NLN, 2013; University of Applied Science Act 2014/932, A1129/2014, L2015/325) and by Doctoral degree holders having a more self-critical attitude towards their own research competence.

In this systematic review, health science teachers have evaluated themselves as highly competent in almost all areas of teaching competence. Comparing the perspectives of nurse teachers, nursing students, nurse leaders and nurse mentors, though, it is apparent that nursing students evaluated their teachers' competence significantly less positively than did the teachers themselves. In fact, out of all participants in the study, teachers had the highest regard for their own teaching competence (Salminen et al., 2013).

5.1. Limitations

In searching for studies to include in this systematic review we were only able to find descriptive studies, and each of these reported their findings using different units of measurement. This has limited our ability to use more advanced analytical methods and the results should only be generalised with great caution because of these limitations.

5.2. Implications

This study has confirmed that the competence of health science teachers is an under-researched phenomenon. Identifying the core competences that health science teachers require is essential if we are to prepare highly competent healthcare professionals for the future. A number of regulations describe what kind of areas need to be included in the education of health science teachers (University of Applied Science Decree 352/2003, WHO 2016, European commission 2017, Ethical Principles for the Teaching Profession 2017, OECD 2017, NQF 2017). However, in this systematic review we have shown that there is a lack of empirical evidence and knowledge about which areas of competence are needed to enhance and improve the quality of health science teaching. We suggest that further research is needed, to create and test a core competence model for health science teachers.

Based on the results of this systematic review, it seems that higher level university education, more involvement in research, and more opportunities for younger teachers to practice their teaching skills are strategies worth considering. Only a few studies discussed how to maintain teacher competence. Lifelong learning is fundamental for the future, particularly because of ongoing digital developments in education (Vilen and Salminen, 2016; Töytäri et al., 2017). This systematic review has shown that the health science teachers' core competencies need to be both better defined clearly and further tested.

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Table 1. Inclusion criteria by PICOS review

Inclusion Criteria	
Population	Health science teachers, educators and lecturers in the following professions: caring science, dental hygienist, dental technician, healthcare, medical technologist, midwife, naprapath[1], occupational therapist optician, osteopath, paramedic, physical therapist, podiatrist, prosthetist, public health nurse, radiographer, rehabilitation counselor, registered nurse, and social service worker
Context	Health science education: theoretical education and/or practical education with employment by a university (clinical facilitator, nurse teacher, clinical educator, clinical teacher)
Outcome	Areas of competence in teaching: knowledge, skills and attitudes/values
Types of studies	Peer-reviewed original studies published during years 1/2007-1/2018; languages English, Finnish, Swedish

[1]Naprapath or naprapathy- closely related to osteopathy while there is a difference in the focus of naprapathy on human soft tissue and on its manipulation to restore healthy process of the human body.

Table 2. Databases and search results for the original studies

Databases	Number of Original Studies
CINAHL (EBSCO)	837
PubMed	480
Medic	8
Eric (ProQuest)	578
Total	1903
Duplications	18

Table 3. Extracted data of original studies with the quality assessments scores

Original studies, country	Purpose	Participants	Methodology: design, data collection, data analysis	Key findings	Quality assessment (MAStARI)
Coplen et al. (2011), USA	To investigate all U.S. dental hygiene educators' demographic characteristics, future plans and perceptions of important skills for future faculty	Faculty members including dental hygiene, health education, allied health (n=631)	Electronic survey sent by email, instrument developed for the study (40 items with 1-4 Likert-scale) Descriptive statistics, chi–square test (SPSS), $p<0.05$	The participants evaluated the importance of skills in clinical dental hygiene (99%), educational skills (97%), technology skills (94%), and research skills (53%). The factors influencing the outcomes of skills in order of importance were degree level, age, work position, and university versus college education.	5
Kell and Jones (2007), Wales	To map Welsh placement educators' perceived conceptions of teaching and teaching in practice	Physiotherapy placement educators employed by university (n=141)	Anonymous paper survey, by post, questionnaire including demographics, the Lecturers' Conception of Teaching and Learning questionnaire (50 items), and the Trainer Type Inventory Cross-tabulation and Chi-squared analysis, Levene's test, ANOVA (SPSS)	The participants evaluated their competence in problem solving (32.63± 2.66), interactive teaching (29.45 ± 3.47), facilitative teaching (23.39 ± 1.81), training for specific jobs (21.39 ± 2.73), knowledge of the subject (20.82 ± 2.82), imparting information (19.53 ± 3.32), pastoral interest (18.37 ± 1.77), motivating students (18.26 ± 2.35), and use of media (11.89 ± 3.74).	4
Koivula et al. 2011, Finland	To assess research utilisation by nursing teachers and assess connections between the teachers' background, further education and research activity variables and research utilisation on nursing education	Nursing teachers from polytechnics (n=339)	Descriptive, cross-sectional design; electronic survey sent by email, a structured questionnaire including demographics (8 items), and Nursing Teachers Research Utilization Scale (NTRUS) (30 items, 1-5 Likert-scale) Descriptive statistics, Kruskal-Wallis and Mann-Whitney test, Bonferroni correction (SPSS), $p<0.05$	The participants evaluated their research utilisation in the following order: teaching based on nursing science (32.7 ± 4.1), teaching emphasising ethics and evidence (16.4 ± 2.3), traditional approach to teaching (15.6 ± 2.3), and the lowest positive attitude to research (10.4 ± 2.0). The factors influencing most significant differences among the outcomes were academic degree, official title, full-time versus part-time teaching, age, work experience, research and development activities.	6
Numminen et al. 2011, Finland	To evaluate educators' knowledge on the codes of ethics	Nursing educators from 24 polytechnics (n=183)	Descriptive, comparative, cross-sectional design Paper survey, self-administered structured questionnaire, instrument developed for the study including demographics (11 items), statements of the codes (30 items), ethical concepts (9 items), functions of the codes (32 items), codes of other healthcare professionals	The educators evaluated their knowledge of the codes of ethics as adequate to teach these to their students (85%). Those teachers who assessed their knowledge as adequate had more frequent experiences in teaching codes of ethics ($F = 3.76 – 12.44$, $p = 0.006 - < 0.001$). The educators evaluated the importance of the codes of ethics for: the relationship between the nurse and patients (4.63 ± 0.51): the work and	6

			(7 items), and laws and agreements related to the codes (15 items) with 1-5 Likert-scale. Descriptive statistics, t-test, ANOVA, Pearson correlation coefficient, Chi-square test (SPSS), $p<0.05$	professional competence of nurses (4.42 ± 0.58): and the mission of nurses (4.22 ± 0.59).	
Salminen et al. 2012, Finland	To describe healthcare teachers' attitudes towards entrepreneurship and their competence on entrepreneurship as evaluated by teachers themselves.	Nurse teachers from six polytechnics (n=111)	Electronic survey sent by email, questionnaire including demographics, instrument developed for the study (28 items, 1-5 Likert scale & 24 items, 1-4 Likert scale) Descriptive statistics, cross-tabulations, Pearson correlation coefficient, Chi-square test, Fisher's exact test (SPSS), $p<0.05$	The participants (76%) evaluated their attitude towards entrepreneurship as positive. The competence of entrepreneurship was evaluated as poor (91%). The factors influencing most significant differences among outcomes were entrepreneurship education and work experience as entrepreneur.	6
Salminen et al. 2013, Finland	To assess the competence of nurse educators based on their own evaluations and to describe the cooperation between educators.	Nurse educators from 14 polytechnics (n=342)	Descriptive, cross-sectional survey design; electronic survey sent by email or contact person and/or paper version, questionnaire including demographics and Tool for Evaluation of Requirements of Nurse Teacher (ERNT) (20 items, 1-5 Likert scale) Descriptive statistics, ANOVA, Tamhane's post-hoc test, (SPSS), $p<0.05$	Nurse educators' competence varied from mean value of 2.85 to 4.66. Educators evaluated their competence regarding relationship with students most highly (4.66 ± 0.41). The lowest score was given for teaching skills (4.37 ± 0.51).	6

Table 4. Competence areas of health science teachers

Teacher competence	Author/s and year of publication					
	Coplen et al., (2011)	Kell & Jones, (2007)	Koivula et al., (2011)	Numminen et al., (2011)	Salminen et al., (2012)	Salminen et al., (2013)
	n=631	n=141	n=339	n=183	n=111	n=342
KNOWLEDGE						
Knowledge of subject	-	83%	-	-	-	-
Evidence based knowledge	-	-	-	-	-	-
Teaching based on nursing science	-	-	82%*	-	-	-
Selection of research for teaching	-	-	71%*	-	-	-
Teaching emphasising ethics and evidence	-	-	82%	-	-	-
Traditional approach to teaching	-	-	78%*	-	-	-
Multidisciplinary (other science) teaching	-	-	69%*	-	-	-
Knowledge of codes of ethics	-	-	-	80%	-	-
Knowledge in entrepreneurship	-	-	-	-	46%*	-
SKILLS						
Pedagogical skills	97%*	-	-	-	-	87%
Interactive teaching	-	74%	-	-	-	-
Facilitative teaching	-	78%	-	-	-	-
Evaluation skills	-	-	-	-	-	88%
Problem solving	-	82%	-	-	-	-
Leadership skills	-	-	-	-	58%	-
Research skills	53%*	-	-	-	-	-
Acquisition and imparting of knowledge	-	78%	69%*	-	-	-
Technology skills	94%*	60%	-	-	-	-
Clinical skills	99%*	-	-	-	-	-
Training for specific jobs	-	86%	-	-	-	-
Personal guidance	-	-	-	-	-	-
Caring interest	-	92%	-	-	-	-
Motivate students	-	91%	-	-	-	-
Relationship with students	-	-	-	-	-	93%
ATTITUDES/VALUES						
Positive attitude to research	-	-	69%*	-	-	-
Positive attitude towards entrepreneurship	-	-	-	-	76%	-
Personality factors	-	-	-	-	-	88%

1-100% represents the scale of agreement (100%-fully agree)
*factors influencing significant outcomes among different groups of participants presented in the original studies ($p<0.05$)
- not included in the study

Table 5. Background factors relating to teacher competence

Factors	Outcomes										
	Teaching based on nursing science[1]	Selection of research for teaching[1]	Traditional approach to teaching[1]	Multi-disciplinary sources on teaching[1]	Knowledge in entrepreneurship[2]	Educational (/teaching) skills[3]	Research skills[3]	Acquisition and imparting of knowledge[1]	Technology skills[3]	Clinical skills[3]	Positive attitude to research[1]
	n=339	n=339	n=339	n=339	n=111	n=631	n=631	n=339	n=631	n=631	n=339
Age	NS	NS	NS	p=0.01	-	p=0.05	-	NS	-	p=0.02	NS
29 and under[3]						94%				96%	
30-39[3]						97%				99%	
40-49[3]						99%				99%	
50-59[3]						100%				100%	
60 years and older[3]											
40 years or under[1]				61%							
51-60 years[1]				71%							
Gender	NS	NS	NS	NS	-	-	-	NS	-	-	NS
Teacher's work organization	-	-	-	-	-	-	p<0.01	NS	-	-	NS
University							74%				
College							42%				
Diploma	NS	NS	NS	p=0.03	-	-	-	NS	-	-	NS
Nurse				67%							
Nurse + 1-2 other dip.				73%							
Degree	p=0.01	NS	NS	NS	-	-	p=0.01	p=0.02	-	p=0.01	NS
Associates[3]							50%			94%	
BA[3]							45%			98%	
MNSc[1]	82%						59%	69%		99%	
PhD[1]	87%						50%	79%		96%	
Other[1]								65%			
Title/position	p=0.02	p=0.01	p=0.06	NS	-	-	-	NS	p=0.03	-	NS
Lecturer[1]	82%	71%									
Principal lecturer[1]	87%	80%	73%								
Full-time teacher[1]	80%	68%	81%								
Other title[1]	74%										
Leadership position[3]									99%		
No leadership position[3]									92%		
Experience in healthcare	NS	NS	NS	NS	-	-	-	NS	-	-	NS
Experience as a teacher	NS	NS	NS	p=0.01	-	-	-	NS	-	-	NS
Under 10 years				65%							
10-20 years				69%							
Over 20 years				73%							
Further education	NS	NS	p=0.04	NS	-	-	-	NS	-	-	NS
Yes			77%								
No			80%								
Research and development activities	p<0.01	NS	NS	NS	-	-	-	p<0.01	-	-	NS
Member of research team and project	85%							73%			
No research	79%							74%			

Publication activities	p=0.02	p=0.04	p=0.02	p=0.04	-	-	-	p<0.01	-	-	p=0.01
Scientific publication	84%	68%	74%	71%				79%			72%
Other publications			79%					70%			
No publications	79%	66%	79%	66%				60%			67%
Experience as entrepreneur	-	-	-	-	p=0.02	-	-	-	-	-	-
Entrepreneurship education	-	-	-	-	p=0.03	-	-	-	-	-	-
Teaching entrepreneurship	-	-	-	-	p=0.03	-	-	-	-	-	-

[1] Koivula et al. (2011); [2] Salminen et al. (2012); [3] Coplen et al. (2011)
- not included in the study; NS no significant difference

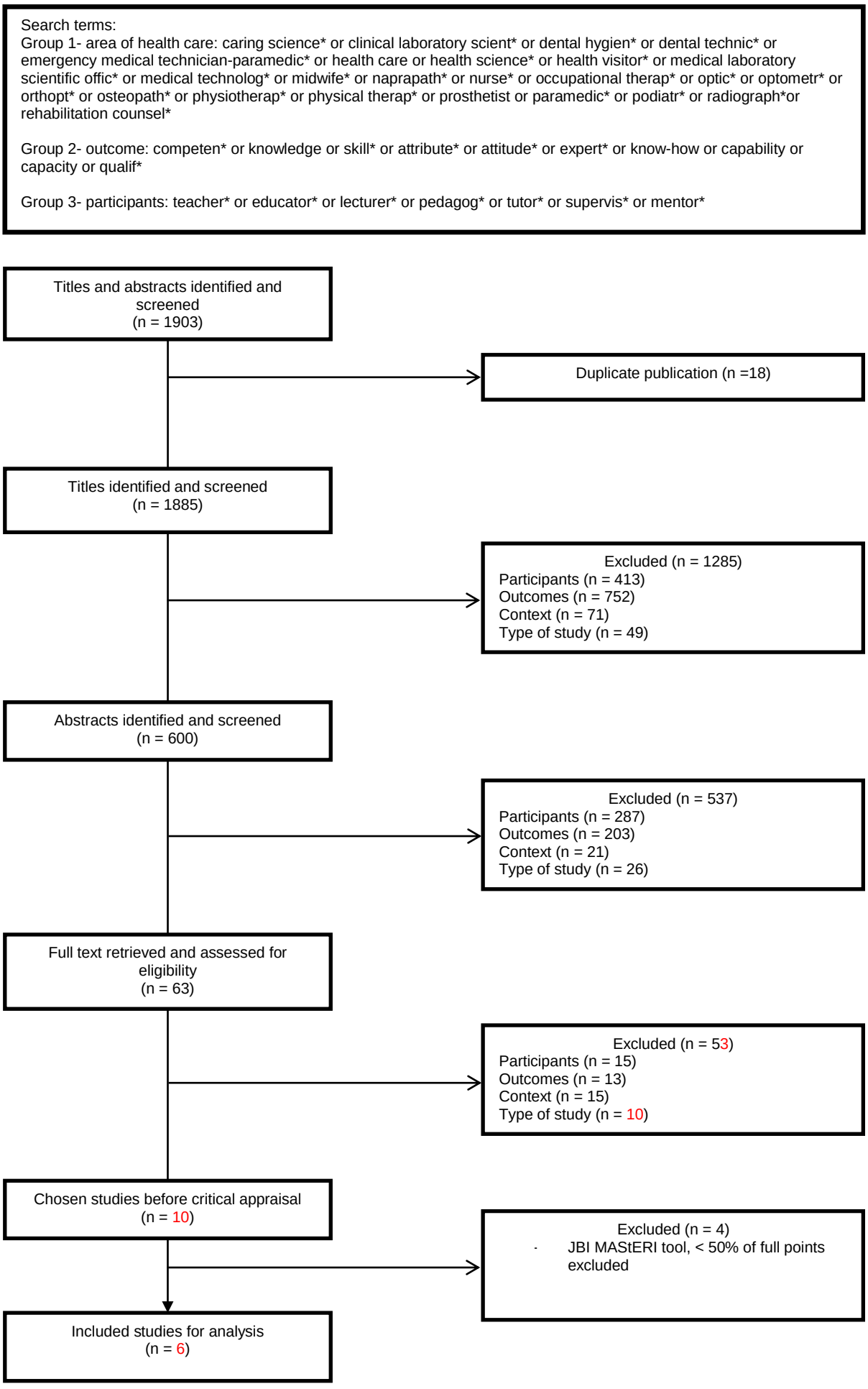

Figure 1 Search terms and flow chart of study selection process according to CRD (2009)