Embedding Sustainability in the Nursing Curriculum

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11.1 Sustainability, Climate Change and Health Care

The health care sector is an important contributor to the global environmental changes [1, 2] that are affecting the earth's essential support systems and, consequently, human health [3]. Due to its large carbon dioxide (CO_2) emissions, immense water and food consumption, the use of toxic materials and the production of vast amounts of waste, healthcare is ultimately compromising public health and damaging the ability of future generations to meet their own (health) needs [2, 4]. Evidently, the paradox of providing health care whilst simultaneously harming health must be confronted and eliminated [4].

Influential academic reports [3, 5] highlighted climate change as one of the major health threats of the twenty-first century. The World Health Organization (WHO) reaffirmed this concern in a report launched at the United Nations Climate Change Conference in Poland [6] and stated that 'the continuing delay in addressing the scale of the challenge increases the risks to human lives and health'.

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Human health will be affected by direct impacts such as heat stress and flooding, indirect impacts mediated through natural systems such as infectious diseases and air quality (including aeroallergens such as pollen) and impacts heavily mediated by human systems such as food security [7]. At the same time, however, the provision of health care uses vast amounts of energy in the form of heating, electricity and energy-intensive goods and services [8, 9]. In Germany, for example, about 6000 kWh of electricity and 29,000 kWh of heat are consumed per bed per year, more than the consumption of a single-family house [10]. The health care sector accounts for at least 5% of the CO_2 emissions in the EU, and nearly 10% of CO_2 emissions in the USA [8, 11, 12], with an overall 4.4% of global greenhouse gas emissions (GHGs) being attributable to healthcare provision [9]. Hence, the future prospect of climate change demands a significant reduction in our health systems' carbon footprint as well as sound preparation for its potential health impacts [13, 14].

Additionally, due to hygiene regulations and financial savings, large quantities of single use only materials are used in health care provision, producing vast amounts of waste, and are an increasing concern in relation to adverse environmental impacts and environmental health risks [15–18]. For example, up to 36% of the waste generated during an operation is plastic [19] and the WHO estimates that metropolitan general hospitals in the USA generate as much as 10.7 kg/occupied bed/day [15]. Additional emissions are produced during the production and transport of disposable products [9]. Therefore, a more sustainable health care system needs to tackle this mounting problem via proper waste management as well as source-reduction strategies [15, 18].

Due to the health systems' growing environmental impact and the evident environment-health linkages, there has been an emerging interest in improving sustainability. For example, the Ostrava Declaration [20] resulting from the Sixth Ministerial Conference on Environment and Health (representing the ministers and representatives of Member States in the European Region of the World Health Organization responsible for health and the environment) explicitly calls for building the environmental sustainability of health systems and reducing their environmental impacts. The 'WHO Global strategy on health, environment and climate change 2019–2023' also acknowledges the obligations of the health sector in shaping a healthy and sustainable future and calls for the health sector to lead by example in demonstrating good practice in sustainability (by reducing the environmental impact of health care practice) and to act as leaders and advocates for health and sustainable development [21].

Hence, the health care sector urgently needs to become more environmentally responsible and sustainable. Building on the Brundtland report (World Commission on Environment and Development 1987) [22], sustainable health care can be defined as 'designing and delivering health care that meets today's health and health care needs of individuals and populations without compromising the ability of future generations to meet their own health and health care needs; this requires the provision of health care that recognises and respects the dependence of our health on the earth's ecosystems, without resulting in unfair or disproportional impacts within

society' [23, 24]. The involvement of well-informed nurses is crucial in facilitating the transition towards a more sustainable health care provision [25].

11.1.1 Sustainability, Climate Change and Nursing

As explained by Huffling and Schenk [4]: 'health care and nursing practice, with resource- and energy-intensive processes, contribute to environmental harm through pollution and resources depletion. These negative impacts contribute to illness and poor health: when ill, people seek health care for treatment, which then further contributes to environmental harm, and so on'. So whilst nursing focuses on health and healing, nurses are inadvertently causing harm. As we have an obligation not to harm or increase the risk of harm to others, this raises the question whether climate mitigation is our moral obligation based on the first-do-no-harm principle. The nursing profession is underpinned by maintaining health and has currency promoting the health of individuals and wider society [26]. Viewed in the context of climate change, this is particularly relevant as we increasingly witness the limits of the Earth's resources and the significant adverse impacts the delivery of healthcare has on the environment [9, 27]. Arguably, therefore, the nursing profession has a duty to contribute to climate change adaptation (reducing vulnerability to the harmful effects) and mitigation (reducing or preventing greenhouse gas (GHG) emissions). In this context it is well-placed to take a leadership role in addressing climate change [28]. The International Council of Nursing (ICN) position statement on 'Nurses, climate change and health' calls for 'nurses to take immediate action to build climate resilient health systems' [29].

Nurses have a diversity of roles in the promotion of sustainability and addressing climate change. Nurses have, for example, control over the use, re-use and potential recycling of items used in the delivery of healthcare, particularly in the context of scarce natural resources. Research has indicated gaps in nursing knowledge regarding some of the raw materials that make up many of the items used in everyday healthcare [30]. The potential to reduce, reuse and recycle clinical items may seem to conflict with infection prevention procedures, indicating a requirement for knowledge of these issues in order for nurses to make sensible and safe decisions and support the sustainability agenda [31]. The clinical and general public response to COVID-19 has led to a number of significant resource challenges. For example in the UK it has been difficult to access personal protective equipment (PPE) for clinical staff due to supply issues. Additionally, the disposal of PPE will negatively impact the environment [32, 33]. Furthermore, there are ethical issues regarding the manufacturing of masks in conditions that are harmful to workers. Being environmentally responsible can improve the health of those far removed from our immediate environment [34]. Conversely, the potential to reuse vast amounts of equipment due to infection prevention procedures at this time seriously impacts on the sustainability agenda within healthcare facilities.

Nurses are frontline professionals and are in a key position to respond quickly to constantly changing health and social care needs at a population level across a range

of settings. The changes in climate will lead to different patterns of disease that will require clinical interventions as well as health promotion. For example, adverse weather conditions that lead to local flooding may require emergency interventions to cope with initial injury; long-term care may be needed for vulnerable patients living in damp conditions, or who have mental health issues as a consequence of the flooding event or loss of income. Added to this, emerging infectious diseases and an increased risk of non-communicable diseases will affect the health of all age groups, posing major challenges to healthcare systems [35, 36].

Additionally, the WHO [21] states that health professionals need to promote behavioural change towards more sustainable and healthier ways of living. Nurses can play a key role in health promotion by emphasising the co-benefits of living in a way that reduces human impact on the climate. Significantly, changes in diet and moving to more plant-based consumption will impact on the incidence of heart and respiratory diseases and spending more time outdoors in nature will foster an appreciation for the natural world whilst promoting physical and mental well-being [37].

Hence, with proper sustainability-related education and training, nurses can be encouraged to practise to the full extent of their skills, to expand their health promotion role to address current and emerging ecological public health threats and to take significant leadership roles in sustainable health policy, planning and provision.

11.2 Importance of Integrating Sustainability into the Nursing Curriculum

In view of increasing calls for more sustainable health systems, nurses need to be supported to acquire and develop the key sustainability-related competencies needed for the transition toward more sustainable health systems. Nurse experts in this field increasingly stress the importance of integrating sustainability into nurse education [14, 17, 28, 38–40]. In order to be responsive as nurse leaders, the ICN recognises the importance of embedding 'the concept of sustainability in nursing practice as well as climate change-related knowledge into nursing curricula and in post-registration continuing education' [29].

Nurses will require the knowledge, skills, competencies and confidence if they are to be proactive and meet this challenge. Barriers include a reactive working culture, where the focus is to manage disease rather than prevent illness and promote health [25]. These will need to be overcome so that nurses have the confidence to challenge unsustainable practice. Interestingly, Power [41] suggests that whilst already qualified nurses may be absorbed within existing working cultures, it is the student nurses who might be better placed to act as change agents and challenge existing practice to bring about improvements. Aronsson et al. [42] demonstrate how nurses who have been exposed to sustainability education can take positive actions on sustainability when they are in practice. Therefore, integrating sustainability into nursing curricula is a key action necessary to raise awareness.

Evidence exists of the importance of embedding sustainability, climate change and health into curricula, with emphasis on the how and where, and which topics should be included [17, 40, 43–46]. However, integration and its success often rely

solely on the educator. The reasons for this are manifold: educators are poorly equipped and lack the necessary knowledge [40, 45]; teaching climate change and resource scarcity may appear to have little or no relevance to healthcare [17, 40]; difficulties finding space to integrate topics into already crowded curricula, and the lack of existing assessment approaches [45].

Previous studies [47] assessed attitudes before and after the delivery of one specific sustainability scenario-based learning session when delivered to second year nursing and midwifery students. This study found that attitudes and knowledge improved immediately following participation in the session, demonstrating immediate learning. What is important about this research was the way in which educational intervention was integral to a clinical skills session [17, 48]. Rather than seeing climate change and sustainability as something separate from nursing, topics were fully integrated into subjects such as leadership, public health and clinical care pathways. Finding out what students need to know will help identify trends and themes within the curriculum [45, 49, 50]. These themes can be divided into topics to be taught and mapped against professional body competencies and/or legal expectations and frameworks thus giving them professional relevance [51]. Early introduction and integration of these themes into the curriculum help emphasise the relevance and importance of the subjects and their relationship with professional identity [40, 44, 52]. By involving students, listening to their concerns, encouraging self-awareness and motivation, students can be encouraged to take ownership which can result in learner empowerment and learner-driven change.

11.3 Key Sustainability Competencies for Nurses: An Expert Assessment

The Erasmus-funded European NurSusTOOLKIT project was developed to provide free, online, evidence-based Sustainability Literacy and Competency (SLC) resources in nursing education. The purpose was to develop innovative teaching and learning approaches and materials based on sustainability values and concepts, evidence, expertise and professional relevance.

As part of the NurSus-project, the perspectives on integrating sustainability-related education into nursing curricula among 52 European nurse educators and senior professionals, using a two-rounds online Delphi-survey, were explored [51]. The Delphi approach is a method for soliciting expert opinion, based on an iterative process of survey, feedback, and re-survey (i.e. the second survey round is based on the results of the previous one) [53–58]. The participants represented a diverse group of nurse educators and senior nursing experts, with their selection based on appropriate professional networks (e.g. European Federation of Nurse Associations EFN, European Network of Nursing in Higher Education ENNE), the researchers' networks and relevant academic publications. The participants included, among others, six presidents of National Nurse Associations and six other national representatives in the European Federation of Nurse Associations (e.g. deputy delegates). The panel consisted of experts from Northern, Southern, Western and Eastern European countries.

The Delphi-survey results clearly illustrated that the participating experts think that it is important to integrate sustainability-related knowledge and skills into nursing curricula; the majority of participating experts think that it is (very) important to integrate sustainability in nursing programmes (Fig. 11.1).

It is interesting to note that the perceived importance of integrating sustainability into nurse education was also confirmed in surveys among European student nurses [40, 48]. The participating experts considered it important to integrate sustainability in nurse education in order to educate future-fit nurses; to increase environmental awareness and decrease environmental impact; to promote healthy sustainable communities; to respond to Corporate Social Responsibility, professional and/or educational guidelines and to recognise our moral responsibility. Furthermore, most participants (88%) indicated that sustainability should be an integral part of relevant modules throughout the curriculum, with or without a brief introduction module. This means that sustainability-related education should be ideally integrated into existing parts of the nursing programme [59].

The Delphi-survey also included the experts' evaluation of the most important sustainability-related competencies for nurses. Regarding the cognitive and functional competencies, the survey outcomes illustrated that the ability to show ownership, responsibility and ability to justify professional decisions (in view of sustainability) was seen as very important. Other top scoring competencies related to the enhancement of sustainable health care (all levels) by applying sustainability knowledge and skills as well as by applying organisational awareness, problem solving strategies and management skills. Furthermore, participants indicated that nurses should be able to

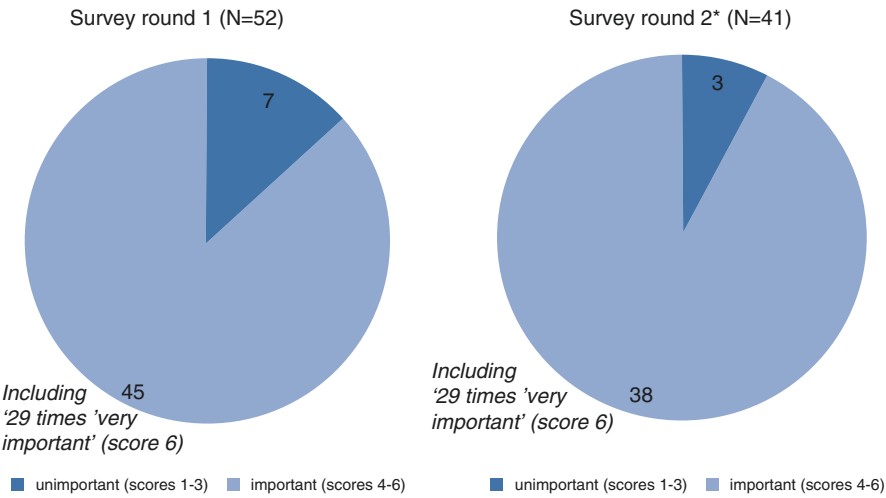

Fig. 11.1 Survey rounds 1 and 2. How important do you believe it is to integrate sustainability-related education into the nursing curriculum (on a scale from 1 to 6, where 1 means 'very unimportant' and 6 means 'very important')?

identify possible synergies between health promotion and environmental sustainability and to demonstrate resilience in their sustainability-related assessment and planning of care. With regard to important personal and ethical sustainability competencies, the survey participants indicated that nurses need to be able to show responsibility and willingness to change. Additionally, the experts felt that nurses need to be motivated to contribute to a sustainable nurse profession and to demonstrate self-sufficiency and resilience in their own professional development. Other personal competencies that were considered important included reducing your own environmental impact (in particular relating to waste segregation and energy use) and encouraging a positive attitude towards sustainable behaviour in others.

Building on the survey outcomes [51], Box 11.1 shows the key sustainability competencies for nurses. This overview shows that nurse students need to become motivated to contribute to sustainable nursing and to reduce environmental impact. They need to become capable of justifying sustainable decision-making and demonstrate the ability to use their knowledge, skills, organisation awareness, problem solving capacities and management skills to contribute to the sustainability changes needed. For this, they need to be equipped with key sustainability knowledge and skills. Nurses need to be trained to integrate sustainability into daily nursing practice, communicate about sustainability (and how it relates to health, health care, nursing and the health-promoting duties of health practitioners) and manage and organise sustainable practices. Furthermore, applied knowledge should be embedded in sound theoretical understanding of why certain sustainability-related practices are important to implement [51]. The NurSusTOOLKIT project, accordingly, developed education materials for integrating sustainability in nursing curricula.

Box 11.1 Key Sustainability Competencies for Nurses

Ability to show ownership, responsibility and ability to justify professional decisions (in view of sustainability)
Ability to use the knowledge and skills needed to contribute to improving the sustainability of health systems at different levels (e.g. individual practice, health service management, the design of care systems)
To encourage a positive attitude towards sustainable behaviour in others (e.g. sustainable transport, waste management, energy use, diet)
To show responsibility and willingness to change (in view of sustainability)
To be motivated to contribute to the sustainability of the nursing/midwifery profession
Ability to use the organisational awareness, problem solving strategies and management skills needed to contribute to improving the sustainability of health systems at different levels (e.g. individual practice, health service management, the design of care systems)
Ability to identify potential synergies between policies and practices that promote environmental sustainability and those that promote health
Ability to demonstrate resilience in assessing and planning the organisation of care (in view of sustainability)
To be motivated to adopt appropriate segregation of waste
To be self-sufficient and resilient in own professional development

11.4 Structure and Design of Digital Educational Materials

The NurSusTOOLKIT is a sustainability learning/teaching programme providing an evidence-based resource repository for nurse educators. It contains a variety of teaching and learning strategies, is adapted for context specific relevance and is linked to national nursing standards and competencies for several countries (UK, Germany, Netherlands and Spain).

11.4.1 The Sustainability Literacy and Competency (SLC)-Framework

The Sustainability Literacy and Competency (SLC)-Framework is based on Tempel and Ilmarinen [60] 'house of workability' model (Fig. 11.2). As such, the dimensions of the SLC-Framework are depicted in the form of a house with its surrounding environment.

The first floor comprises sustainability values and concepts, and an evidence base, providing the SLC-Framework with a strong foundation.

Various declarations on concepts and values in higher education and sustainable development underpin the SLC-Framework including The Lüneburg Declaration on Higher Education for Sustainable Development [61] and The Future Fit Framework published by the UK Higher Education Academy [62]. The evidence-base resulted from:

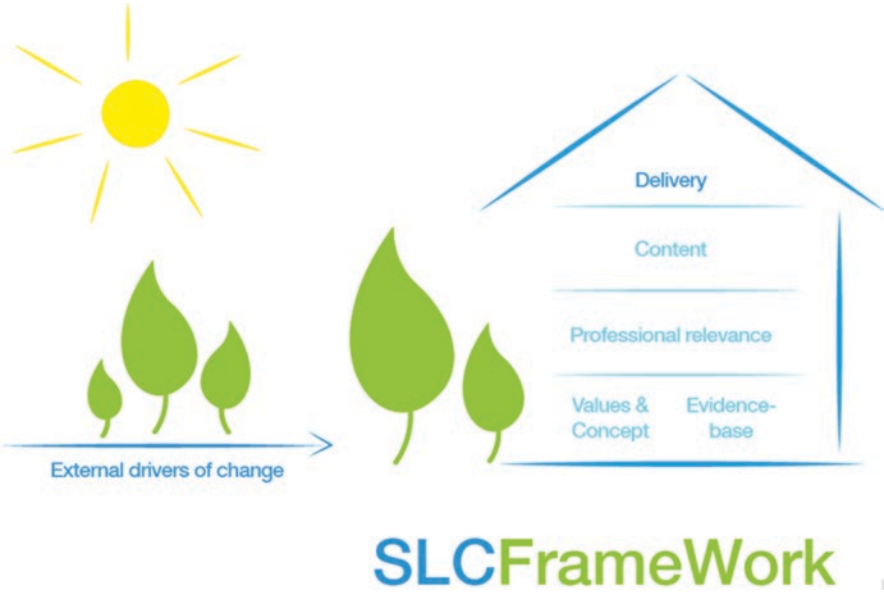

Fig. 11.2 SLC-framework. (Permission from the NurSus Team)

- literature reviews: (1) What nurses need to know about sustainability and (2) What pedagogic approaches are used to embed sustainability in curricula in nursing or higher education?
- curriculum scoping: to identify areas where sustainability is embedded and possibility of integrating sustainability topics
- the results of the Delphi study
- student engagement including the results of The Sustainability Attitudes in Nursing Survey (SANS_2) [48].

These activities resulted in a prioritised list of topics for sustainability and nursing.

The second floor comprises professional relevance for the four countries UK, Germany, Netherlands and Spain.

The third floor is strongly supported by the first and second floor. It contains the content, 60 topics in five themes (e-modules) which were developed and tested through pilot and prototype development [51]:

1. Underpinning concepts: Sustainability and health
2. Providing environmentally sustainable health care
3. Relationships between health and the environment
4. Healthy (sustainable) communities and
5. Social and policy context.

The fourth and top floor is the repository for the resources. Although the materials for each topic were developed by teams in different countries and were adapted to encompass the characteristics, context and more prevalent health problems of each country, they all have the same structure. For each topic, there is a Description of Materials, Teachers' Guide, Lecture Slides, Lecture Notes, Interactive Activities, and References and Resources. The 'description of materials' provides a clear indication of how the module can be integrated into the nursing curriculum. Pre-requisite knowledge is defined and there are links to national standards and competencies. The Interactive Activities range from quizzes to scenario-based sessions. These can be used as an introduction to a topic or as a form of summative and/or formative assessment. Priority settings used in the Delphi Study lead to the development of core (common) modules based on prior knowledge, skills and competencies.

The surrounding environment of the house represents the external drivers of change. These include professional and academic developments that support and influence the SLC-framework over time and risks or barriers to integrating and teaching SLC content in the nursing curriculum.

The main target groups for Sustainability Literacy and Competency (SLC) framework and the teaching materials supported by significant resources incorporated in the NurSusTOOLKIT are nurse teachers/educators in universities and schools of nursing. As the resources and materials have been sourced in Creative Commons, they are free and can be reused or individually adapted, shortened or supplemented as required.

The NurSusTOOLKIT provides vocationally relevant Sustainability Literacy and Competency resources and teaching materials to enable nurses to work in a labour market that needs to adjust to and prepare for a changing climate.

11.5 Quality Assessment of the NurSusTOOLKIT Educational Materials

Developing and testing the teaching and learning materials were carried out by education experts, technical experts in evaluating digital learning and teaching materials in higher education and practitioners and students in the UK, Spain and Germany, and were revised based on feedback.

A modified and authorised questionnaire from the Spanish Standard for the assessment of Digital Educational Material Quality (COdA) was used [63]. The COdA tool enables the evaluation of the quality of Digital Educational Material (DEM) at University level with three dimensions: Didactical, Technological and Accessibility. It is a validated tool to assess and guide the creation of educational and technologically effective digital teaching material; the COdA tool was evaluated for validity and reliability [64].

The original COdA questionnaire consists of 11 criteria: coherence/understandability, content quality, ability to generate learning, adaptability, interactivity, motivation, format and design, reusability, portability, interface accessibility and content accessibility. Each criterion is broken down into sub-criteria, which are scored from 0 (when the sub-criterion was not reached) to 10 (if it was fully reached). The ratio per criterion and the global ratio were calculated using the scores from the COdA questionnaire. Based on the global ratio, a quality categorisation of the materials is defined, including ratings of excellent (ratio ≥ 9), very good ($9 >$ ratio ≥ 8), good ($8 >$ ratio ≥ 6), not good enough ($6 >$ ratio ≥ 4) and poor ($4 >$ ratio ≥ 0). The minimum quality for a DEM is set to a value higher or equal to 6.

For a pre-use evaluation of the DEM, two modalities of the COdA tool for two user profiles were designed, targeting students and professionals (teachers, clinical professionals and expert advisors). Fifteen experts rated the content validity to assess the desired construct of the two modalities of the COdA tool. Using a questionnaire Likert scale (from 1 to 5) they assessed utility, clarity, completeness, precision and usability for each criterion. The technical experts in digital educational materials evaluated these using the complete original version of the COdA tool [23].

In addition to the COdA questionnaire, socio-demographic data were collected from the participants, and two open-ended questions were included inviting comments about the experience of using the materials and suggestions for improvement. A content analysis was conducted for this qualitative data.

Native speakers translated the questionnaires into English and German. These translations were translated back to Spanish by other native speakers and modifications were made where necessary.

According to independent experts (COdA authors), the final versions of COdA represented adequate translations of the Spanish original. Finally, to assess the content validity of the English and German versions, the same process described above for the Spanish versions was carried out.

The evaluation of the NurSusTOOLKIT educational materials provided valuable information on its relevance, usability and acceptability and resulted in the strategy for the development of new content. All content adopted a standard format based on this assessment.

The NurSusTOOLKIT educational materials were evaluated by 299 nursing students (161 students from Jaén University; 106 from Plymouth University and 32 from Esslingen University) and by 22 professional evaluators with different profiles: (teachers, clinical professionals and expert advisors). The students and professionals evaluated the materials as good or very good, scoring them with 7.98 ± 1.28 and 8.50 ± 1.17 points, respectively. The ability to generate learning was scored higher among students (mean difference between students and professionals: 0.84;0.22–1.47; $p = 0.008$). It is concluded that students, professionals and technical experts considered the materials to be of very good quality, especially with regard to the quality of content, format and design. For students, these materials can generate reflection and learning about environmental and health issues during nursing training [23].

11.6 Effectiveness of NurSusTOOLKIT Educational Materials

It was also important to determine the real effectiveness of the NurSusTOOLKIT educational materials to achieve the acquisition of health and environmental competences in students, beyond the quality perception.

In a quasi-experimental study, an evaluation of a pre-post educational intervention demonstrates the effectiveness of educational materials for training nursing students in environmental health competencies. The e-NurSus Children intervention was carried out by applying the children's environmental health content of the NurSusTOOLKIT to 267 nursing students in Spain and 157 students in the UK. The effectiveness of the educational intervention on the attitudes, knowledge and skills of the students was determined by measuring these competencies before and after the e-NurSus Children intervention. The attitudes, knowledge and skills of the nursing students improved after the e-NurSus Children intervention, with a greater increase in environmental health knowledge (39.02%), followed by skills (29.98%) and finally attitudes (15.81%). The e-NurSus Children intervention is useful for improving the attitudes, knowledge and skills of nursing students with respect to children's environmental health [65].

11.7 Examples of Topics and How They Are Integrated into the Nursing Curriculum in a Number of Educational Institutions

11.7.1 UK

Richardson et al. [17, 47, 48, 66] demonstrate how embedding sustainability and climate change in nursing curriculum can positively change nurses' attitudes and increase knowledge. The educational interventions they use are drawn from the NurSusTOOLKIT (nursus.eu) (see examples Box 11.2).

Box 11.2 Summary of NurSusTOOLKIT Educational Interventions Integrated into Undergraduate Nursing Curriculum in the UK

Educational intervention year 1	Educational intervention year 2	Educational intervention year 3
The session focuses on a case study scenario of a family when health and care is compromised due to climate change and compromised resource issues. Although fictitious, the case study is based on actual research on climate change and health; it includes real events that resulted in supply change challenges and the issuing of a medical device alert. The materials include a lecture with relevant short video clips, group activities, and additional references and resources (full details can be found at https://open.plymouth.ac.uk/login/index.php see Topic *P1_B1 Introduction: The relevance of sustainability and climate change to nursing and healthcare*)	In the session, students are challenged to make connections between items they use in clinical practice that are made from natural resources (such as oil and cotton), and potential challenges to clinical care if the natural resource was no longer available (see this short film by way of example http://youtu.be/zIFT2Dbg08o). Full details of how to run this session, together with associated research can be found at https://open.plymouth.ac.uk/login/index.php *P2_B1 Sustaining the global environment: strategies to minimise clinical waste in healthcare*, download the Health Environment and Resources Toolkit File	Students are presented with a clinical scenario of a patient manifesting symptoms that related to an outbreak of Escherichia coli (E.coli). A short lecture is followed by group discussion that links the potential for an increase in the spread of waterborne disease with climate change. Students are required to design a programme to manage the outbreak, including dealing with potential attention from the media. They are also invited to discuss how they could develop a wider public health awareness campaign. Following this they consider how climate change and damage to the environment (e.g. flooding, soil degradation) might impact on health (see https://open.plymouth.ac.uk/login/index.php *P3_B1 E-Coli outbreak and links to climate change*)

The core sustainability competencies developed by the NurSusTOOLKIT Project have been presented to the UK Nursing and Midwifery Council as possible basic standards for Registered Nurses as part of the consultation for new nursing standards. The NurSus team is working in collaboration with a new network in the UK (http://networks.sustainablehealthcare.org.uk/network/green-nurse-network) to promote sustainability in nursing. The NurSus team is also working with the Royal College of Nursing in the UK to develop NurSusTOOLKIT materials for the continuing professional development of qualified nurses.

11.7.2 Spain

Students participated in a taught session entitled e-NurSus Children with the purpose of improving their competencies on environmental risks and children's health issues. Students were introduced to a case study involving an asthmatic child. They

worked in groups of four to five people discussing issues arising from the assessment of the environmental risks to which the child was exposed in his home, school and environment. After analysing the case and interpreting the data provided, the students provided solutions and proposed nursing interventions to address the case raised. There were a maximum of 20 students in each session. The duration of each session was 90 min. All the materials used in the sessions are available in Spanish and English, in module *J3_A1 Children's health and the environment* on the NurSusTOOLKIT platform. The materials include the case study scenario and a game to encourage learning in a fun way (full details can be found at https://open.plymouth.ac.uk/login/index.php).

The materials have also been presented to secondary and baccalaureate students to raise awareness of the importance of the relationship between sustainability, climate change and health. This activity in which the students attend the University of Jaén is called Coffee with Science (https://www.ujaen.es/servicios/ucc/eventos/cafe-con-ciencia-2019). Students played in groups using the different resources from the NurSusTOOLKIT such as games from topics *J3_A1 Children's health and the environment* and *E3_B2 Our Climate our Health* (full details can be found at https://open.plymouth.ac.uk/login/index.php).

At the Catholic University of Murcia, materials from NurSusTOOLKIT are used in various sections of the curriculum of Community Nursing, year one. These materials have been integrated into Theme II: Environmental sustainability and Nursing, Topic 8: Ecology, sustainability and health (https://laurea.ucam.edu/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&idiomaPais=es.ES&_anoAcademico=2020&_codAsignatura=11353).

The tool COdA (Quality of Learning Objects) has been included in the Spanish standard UNE 71362: 2017 Quality of digital educational materials. The application profiles of this tool (students' profile, professionals' profile and technical profile), designed by NurSus team, have been included in the standard UNE 71362 as a mode of using this standard to evaluate digital educational materials, see: http://www.aenor.es/aenor/normas/normas/fichanorma.asp?tipo=N&codigo=N0058497&PDF=Si - .WWZUccabLwe.

11.7.3 Germany

Although the NurSusTOOLKIT was developed for integration in the nursing curriculum, it has been successfully used in other areas [67, 68]. At the University of Applied Sciences in Esslingen, nurse teacher students took part in a general studies course offered by the university. This course took place over 2 full days, 3 weeks apart. The activity from *P1_B1, The relevance of sustainability and climate change to nursing and healthcare* was used as an introduction to sustainability. The students evaluated this as being fun and very informative. A second session *E2_C1 The preservation of a stable ecological environment—waste reduction and disposal, resource ethics*, available in German and which covers hand hygiene, was completed by the students. As the majority of students work part time in clinical nursing practice they

were asked to observe their own and colleagues' behaviour between sessions. After being in the clinical area, the majority reported a greater awareness regarding the use of gloves by themselves and by their colleagues and a personal reduction in the use of gloves after the session.

Other projects, which have been completed within a curricular module 'Research and Development in Educational and Nursing Practice', include:

- planning an interactive information stand, based on the NurSusTOOLKIT modules *E2_C3 The importance of sustainable nutrition in healthcare provision* and *P2_B1 Sustaining the global environment: strategies to minimise clinical waste in healthcare* for an open day at a local hospital
- researching the history of consumables (plastic aprons, medicine cups and infusion bottles) and their supply chain in order to recommend alternatives based on *P2_A1 Sustaining the global environment—the limited global resources used in nursing care and where they come from*
- using scenario-based teaching [66] and *P1_B1 Introduction: The relevance of sustainability and climate change to nursing and healthcare*, *E3_B2 Climate change and health* and *P2_B1 Sustaining the global environment: strategies to minimise clinical waste in healthcare,* students demonstrated integration of sustainability, climate change and health during an introductory block of student nurse training. Full details can be found at https://open.plymouth.ac.uk/login/index.php

An increasing number of students are completing their bachelor and master dissertations with healthcare related sustainability as the focus.

These examples demonstrate that the NurSusTOOLKIT educational materials show great potential for training nursing students in universities and schools of nursing in health and environmental issues. In the coming years, integrating NurSusTOOLKIT materials in nursing curricula, at an international level, may provide more evidence of its effectiveness.

11.8 Summary

The free online access to the NurSusTOOLKIT provides an interesting tool for use in Higher Education and Lifelong Learning, increasing the employability of health professionals. Nursing teachers are incorporating the NurSusTOOLKIT modules into the nursing curriculum beyond the partner universities that are members of this research team. Based on a recent audit by the NurSus administrators (personal correspondence), the NurSusTOOLKIT is currently being used by over 500 registered participants in 16 countries, including Australia, the USA and Canada. The contents of the NurSusTOOLKIT have generic healthcare applicability and can also be of relevance to educators of other healthcare and non-healthcare providers [67, 68].

Healthcare educators, practitioners and managers will be able to use the NurSusTOOLKIT as a resource, as it provides evidence-based information to

support practice, and promote in-house training in health and sustainability. It is hoped that policy-makers will use the evidence-based content to develop health and sustainability mitigation strategies and for nursing and healthcare professional bodies to adopt these strategies.

The NurSusTOOLKIT is available in a range of languages: English, Dutch, German, Spanish, French, with some limited availability also in Polish, thus broadening its accessibility across Europe. Materials can be freely accessed on the NurSusTOOLKIT online platform (http://nursus.eu/).

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