

Competencies on environmental health and pedagogical approaches in the nursing curriculum: A systematic review of the literature



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ABSTRACT

It has been suggested that climate change is the biggest threat to public health for the 21st Century; increased demand on health services will impact on already overstretched resources and systems will need to be able to respond. However limited attention is given to climate change and sustainability in nursing education; there is no clear guidance on curricula content for nurses or recommendations regarding the skills and competencies that will be required. Literature published in Dutch, English, German, and Spanish was searched and 32 papers met the inclusion criteria for the review. Results suggests that holistic/systems thinking is relevant to healthcare so bringing a 'sustainability lens' to nursing curricula could be seen as being consistent with wider determinants of health. The literature review has identified the educational approaches necessary to provide a broad based curriculum and a cross-disciplinary approach. The findings suggest that topics such as the use of resources, food, health promotion, globalism, disease management, and the environmental impact of delivering healthcare, if embedded in nursing education could support the nursing profession's response for this new and important aspect of healthcare.

1. Introduction

The health effects of climate change are being experienced across the world and are well documented in the literature (The Lancet Countdown, 2017). Furthermore, repeated extreme weather events have affected both basic raw materials needed for everyday living (e.g. wood, and cotton) and dependence on fossil fuels has led to potential risks to supplies (Grose and Richardson, 2014). Preparing nurses to be readily adaptable to the health impacts of climate change and challenges to the supplies of basic raw materials used in the delivery of healthcare is essential (Richardson et al., 2014a). Richardson et al. (2014a) suggest that sustainability skills are not widespread amongst nurse teaching staff; knowledge about sustainability and climate change principles is largely absent from the nursing curricula. However nursing

may be highly vulnerable to the impact of climate change with the healthcare needs of the very young and very old particularly of concern (Leffers et al., 2017). It has been suggested that the impact on healthcare systems will be the greatest problem clinicians and managers face in the 21st Century (Naylor and Appleby, 2012). Therefore nurses will need to have relevant competencies to respond to climate change and sustainability challenges in the future.

Nurses are in a position to prepare for, and respond to the potential health effects caused by increasing extreme weather events (Goodman, 2011). In their role as health educators they can help communities to understand potential risks to infrastructure from e.g. flooding and potential risks to individual health from e.g. raised CO₂ levels. Providing support to people who may be at risk (especially the old and very young) has two outcomes: firstly individuals and communities may be

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better prepared for catastrophic events, secondly nurses can encourage use of the outdoors thereby improving mental health and wellbeing. Leffers et al. (2017) state ‘the integration of climate change into nursing education is essential so that knowledge, skills, and insights critical for clinical practice in our climate-changing world are incorporated in curricula, practice, research, and policy’.

Over the last twenty years education for sustainable development (ESD) has begun to have an impact, changing the way we learn and making individuals and organisations consider how best to raise awareness and change practice. ESD provides a framework for programme managers and tutors to embed sustainable principles across their curricula (UNESCO, 2005; Sterling, 2012). In particular, Sterling’s review (2012) provides recommendations about how ESD can be embedded into Higher Education; primarily the focus should be on interdisciplinarity i.e. multidisciplinary working across a range of subjects and disciplines. Within the guidance on introducing ESD principles a range of methods are suggested, for example discussion groups, self-reflection and debates (Cotton and Winter 2010). In recent research Richardson et al. (2014b) describe the development, use and evaluation of scenarios which are relevant to every aspect of the role of the nurse and therefore have greater impact on their learning. In this example design students were encouraged to engage with the student nurses in discussion about the sustainable use of healthcare resources. This interdisciplinarity was shown to enhance the student nurses’ experience, and enable the design students to come up with sustainable solutions to everyday problems experienced by nurses on the ward and in the nursing school environment (<http://youtu.be/zlFT2Dbg08o>). Finding innovative ways of embedding the principles of ESD in the nursing curriculum has been shown to change attitudes towards climate change and sustainability, and inclusion of these topics in the nursing curriculum, with demonstrable changes in knowledge (Richardson et al., 2017). However there remains a lack of sustainability and climate change competencies in nursing and no clear guidance on knowledge and skills requirements (Leffers et al., 2017).

This review is part of a larger European (NurSusTOOLKIT www.nursus.eu) initiative that aims to build an evidence-based resource to support sustainability literacy and competency in nursing. The aim of this project is to produce teaching and learning materials in a number of different languages and make freely these available via the Internet. The NurSus project collaborators are based in Germany, Spain, The Netherlands and UK, the teaching resources are available in six languages.

The aim of this paper is to present a review of literature that focuses on the environmental competencies required and pedagogic approaches used to embed sustainability in curricula in nursing education.

2. Methods

The questions for the focus of this review are: What do nurses need to know about sustainability and climate change? What pedagogic approaches are used to embed sustainability in curricula in nursing or higher education?

2.1. Search strategy

A comprehensive search strategy was used to identify relevant literature in four languages: English, Dutch, German and Spanish. Appropriate databases were searched to identify relevant documents published in English, Spanish, German and Dutch. Databases from each country and/or language were used to find research related to the topic (Table 1).

The search terms and key words were translated from English into German, Spanish and Dutch (then back translated for accuracy).

1. Nurs* OR "healthcare practic*" OR midwi*
2. Sustainability OR "climate change"

3. 1 AND 2
4. Educ* OR training OR skills
5. 1 AND 2 AND 4
6. Pedag* OR "educ* approaches"
7. 2 AND 6
8. "Higher educ*" OR universit*
9. 1 AND 7 AND 8

2.2. Inclusion criteria

The inclusion criteria were: published papers that report climate change and sustainability topics that nurses need to know, be aware of and have skills and competencies in, and pedagogical approaches to embed it to curricula in high education; the article title, abstract and body of original research papers, policy documents, professional body/organisation documents, published and unpublished (grey literature) relevant to the research questions; whose languages were English, Spanish, Dutch or German.

2.3. Exclusion criteria

Letters, newspaper articles and non-academic documents were excluded.

Our search was limited to literature published between January 2004 and November 2017. Searches were conducted between December 2014 and February 2015 and an update in November 2017.

An initial search identified 4718 titles as possibly meeting the inclusion criteria of which 4110 were discarded as not meeting the aims of the study. Then, 620 abstracts were reviewed and 588 discarded as being duplicates or not meeting the inclusion criteria. Finally 32 papers were entered into the review (Fig. 1).

2.4. Potential for bias

Citations were filtered independently by two members of the team in each country; where there were discrepancies, the full article was retrieved for more detailed scrutiny. The limitations of the search strategy are based on the tension between the need to ensure specificity whilst at the same time attempting to be fully inclusive. The key words allow for the potential to find a very large number of irrelevant papers, in attempting to be very specific, we may have excluded some publications that may have been relevant. Attempts to avoid this were made by using an iterative process; documents we were aware of through our networks were searched and included if relevant.

2.5. Thematic analysis

Papers selected were subjected to thematic analysis using standard methods that have been used previously (Mays et al., 2005; Humphreys et al., 2007; Nichols et al., 2009). They were categorised according to the following aspects of teaching and learning (multiple categories per paper were possible): knowledge/awareness; skills; attitudes; competence; behaviour; pedagogical approaches; and subjected to thematic analysis.

3. Results

Table 2 shows that 32 papers were included in the review. The right hand column provides the reference and the left hand column describes the reason for inclusion. One paper was included because it provided national (UK) guidance and context to current thought on ESD (QAA763, 2014).

The papers were read and re-read independently by two researchers who then compared the themes they had identified. Themes were identified by noting similar ideas across the papers and grouping those ideas into three areas: 1] Underpinning theoretical assumptions 2]

Table 1
Databases searched in the NurSus participating countries.

English	Spanish	German	Dutch
Plymouth University collections via PRIMO	Cuiden and CuidenPLus	Carelit	PICARTRA
CINAHL	CUIDATGE	Pubmed	GLIN
Medline Europe PubMed Central	LILACS		Invert: Index van de Nederlandstalige Verpleegkundige Tijdschriftliteratuur
EMBASE	CSIC		NAZ – Nederlandse Artikelendatabank voor de Zorg
Global health (Ovid)	ICYT		Vakbibliotheek
SCOPUS	IME		
ERIC	ISOC		
British Education Index (BEI)	TESEO		
Australian Education Index (AEI)	SciELO		
Web of Science	Periódicos CAPES		

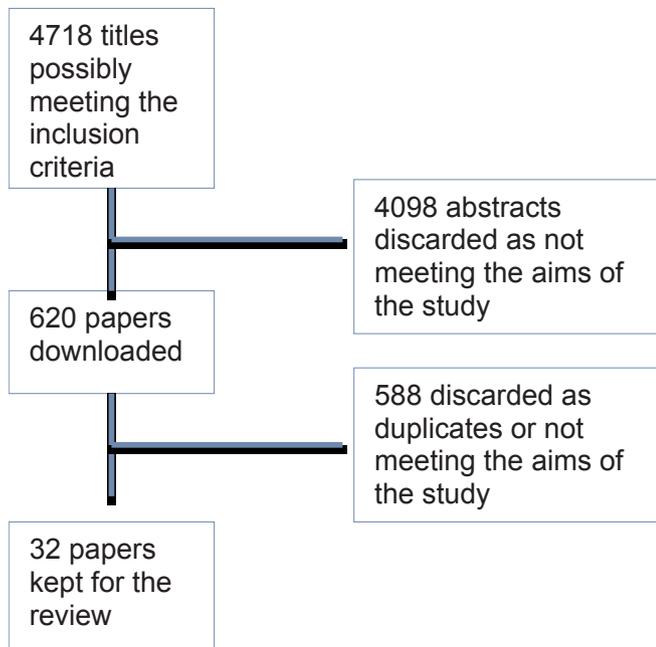


Fig. 1. Flow chart.

Educational approach; and, 3] Type of activity. Researchers were looking for consistency of ideas and areas where a particular activity or approach had been explored or was represented in several of the papers.

The thematic analyses revealed the need to raise awareness amongst nurses; six specific themes were evident as topics for study in nursing and healthcare curricula that related to sustainability and climate change: resources, food, health promotion, globalism, environmental impact, disease management. In order to focus the data from the papers appropriately toward the development of teaching and learning materials, the themes are categorised according to the following headings: knowledge/awareness; skills; attitudes; behaviour; competence. It was notable that most of the literature focused on knowledge and awareness; limited attention was given to the skills and competencies nurses would require in order to become more sustainable and deliver care in a changing climate. The papers describe a variety of pedagogies and curriculum models which directly meet the aim of the search.

3.1. Theme 1: underpinning theoretical assumptions

Two distinct changes in curriculum reform in higher education over the past 10 years have enabled the interdisciplinarity (or collaborative learning) which is fundamental to sustainability education (Sterling et al., 2005; Fahey, 2012; Sterling, 2009; Bell, 2010). The move from didactic learning to more ‘progressive’ or ‘social constructivist’ approaches have supported students to think broadly about issues of

sustainability recognising the context in which people live their lives and how this affects their attitudes and values (UEA, 2010; QAA763, 2014). This shift in philosophy and its associated organisational transformation has laid the groundwork for sustainable literacy which underpins the theoretical assumptions of ESD (Sterling et al., 2005; SDU, 2009).

In pedagogical terms this flexibility is based in liberal humanist approaches (UEA, 2010). The learning environment is not necessarily classroom based; students are encouraged to leave the classroom and consider issues relating to a vulnerable environment in outside spaces (SDU, 2009). Key principles in ESD are considerations of how to make environments and people resilient and adaptable (Cotton and Winter 2010). Approaches such as systems thinking (Sterling et al., 2005) allow students to consider, for example, where materials are grown, how they are transported, where they are used and how they are discarded. Understanding the whole system (holistic thinking) develops awareness of where potential stress points might occur (Sterling et al., 2005). For example nurses taking an instrumentalist approach to developing the skills and competencies necessary to make changes in what they do in order to reduce the materials they use everyday (Bell et al., 2012).

ESD competencies can be embedded into all disciplines (Sterling, 2009; Sterling et al., 2005). They enhance learning by engendering a world view (Christie et al., 2013). Individual students can both use self-directed approaches which they then bring to the larger group to discuss issues such as the need for social change. Pedagogical approaches to discussion are based on the balance between positivist ideas of understanding facts over social constructivist ideas of getting those facts across to populations to enable behaviour change (Burandt and Barth, 2010; Christie et al., 2013).

3.2. Theme 2: educational approach

Once there is an understanding of the methodology needed to embed ESD there are multiple educational approaches, which can be considered. For the purposes of this literature review these have been divided into three distinct areas: a] Organisational b] Education, and c] Evaluation.

A] Organisational

Koehn and Uitto (2014) suggest a review of institutional capacity and capability to embed sustainability education is a first step in developing teaching and learning. This might take the form of the campus as a ‘living laboratory’ (QAA763, 2014) so that there is organisational commitment to both curriculum development and strategic awareness of the need for environmentally focussed estates (Sterling et al., 2005; SDU, 2009; Sterling, 2009). In this way it might be possible to future proof the university ensuring the buildings are managed sustainably and the students develop awareness of the need for social resilience to the effects of climate change (SDU, 2009). This organisational context promotes in students important attitudes with respect to climate change

Table 2
Papers included in the review and reason for inclusion.

Reference	Reasons for inclusion
Anaker, A., Elf, M. (2014) Sustainability in nursing: a concept analysis. <i>Scandinavian Journal of caring sciences. Scandinavian Journal of Caring Sciences</i> 28: 381–389.	A concept analysis of 14 articles that refer to sustainability in nursing develops a 'concept' sustainability within nursing and sets out recommendations for education.
Goodman B., East L. (2014) The 'Sustainability lens': A framework for nurse education that is 'fit for the future'. <i>Nurse Education Today</i> 34(1):100–103.	A paper that sets out how a sustainability nursing framework for education should look, provides an indication of topics for inclusion in curricula
López-Fernández MT, Pastor-Torres E, Sánchez-Sauco MF, Ferris y Tortajada J, Ortega-García JA. <i>Enfermería en salud medioambiental. (2009) Experiencia en una unidad de salud medioambiental pediátrica. [Nursing in Environmental Health. Experience in a paediatric environmental health unit]. Enfermería Clínica</i> 19(1):43–47.	Nurses have a near position to children and family, so they are able to identify environmental health risks and prevent them. To develop this function, paediatric environmental units are created. This paper proposes the incorporation of contents of environmental paediatric health in the formative programs of nursing. Nursing as a key in decreasing environmental threats.
Galiana ME., Gascón E. (2004) La ecología como centro de interés. La enfermera comunitaria en salud ambiental. [Ecology as a centre of interest. Community nurse in environmental health]. <i>Revista ROL de Enfermería</i> 27(1): 21–28.	Importance of the role of community nursing in environmental health. The role of community nursing in environmental health is analysed through a literature review.
Adlong W, Dietsch E (2015) Nursing and climate change: An emerging connection. <i>Collegian</i> 22(1):19–24.	Paper aims to assist nurses to recognise the consequences of climate change, disseminate knowledge about these consequences and to be active in mitigation strategies.
Goodman B. (2011) The need for a 'sustainability curriculum' in nurse education. <i>Nurse Education Today</i> 31(8): 733–737.	Suggest changing the form of education in order to integrate sustainability in the nursing curriculum.
Bell E. (2010) Climate change: what competencies and which medical education and training approaches? <i>BMC Medical Education</i> 10:311–318.	Describes competencies for climate change that might be included in medical education.
Bell E., Horton G., Blashki G., Seidel B. (2012) Climate change: could it help develop 'adaptive expertise'? <i>Advances in Health Science Education</i> . 17:211–224.	Discussion of key competencies needed in medical education. Proposals for curricula content for healthcare professionals to develop adaptive expertise for climate change.
Sayre L., Rhazi N., Carpenter H., Hughes N.L. (2010) Climate change and human health: the role of nurses in confronting the issue. <i>Nursing administration quarterly</i> 34(4): 334–342.	Building 'adaptive expertise' in medical education. Focus on how nurses can help to prepare healthcare facilities for impacts of climate change.
Polivka BJ, Chaudry RV., Mac Crawford J. (2012) Public Health Nurses' Knowledge and Attitudes Regarding Climate Change. <i>Environmental Health perspectives</i> 120(3): 321–325.	Focus on the role of public health nursing and climate change.
Richardson J., Grose J., Gill JL., Hertel J., Jackson B., Sadeghian H., Kelsey J. (2014a) Effect of climate change and resource scarcity on health care. <i>Nursing Standard</i> 28: 44–49.	Focus on the need to nurses to understand the potential for resource scarcity and sustainability. Provides an example of an educational approach.
Richardson J., Grose J., Doman M., Kelsey J. (2014b) The use of evidence- informed sustainability scenarios in the nursing curriculum: development and evaluation of teaching methods. <i>Nurse Education Today</i> 34:490–493	Describes the use of sustainability scenarios in nursing education.
Haarhuis JM. (2006) <i>Duurzaam ontwikkelen. Onderwijs en gezondheidszorg</i> 30:13–14.	Describes a short interview with Monica Bronsgeest, who at that time was involved in a Dutch initiative for a more sustainable MBO vocational education, leading the sub-group on healthcare and wellbeing.
Cotton D, Winter J. (2010) It's not just bits of paper and light bulbs: a review of sustainability pedagogies and their potential for use in higher education. In: <i>Sustainability Education Perspectives and Practice Across Higher Education</i> , P Jones, D Selby S Sterling (Eds.) Earthscan. London.	Pedagogies used in education for sustainable development (ESD).
QAA763 (2014) <i>Education for Sustainable Development: Guidance for UK higher education providers. The Quality Assurance Agency for Higher Education. London. UK.</i>	National guidance on curriculum design.
SDU Sustainable Development Unit (2009) <i>Fit for the future: Scenarios for low-carbon healthcare 2030. Cambridge. UK.</i>	Scenarios used in healthcare education.
Sterling S. (2009) <i>The Future Fit Framework: An introductory Guide to teaching and learning for sustainability in HE. The Higher Education Academy. York. UK.</i>	Pedagogies used in education for sustainable development (ESD).
Sterling S, Maiteny P, Irving D, Salter J. (2005) <i>Linking thinking: New perspectives on thinking and learning for sustainability. World Wildlife Fund (WWF) Scotland. UK.</i>	Pedagogies used in education for sustainable development (ESD).
UEA Future Skills Initiative Handbook (Nursing). (2010) <i>Template Integrating 'Sustainability' within Degree Programmes. University of East Anglia.</i>	Educational approaches.
Fahey (2012) <i>Curriculum change and climate change: inside outside pressures in higher education. Journal of Curriculum Studies</i> 44(5):703–722.	Theoretical curriculum models used in changing a cross university programme: objectives-based and action research.
Burandt S, Barth M. (2010) <i>Learning sessions to face climate change. Journal of Cleaner Production</i> 18:659–665.	Descriptions of adapted sustainability science approaches: the syndrome approach and scenario analysis.
Christie B, Miller K, Cooke R, White J. (2013) <i>Environmental sustainability in higher education: How do academics teach? Environmental Education Research</i> 19(3):385–414.	Concerns about whether existing teaching methods facilitate ESD.
de Haan G. (2010) <i>The development of ESD-related competencies in supportive institutional frameworks. International Review of Education</i> 56:315–328.	Offers a Model of Competence for ESD in the formal education sector.
Koehn P, Uitto J. (2014) <i>Evaluating Sustainability education: Lessons from International development experience. Higher Education</i> 67: 261-235.	Offers a range of evaluative questions and methods useful as a conceptually grounded framework for adaptation and application in academic sustainability assessments.
George, M., Bruzzese, J., Matura, L.A. (2017) "Climate Change Effects on Respiratory Health: Implications for Nursing". <i>Journal of Nursing Scholarship</i> 49(6): 644–652.	Stated that nurses can play an important role in reducing the respiratory deleterious effects of climate change.
Grose, J., Richardson, J. (2016) "Can a sustainability and health scenario provide a realistic challenge to student nurses and provoke changes in practice? An evaluation of a training intervention". <i>Nursing & Health Sciences</i> 18(2): 256–261.	Skill sessions with sustainability and health scenarios were used.
Kurth, A.E. (2017) "Planetary Health and the Role of Nursing: A Call to Action". <i>Journal of Nursing Scholarship</i> 49(6): 598–605.	Stated that it is critical that nurses and other health professionals consider the multiple effects of ecosystem strain on human health, and anticipate population health and health system planning and response.

(continued on next page)

Table 2 (continued)

Reference	Reasons for inclusion
Nicholas, P.K. and Breakey, S. (2017) "Climate Change, Climate Justice, and Environmental Health: Implications for the Nursing Profession". <i>Journal of Nursing Scholarship</i> 49(6): 606–616.	Noted that it is essential that nurses embrace concepts related to social justice and engage in the policy debate regarding the deleterious effects on human health related to global warming and climate change.
Richardson, J., Grose, J., Bradbury, M., Kelsey, J. (2017) Developing awareness of sustainability in nursing and midwifery using a scenario-based approach: Evidence from a pre and post educational intervention study. <i>Nurse education today</i> 54: 51–55.	Scenario-based learning approach with nursing students to promote the change attitudes and knowledge towards sustainability and climate change.
Richardson, J., Grose, J., Nelmes, P., Parra, G., Linares, M. (2016) Tweet if you want to be sustainable: a thematic analysis of a Twitter chat to discuss sustainability in nurse education. <i>Journal of advanced nursing</i> 72(5): 1086–1096.	Social media was an effective way of discussion on environmental and health issues in nursing.
Richardson, J., Grose, J., O'Connor, A., Bradbury, M., Kelsey, J., Doman, M. 2015, "Nursing students' attitudes towards sustainability and health care", <i>Nursing Standard</i> , vol. 29, no. 42, pp. 36–41.	Scenario-based learning improved nursing students' knowledge of the cost of clinical waste disposal.
Veenema, T.G., Lavin, R.P., Griffin, A., Gable, A.R., Couig, M.P., Dobalian, A. (2017) Call to Action: The Case for Advancing Disaster Nursing Education in the United States. <i>Journal of Nursing Scholarship</i> 49(6): 688–696.	A global nursing workforce is needed that possesses the knowledge, skills, and abilities to respond to any disaster or large-scale public health emergency.

such as responsibility, willingness to change, and confidence in the future (Anaker and Elf, 2014).

B] Education

Tutors need to feel able to deliver information in new ways and they may need upskilling (Cotton and Winter 2010; UEA, 2010; QAA763, 2014). These new methods will be enhanced by cross disciplinary working for example, encouraging students to take on small pieces of action research, and working together on specific problems (Sterling et al., 2005; Sterling, 2009; Cotton and Winter 2010; de Haan, 2010; Christie et al., 2013; QAA763, 2014). The literature suggests 'student centred learning' provides opportunities for students to take control and investigate how best to develop their own sustainability literacy skills (Sterling, 2009; UEA, 2010; Fahey, 2012). Multidisciplinary working is recommended working with a variety of disciplines will encourage discussion of the scientific, sociocultural and economic issues in relation to the effects of climate change and how higher education can respond (de Haan, 2010; Christie et al., 2013). Bell (2010) extends the concept of environmental literacy to include 'eco-medical literacy' which she describes as 'the ability to access, understand, integrate and use information about the health-related ecological effects of climate change to improve medical services'. She maintains that the context in which eco-medical literacy takes place has to consider the public health and legal and ethical issues which will affect how and where societal and health service changes in behaviour are possible.

C] Evaluation

Several of the authors described approaches to evaluation of sustainability programmes both of the curriculum (Bell et al., 2012) and of the students themselves (QAA763, 2014). Bell (2010) suggests an 'integrated assessment of global performance using criteria based assessment'. In order to achieve this there needs to be clear identification of intended outcomes from the outset of delivery. For students and for the programme as a whole Sterling (2009) suggests the 4Rs model (retain, revise, reject, renew). This approach provides a process evaluation which critically appraises the programme as it is delivered and assesses outcomes in order to feedback into the curriculum and improve it. Koehn and Uitto (2014) focus particularly on health programmes advocating the Health Impact Assessment model which enables a whole community assessment of what needs to be done to improve its resilience, assess progress towards identified goals and reviews outcomes.

3.3. Theme 3: type of activity

This theme focusses on the specific activities which can be used with students. The sub themes are: a] methods b] competencies development

and c] evaluation.

A] Methods

The majority of papers suggest the use of case studies or scenarios as being useful in working with multidisciplinary groups discussing issues of sustainability. This allows the groups to develop as individuals because they can offer insights from their own disciplines whilst at the same time learning from others (Sterling et al., 2005; Sterling, 2009; Bell, 2010; Cotton and Winter 2010; UEA, 2010; Bell et al., 2012; Christie et al., 2013; QAA763, 2014). The case studies can be used in a variety of ways either in focus groups (Koehn and Uitto, 2014); role plays or simulations (Sterling et al., 2005; Burandt and Barth, 2010; Cotton and Winter 2010; Christie et al., 2013), group discussion and debates (Sterling et al., 2005; Sterling, 2009; Cotton and Winter 2010; Sterling, 2009; Burandt and Barth, 2010; UEA, 2010; Christie et al., 2013) or skill sessions with sustainability and health scenarios (Grose and Richardson, 2016). Even social media was an effective way of engaging nurses and students in a discussion on environmental and health issues in nursing (Richardson et al., 2016). Some authors suggest more traditional methods of imparting information such as lectures and tutorials (Christie et al., 2013) whilst others recommend moving students outside the classroom and engage them in experiential learning using stimulus activities and fieldwork (Sterling et al., 2005; Cotton and Winter 2010; QAA763, 2014). Richardson et al. (2017) stated that scenario-based learning approach with nursing students could change attitudes and knowledge towards sustainability and climate change; this method improved also nursing students' knowledge of the cost of clinical waste disposal (Richardson et al., 2015). Whichever method of delivering the material is chosen the fundamental principles of mitigation and adaptation need to be developed allowing students to discuss firstly the most up-to-date information about climate change and then to develop ideas about how the social and economic impacts can be managed sustainably. Bell (2010) also discussed the need for students to consider the post disaster impact on mental health suggesting that mental health services need added training in grief counselling.

B] Competencies development

All authors discuss a range of competencies that will need to be developed to inform the public of the true implications of climate change in a form that is easily understood and readily updatable. Key to this process are communication, management and decision making skills (Bell, 2010; de Haan, 2010). The literature also focusses on individual development and the need to develop in all students, but specifically in health workers, critical reflection and innovative problem solving (Bell et al., 2012; Fahey, 2012). The authors point out that the details of how climate change may affect personal lives could have

negative consequences if students are not given opportunities to consider how to overcome personal challenges (Bell, 2010). Fundamental to skills development is allowing time in the curriculum for students to develop these skills and balance course work and work/life balance so they are fit to manage their own time and support others to develop adaptation and mitigation strategies (Sterling et al., 2005; Bell et al., 2012; Fahey, 2012; QAA763, 2014).

There was limited literature reporting the competencies required for nurses to be able to deal with climate change and sustainability. Generic competencies were suggested such as: flexible thinking and critical reasoning (Bell et al., 2012); showing ownership, responsibility and ability to justify professional decisions (Richardson et al., 2014a, 2014b); utilising problem solving strategies to explore processes in need of development in order to contribute to increased sustainability (Richardson et al., 2014a, 2014b). Specific adaptation competencies were suggested: emergency care adaptation including climate change issues and dealing with emerging outbreaks (Bell, 2010), and being able to treat climate related illnesses (Sayre et al., 2010). Competencies related to food were: to promote food security and protection of breastfeeding; identify risk or ineffective breastfeeding; encourage intake of organic produce (López-Fernández et al., 2009). A range of competencies specific to community, environmental and child health were proposed (López-Fernández et al., 2009; Galiana and Gascón, 2004).

3.3.1. Knowledge and awareness

Papers focused on the need for nurses to have knowledge and awareness about waste management and sustainable procurement and use interdisciplinary approaches to explore the issues (Goodman and East, 2014; Sayre et al., 2010; Richardson et al. 2014a, 2014b; Haarhuis, 2006). Specific topics included aspects of energy use and the development of renewables to support green hospitals (Goodman and East, 2014; Sayre et al., 2010; Haarhuis, 2006; Adlong and Dietsch, 2015). Consideration was given to available resources, including financial, and how to best utilise these to deliver sustainable nursing care, thus promoting parity for all service users (Polivka et al., 2012). Examples such as materials, technology and environmentally safe products (López-Fernández et al., 2009), transport and water conservation project (such as tree planting) were given (Sayre et al., 2010). Issues regarding lead pollution and poisoning were identified as a concern in community and environmental health, particularly when nursing children (Galiana and Gascón, 2004).

A number of papers highlighted food as an important topic (Goodman and East, 2014), including the need to reduce meat consumption, promote food security and highlight breastfeeding as a natural food (Sayre et al., 2010; López-Fernández et al., 2009).

Health promotion was seen as an important link with climate change and sustainability (Adlong and Dietsch, 2015; Goodman and East, 2014; Haarhuis, 2006). Exploring nurses' own understanding and philosophy of environmental sustainability and its application to healthcare delivery and health promotion, and eco-medical literacy was seen as instrumental in promoting health and wellbeing (Adlong and Dietsch, 2015; Goodman, 2011; Kurth, 2017). Galiana and Gascón (2004) emphasise the role of the community nurse in environmental health and making links between environmental health and community nursing.

Awareness of nursing in the context of a global environment was proposed as an important and relevant aspect of linking nursing to climate change and sustainability (Anaker and Elf, 2014). For example health in a globalised world, population health, health inequalities, healthy communities (Goodman and East, 2014; Goodman, 2011), rural and remote medicine, and understanding the disease profile of indigenous people (Bell, 2010; Bell et al., 2012). Globalism was also seen as a way of exploring the interdependence of people and environment, including citizenship, diversity, equity and justice (Goodman, 2011; Nicholas and Breakey, 2017). There are clear links between the

vulnerability of certain groups and health inequalities, and the potential impacts of climate-related issues on mental health for which nurses need to be aware (Bell, 2010). This vulnerability extends to children, and nurses need to understand the environmental effects in childhood, for example why children are more vulnerable to harmful environmental effects (López-Fernández et al., 2009).

An awareness of the environmental impact of delivering healthcare and the need to support a healthy environment was deemed necessary (Anaker and Elf, 2014). Topics such as ecology, environmental management, how nursing activities effect the environment, and an understanding of Government policies and standards/targets, together with adaption to climate change requires broad curricula content (Anaker and Elf, 2014; Bell et al., 2012; Polivka et al., 2012; Richardson et al., 2014a, 2014b; Haarhuis, 2006). An awareness of and ability to deal with uncertainty and precaution, environmental (eco) literacy and understanding the relationship between humans and environment were proposed (Bell, 2010; Polivka et al., 2012; Richardson et al., 2014a).

The potential health impacts of heatwaves, flooding, drought and water scarcity, effects of sea level rise salinity and impacts on agriculture, ozone and air quality, infectious diseases are significant; nurses can educate people to avoid impacts through linking impacts to disease management (Polivka et al., 2012). Interestingly, Polivka et al. (2012) found that younger respondents were more likely to agree that nursing professional actions could decrease health-related impacts of climate change.

3.3.2. Skills

Nursing skills for climate change were considered in the role of community nurses in environmental health. For example the development and evaluation of specific community interventions, detection of educational necessities and elaboration of educative programs in environmental health, and identifying children at risk (Galiana and Gascón, 2004). Bell et al. (2012) considered the need for high order problem solving skills for adaptation to climate change, short-term and long-term adaptation strategies, with the potential to engage with complexity and uncertainty. Skills for the management of different disease patterns and emergency care and disaster management were thought essential (Adlong and Dietsch, 2015; Bell, 2010; George et al., 2017; Leffers et al., 2017; Veenema et al., 2017).

3.3.3. Behaviour

Limited attention was given to behaviour, and this mainly focused on the sustainability of the nursing profession, low carbon lifestyles, reducing meat consumption and own environmental impacts (Anaker and Elf, 2014; Goodman, 2011). Behaviour change in a work context for nurses might include the involvement of green teams and environmental task forces, more efficient energy use and waste management, and contribution to emergency planning (Anaker and Elf, 2014; Sayre et al., 2010; Richardson et al., 2014a, 2014b; Haarhuis, 2006). Haarhuis (2006) also emphasises the need for sustainability behaviour when not at work.

C] Evaluation

Activity development will need to be evaluated (Bell, 2010) and course leaders will need to decide what works best for their students' capabilities and the time available for activities within and outside the classroom. Koehn and Uitto (2014) suggest both quantitative and qualitative evaluation methods used before, during and after interventions in order to improve delivery and reflect on what works best. This enables reflection to become embedded into programme delivery as well as amongst individual students.

4. Discussion

It is clear from the review that most of the relevant literature was

published in the English language. The issue of sustainability in nursing has, to date, been rarely documented in the German, Dutch and Spanish scientific literature. However the German literature shows that essentially under the topic of "sustainability" the issues of environmental protection and environmental awareness are subsumed; in this case, no specific occupational group requirements or approaches are described in the literature.

There is coherence and face validity in the sustainability topics suggested as relevant for nursing in the literature reviewed here. Furthermore, some of these topics fall within subjects that will already be evident (to a greater or lesser degree) in nursing curricula: resources, food, health promotion, and disease management. Topics such as globalism and environmental impact (of own actions or delivery of healthcare) could be viewed as specialist or additional curricula content. However, as we need to respond to a potentially rapidly changing environment where resources are finite, nurses will need to have the knowledge, skills and competencies to respond quickly.

The review highlighted a range of educational approaches necessary to provide a broad based curriculum and a cross-disciplinary approach for embedding sustainability in higher education. These methods are essential in nursing and healthcare if we are to engage students in the principles of sustainability and make this topic relevant to their clinical skills development. Without this relevance nurses are unlikely to understand how best to change practice and move towards sustainable healthcare practices that reduce the impact of healthcare on climate change.

A key finding of the review was the need to consider the underpinning theoretical assumptions in higher education, developing interdisciplinarity and flexibility in educational methods, diversifying the spaces in which students are taught can enhance sustainability literacy (Sterling et al., 2005). Student centred learning and multidisciplinary approaches can provide context for public health and ethical issues affected by climate change (Bell, 2010).

Sustainability educational activities need to be diverse, combining traditional methods of lectures with others, for example simulations. Sessions that involve discussions facilitate reflection, to allowing time for students to discuss existing behaviours and design their own approaches to behave more sustainably. Without this reflection there is unlikely to be the ownership which we will maintain behaviour change and increase the likelihood of health services fit for the future. Although some generic competencies were suggested, there was limited literature related to the specific competencies nurses would need to respond to climate change and deliver healthcare more sustainably.

Goodman and East (2014) provide a 'sustainability lens' approach through which they emphasise how nurses construct social worlds and create realities. They argue that nurse educators could develop their own 'sustainability lens' and apply this to the interpretation of professional standards in a new way. In contrast, Leffers et al. (2017) provide an ecological framework within which they suggest that nurse education 'can offer a leadership role to address the mitigation, adaptation, and resilience strategies for climate change'. Recommendations for nursing education include, for example, the consideration of social factors in assessing vulnerability to health impacts of climate change (Leffers et al., 2017). This has important implications for nurse educators who will themselves need to be equipped with the knowledge, skills and diverse teaching methods required to facilitate the learning space for these important and pressing topics. Schwerdtle et al. (2019) provide useful tips for teaching sustainability to healthcare professionals that focus on 'why, what, how', this provides a useful framework for focussing the topic on the relevance to nursing practice. Richardson et al. (2017) provide a practical example of how this 'why, what, how' approach can be applied to teaching sustainability in the context of clinical skills and resource use. Whatever approach is taken with respect to integrating climate change and sustainability into nurse education, it is clear that this will need to be underpinned by relevant knowledge and competencies (Leffers et al., 2017). This requires the

development of evidence-based sustainability competencies for nurses and research to investigate how such competencies are translated from education into clinical practice. .

We are aware that since this review was carried out further relevant papers may have been published that consider climate change and sustainability in nursing. This topic is likely to gather momentum as the impacts of climate change on health, and the impact of healthcare on the environment becomes more evident. The results of this literature review have informed the European funded NurSusTOOLKIT Project that aims to build an evidence-based resource to support sustainability literacy and competency in nursing. Teaching materials can be found via the website www.nurses.eu

5. Conclusion

Nursing professionals need to have knowledge, skills and competencies related to climate change and sustainability because the people they care for, especially children and the elderly are particularly vulnerable to environmental changes. The findings of this review suggest that topics such as the use of resources, food, health promotion, globalism, disease management, and the environmental impact of delivering healthcare, if embedded in nursing education could support the nursing profession's response for this new and important aspect of healthcare.

Author Contributions

- 1) Conception, design, acquisition of data, analysis and interpretation JG, JR, MH, CAN, IMLM.
- 2) Drafting Revising JG, JR, AE, IMLM, CAN, MH.
- 3) Final approval JG, JR, MH, IMLM, AE, CAN.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical approval details

Not applicable.

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