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Research article

# Nursing students' attitudes towards climate change and sustainability: A cross-sectional multisite study

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ABSTRACT

*Background:* Education is a social tipping intervention necessary for stabilising the earth's climate by 2050. Integrating sustainable healthcare into healthcare professions curricula is a key action to raise awareness.
*Objectives:* This study aimed to: i) investigate nursing students' attitudes towards and awareness of climate change and sustainability issues and its inclusion in nurse education, ii) explore differences across a range of countries, and iii) compare attitudes in 2019 with those of a similar sample in 2014.
*Design:* A cross-sectional multicentre study. Data were collected through the Sustainability Attitudes in Nursing Survey (SANS_2) questionnaire.
*Settings:* Seven different universities and schools of nursing in five countries (UK, Spain, Germany, Sweden, and Australia).
*Participants:* A convenience sample of first-year undergraduate nursing students.
*Methods:* The SANS_2 questionnaire was self-administered by nursing students at the seven participating universities at the start of their undergraduate degree, between September 2019 and February 2020.
*Results:* Participants from all seven universities ($N = 846$) consistently showed awareness and held positive attitudes towards the inclusion of climate change and sustainability issues in the nursing curriculum (M = 5.472; SD: 1.05; min-max 1–6). The relevance of climate change and sustainability to nursing were the highest scored items. Esslingen-Tübingen students scored the highest in the 'inclusion of climate change and sustainability in the nursing curricula'. Students at all universities applied the principles of sustainability to a significant extent at home. Nursing students' attitudes towards climate change and sustainability showed significantly higher values in 2019 (Universities of Plymouth, Brighton, Esslingen-Tübingen, Jaen, Murcia, Dalarna, and Queensland) than in 2014 (universities of Plymouth, Jaen, Esslingen, and Switzerland).
*Conclusions:* Nursing students have increasingly positive attitudes towards the inclusion of sustainability and climate change in their nursing curriculum. They also recognise the importance of education regarding sustainability and the impact of climate change on health, supporting formal preparation for environmental literacy. It is time to act on this positive trend in nursing students' attitudes by integrating these competencies into nursing curricula.

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## 1. Background

The earth's climate system is changing due to natural temperature variability and global warming resulting directly from human activities (IPCC, 2021); the consequences of which demonstrate the intrinsic connections between planetary health and public health. For example, 2010–2019 was the warmest decade on record, resulting in a higher frequency and greater severity of wildfires, droughts, heatwaves, hurricanes, and floods, negatively impacting people's health (United Nations Statistics Division, 2020). Additionally, global warming is causing rising sea levels, increased infectious disease transmission, food and water shortages, mass migration, political conflict, and financial loss for individuals and governments; all of which harm people's health physically, mentally, and socially (Paavola, 2017; Smith et al., 2014; Watts et al., 2019).

The United Nations (2015) Sustainable Development Goals recognise the urgent need for worldwide action to mitigate climate change as an emergency health crisis. Current efforts to reduce anthropogenic global warming aim to diminish the greenhouse effect by addressing fossil fuel combustion, deforestation, and use of fluorinated gases (IPCC, 2018, 2021). However, healthcare produces a substantial amount of these human-induced greenhouse gas emissions, thereby causing further climate change (Lenzen et al., 2020). Internationally, healthcare makes up 4.4% of the world's total climate footprint, and if were a country, it would be the fifth-biggest emitter (Karliner et al., 2019). In contrast, 'green' initiatives that promote planetary health, such as environmentally sustainable transport and renewable energy use, bring associated public health co-benefits by reducing respiratory, cardiovascular, maternal, and mental health illnesses. This interconnectivity further strengthens the rationale that the relationship between climate change and health is a pertinent issue for all healthcare professionals (Sherman et al., 2020).

Progressive changes in northern hemisphere tertiary education (i.e., European Higher Education Area brand) requires environmental sustainability competencies to be included in education curricula across all educational levels (Orme and Dooris, 2010; Smith, 2010). Furthermore, Breunig et al. (2014) supported the proposition that education of the broader population on health and sustainable consumption must be integrated into basic learning at all ages, asserting that the teacher is the key to delivering quality education on sustainable practices.

Nursing makes up a large proportion of the healthcare sector, presenting an opportunity to significantly decrease the environmental footprint of healthcare practice, including direct involvement in public health initiatives to reduce climate change (Cook et al., 2019). Integrating sustainable healthcare into healthcare professions curricula is a key action necessary to raise awareness. Education has been identified as one of the social tipping interventions necessary for stabilising the earth's climate by 2050 (Otto et al., 2020). Although Orme and Dooris (2010) documented higher education's 'enormous potential to impact positively on health and sustainability', the importance of teaching sustainability in healthcare education has been slow to be recognised and still relies on the educators to embed the competencies into their curricula. López-Medina et al. (2019), Richardson et al. (2016), Teherani et al. (2017), and Wellbery et al. (2018) recommended early integration of the subject into the curriculum as this emphasises its relationship with professional identity. Professional bodies such as the International Council of Nurses (ICN), the World Medical Association (WMA), the World Organization of Family Doctors (WONCA), and the Environmental Physiotherapy Association have endorsed integrating health and sustainability competencies into the curriculum and training (Shaw et al., 2021).

Many healthcare students will be aware of environmental issues taught at school and the *Fridays for Future* movement (Wallis and Loy, 2021). Furthermore, in a previous study, respondents (Teherani et al., 2017) indicated that the definition of environmental sustainability should be learned before higher education. This awareness can be used as a starting point to demonstrate the links between environmental sustainability, climate change, and healthcare provision, and can encourage further reflection and stewardship (Huss et al., 2020). Therefore, adopting a student-centred approach, which highlights the development of self-awareness and environmental stewardship, is desirable. The educator's role is that of a facilitator, supporting learners to reflect on and understand their activities as they relate to sustainability so that they can contribute to mitigating the problems arising from unsustainable human activities and become agents of change (Colonna, 2020).

Given the different national approaches to mitigation of environmental effects in relation to health, the education of health professionals varies from country to country. The goal, however, needs to be the same; that is, raising awareness of the health consequences of climate change and the relevance to healthcare practice.

Addressing climate change and sustainability will be a major part of the future nursing workforce, and therefore the education system must include this in nursing programs. Richardson et al. (2016, 2017) showed that nursing students in the UK had limited awareness of the relevance of sustainability to healthcare and did not see the importance of this topic for their education before any curriculum input (Richardson et al., 2016; Richardson et al., 2017). However, subsequent UK data suggests that nursing students starting their studies in 2019 were more likely to agree that climate change and sustainability were important topics in nursing than those starting in 2014 (Richardson et al., 2016; Richardson et al., 2019); suggesting a cultural shift within this target population. One aspect currently missing from literature is the comparison of nursing students' attitudes towards climate change and sustainability across different countries, information that could support the development of appropriate teaching and learning materials to support awareness among nurses regarding and promote sustainability action in clinical practice.

Universities are possible agents of change for sustainability through the education of future professionals who will directly or indirectly influence their environment through their knowledge, values, and attitudes (Peer and Stoeglehner, 2013). In this context, the concept of 'environmentalisation or curricular sustainability' implies introducing environmental content in the curricula (Antúnez, 2017).

This study aimed to: i) investigate undergraduate nursing students' attitudes towards and awareness of climate change and sustainability issues and its inclusion in nurse education, ii) explore differences across a range of countries, and iii) compare attitudes in 2019 with those of a similar sample in 2014. The results of this study will provide an indication of current attitudes towards climate change and sustainability among students. Furthermore, it will highlight the extent to which students entering higher education understand the relevance of climate change and sustainability for their chosen profession and inform the development and embedding of sustainability topics in the nursing curriculum.

## 2. Methods

### 2.1. Study design and participants

A cross-sectional multicentre study was designed, using a convenience sample. The target population comprised all enrolled first-year undergraduate nursing students from seven universities and schools of Nursing in five countries: Universities of Plymouth and Brighton in the UK, University of Jaen (UJA) and Catholic University of Murcia (UCAM) in Spain, Esslingen University of Applied Sciences/Tübingen University (Campus for Health Sciences Esslingen-Tübingen) in Germany, Dalarna University (DU) in Sweden, and Queensland University of Technology (QUT) in Australia. All students who voluntarily agreed to participate were included. Incomplete or incorrectly filled out questionnaires were excluded. Universities are participating in this study based on: (i) their efforts to embed sustainability across their undergraduate nursing

curriculum; and (ii) inclusion of sustainability topics in teaching and assessment. This study follows the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (von Elm et al., 2007).

### 2.2. Data collection

The present study is part of research conducted by an international research group that has studied students' awareness of and attitudes towards climate change and sustainability since 2014 (Richardson et al., 2016). The *Sustainability Attitudes in Nursing Survey* (SANS_2) was used to measure nursing students' attitudes towards climate change and sustainability. SANS_2 comprises five items whose response options range from 1 (strongly disagree) to 7 (strongly agree) on a Likert-type scale. Reliability analysis revealed a Cronbach's alpha of 0.82. The SANS_2 questionnaire was translated and validated into French, Spanish, and German to evaluate nursing students' attitudes in four schools of Nursing in Europe (Plymouth, Esslingen, Jaen, and Switzerland) (Richardson et al., 2016). It was subsequently amended to capture attitudes to sustainability practice 'at home' as new students were unlikely to be able to report sustainability in clinical practice. Content validity was again determined through discussions with nursing education and sustainability experts, and they rated content to assess the desired construct (Richardson et al., 2019). The SANS_2 questionnaire was also translated for use in Sweden. Further items (6–8) were added for the present study to investigate nursing students' sustainability awareness (Box 1).

### 2.3. Procedure

Data were collected from first-year undergraduate nursing students at the seven participant universities (to avoid selection bias) between September 2019 and February 2020 at the start of the academic term; before, students had any exposure to sustainability teaching at their university (to avoid reporting bias). Questionnaires were self-administered during classes, in a paper-based or online format depending on each university's availability, and completely anonymous (they did not include any details that allowed the students to be individually identified). Data collected previously in 2014 were available to the research group.

### 2.4. Data analysis

Questionnaire data are presented as mean and standard deviation: SANS_2 Total score (items 1 to 5) and individual items (1–8) per university, and Global SANS_2 score (items 1 to 5) and by item (1–8), of all universities (whole sample).

The SANS_2 scale (items 1–5) showed good reliability (Cronbach's alpha of 0.82 for the total sample). All universities demonstrated good reliability (0.80 or above) except Jaen university: 0.78. DU and QUT Cronbach's alpha values were the highest (0.88). The whole questionnaire reliability (items 1–8) was good (0.80 for the total sample). In comparison, the SANS_2 reliability in 2019 was equal to that obtained in 2014 (Cronbach's alpha: 0.82).

The assumption of a normal distribution was evaluated using the Kolmogorov-Smirnov test. After confirming that all measurements (the SANS_2 total score, each item's mean for each university, the Global SANS_2 score, and each item's mean for all universities) had non-normal distribution, the university comparisons were performed by Kruskal-Wallis test and Mann-Whitney *U* test. The Global SANS_2 score, and each item's mean for all universities, were compared with those measured in 2014 (Richardson et al., 2016). To measure the effect size, the epsilon square statistic ($\varepsilon^2$) was calculated for contrasts made by the Kruskal-Wallis test. For post-hoc bivariate contrasts between universities, the Mann-Whitney U test and the biserial correlation of Glass (r) ranges (Tomczak and Tomczak, 2014) were calculated. A value of $p < 0.05$ was set as the statistical significance level. For the posteriori contrasts between variables with more than two categories, the significance level was corrected using the Bonferroni test (α/N° Contrasts), obtaining a significance level of 0.0023. All analyses were performed using SPSS version 25.

### 2.5. Ethical considerations

Ethical approval was granted by the respective Research Ethic Committees of each participating university (Plymouth: 18/19-1126, Jaen: JUL.19/3.PRY, Brighton: 2019-2653, QUT: 1900000699, Dalarna: HDa dnr 4.2-2016/556, Esslingen-Tübingen: 706/2019BO2, UCAM: ethical approval was not required). All students received information regarding the study and signed the consent. Participation was voluntary, and students had the right to withdraw without adverse effects on their academic standing. The confidentiality of personal data was maintained: student details were not recorded on the questionnaire, and teachers were not aware of specific student responses. The data collected were used for specific research purposes and are kept in the custody of the researchers.

## 3. Results

The initial sample size of 879 participants was reduced by 33 for incorrect questionnaire completion, leaving a final sample size of 846 (Fig. 1).

### 3.1. Relevance of climate change and sustainability issues to nursing

Participants from all seven universities consistently held positive attitudes towards climate change and sustainability (M = 5.472; SD: 1.05) (Table 1). No significant differences were found for SANS_2 Total scores among universities.

**Box 1**
Sustainability attitudes and awareness in nursing survey items.

1. Climate change is an important issue for nursing.
2. Issues about climate change should be included in the nursing curriculum.
3. Sustainability is an important issue for nursing.
4. Sustainability should be included in the nursing curriculum.
5. I apply sustainability principles at home.
6. All university students should learn about the impact of climate change when studying their subject.
7. Concerns about the environment influenced my choice of university.
8. The University of _____'s sustainability reputation influenced my choice of university.

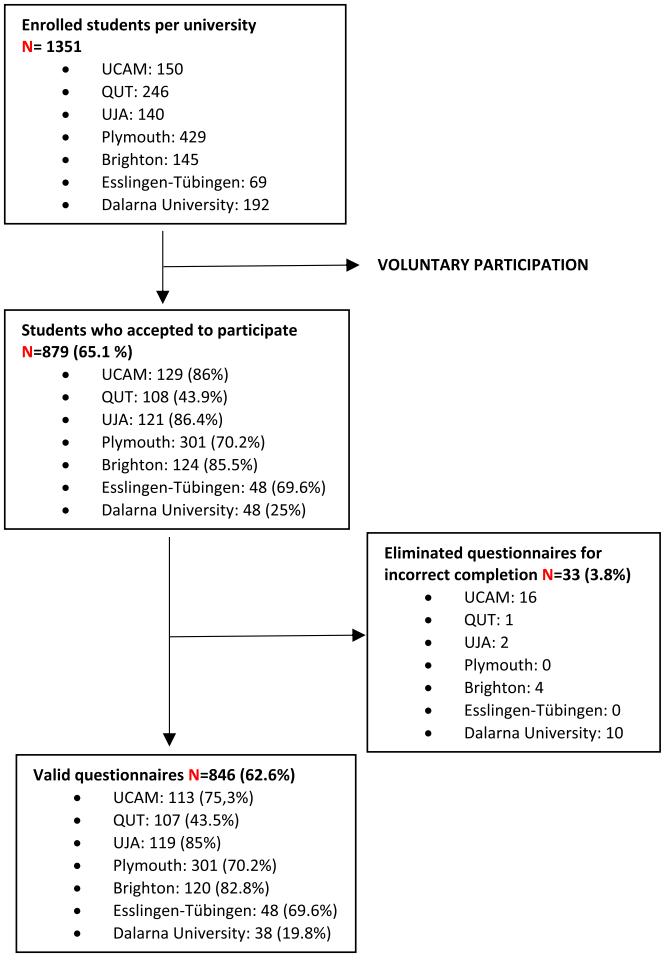


**Fig. 1.** Response percentages total and per university.

**Table 1**
Participant number by university and SANS_2 Total scores.

| University | N | SANS_2 Total (items 1–5): M (SD) |
|---|---|---|
| Catholic University of Murcia (UCAM) | 113 | 5.209 (1.29) |
| Queensland University of Technology (QUT) | 107 | 5.424 (1.20) |
| University of Jaen (UJA) | 119 | 5.439 (1.00) |
| University of Plymouth | 301 | 5.514 (0.92) |
| University of Brighton | 120 | 5.560 (1.02) |
| Esslingen-Tübingen | 48 | 5.592 (1.01) |
| Dalarna University (DU) | 38 | 5.726 (1.08) |
| All universities (Global SANS_2) | 846 | 5.472 (1.05) |

N: Number of participants M: Mean, SD: Standard Deviation.

By item, all participants reported values higher than 5 for items 1 through 6. Statistically significant differences among universities were found for items 1, 4, 6, 7, and 8 (Kruskal-Wallis), $p = 0.000$. The effect size (epsilon-squared estimates) showed weak values, obtaining the highest values for items 7 and 8 ($\varepsilon^2$: 0.179 and 0.181, respectively) (Table 2).

Participants scored highest for both 'climate change and sustainability being important issues for nursing' (items 1 and 3). The highest score was for 'sustainability is an important issue for nursing' (6.21) and was reported by DU participants. These students also obtained a higher score in 'the application of sustainability principles at home', both items with no significant differences (Table 2). Table 3 shows the post-hoc bivariate contrasts between universities.

Participants from UJA reported 'the importance of climate change for nursing' (item 1), obtaining significantly higher scores than students from Plymouth and Esslingen-Tübingen universities. Significant differences were also found between UCAM and Esslingen-Tübingen (Table 3).

### 3.2. *Inclusion of climate change and sustainability in the nursing curricula*

Participants from Esslingen-Tübingen universities provided the highest scores in questions related to 'the inclusion of climate change and sustainability in their nursing curriculum' (items 2 and 4) (Table 2). Esslingen-Tübingen universities participants scored 5.87 for item 4: 'Sustainability should be included in the nursing curriculum', in contrast to students from UJA and UCAM who scored the lowest, which were significant differences. Students from Plymouth and Brighton universities also scored significantly higher than UCAM and UJA students (Table 3).

### 3.3. *General sustainability awareness*

Students from all universities scored significantly higher than DU students that 'all university students should learn about the impact of climate change when studying their subject' (item 6) (Table 3). 'Concerns about the environment and whether it influenced participants' choice of university' (item 7) was the second-lowest scoring item globally (Table 2). Participants from DU scored that item the highest (4.13) and UJA the lowest (1.50) showing strong significant differences, with significant differences also found between DU and Esslingen-Tübingen. Globally, students were less inclined 'to select a university based on its reputation for sustainability', and that item (8) was reported as the least influential (Table 2). QUT participants gave the highest score for item 8, and Esslingen-Tübingen participants gave it the lowest, which was significantly different (Table 3).

### 3.4. *Comparison between 2014 and 2019*

All mean scores (global SANS_2 and items 1 to 5) showed significantly higher values in 2019 (Universities of Plymouth, Brighton, Esslingen-Tübingen, UJA, UCAM, DU, and QUT) than in 2014 (universities of Plymouth, UJA, Esslingen, and Switzerland). All effect sizes were small, except for the global SANS_2 and item 1 scores, which were close to a medium effect size (Table 4).

## 4. Discussion

The sample of nursing students reported positive attitudes at the start of their undergraduate studies in 2019 for climate change and sustainability in relation to nursing and undergraduate nursing curricula. Similar results were also reported in earlier studies that used the SANS_2 tool (Chen and Price, 2020; Cruz et al., 2018). Baseline surveying of these students' opinions is valuable for nursing curricula globally as it provides a clear orientation of current attitudes towards climate change and sustainability from a population with similar characteristics.

The mean result for 'the application of sustainability principles at home' item was high at all universities in 2019. This result corresponds with other studies that focus on climate change for personal and professional life choices (Berryman and Sauvé, 2016; Fielding et al., 2014). It also highlights that students' have an awareness of sustainability principles. This awareness can be used as an opportunity to transfer sustainability principles from their personal to their professional lives. These results can be explained/conceptualised in terms of the "Attitude Theory", which posits that beliefs and affections towards an object can motivate individuals' environmental behaviour. Individuals favouring environmental behaviour will consciously minimise negative impacts on natural and built environments (Berryman and Sauvé, 2016; Pruneau et al., 2006; Wibeck, 2014). Furthermore, positive individual actions are

**Table 2**
Item means and standard deviations per universities and global cohort.

| | UCAM $N = 113$ | QUT $N = 107$ | UJA $N = 119$ | Plymouth U $N = 301$ | Brighton U $N = 120$ | Ess-Tüb. U $N = 48$ | Dalarna U $N = 38$ | Global N = 846 | p |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M (SD) | | | | |
| Item 1: Climate change is an important issue for nursing | 5.90 (1.42) | 5.69 (1.44) | 6.04 (1.25) | 5.63 (1.12) | 5.72 (1.23) | 5.29 (1.34) | 5.76 (1.28) | 5.732 (1.27) | 0.000* |
| Item 2: Issues about climate change should be included in the nursing curriculum | 4.74 (1.90) | 5.03 (1.66) | 5.08 (1.50) | 5.10 (1.39) | 5.25 (1.46) | 5.38 (1.48) | 5.34 (1.56) | 5.085 (1.54) | 0.274 |
| Item 3: Sustainability is an important issue for nursing | 5.35 (1.66) | 5.69 (1.34) | 5.78 (1.24) | 5.90 (1.07) | 5.85 (1.18) | 5.96 (1.05) | 6.21 (1.12) | 5.796 (1.25) | 0.058 |
| Item 4: Sustainability should be included in the nursing curriculum | 4.81 (1.95) | 5.30 (1.54) | 5.01 (1.42) | 5.62 (1.20) | 5.73 (1.30) | 5.87 (1.23) | 5.82 (1.31) | 5.422 (1.45) | 0.000* |
| Item 5: I apply sustainability principles at home | 5.24 (1.65) | 5.41 (1.32) | 5.29 (1.44) | 5.33 (1.25) | 5.26 (1.31) | 5.46 (1.29) | 5.50 (1.27) | 5.325 (1.35) | 0.926 |
| Item 6: All university students should learn about the impact of climate change when studying their subject | 5.61 (1.80) | 5.65 (1.63) | 6.03 (1.47) | 5.57 (1.40) | 5.69 (1.48) | 5.79 (1.57) | 4.61 (1.55) | 5.636 (1.54) | 0.000* |
| Item 7: Concerns about the environment influenced my choice of university | 2.20 (1.80) | 3.51 (1.99) | 1.50 (0.98) | 2.89 (1.67) | 2.98 (1.63) | 1.73 (1.05) | 4.13 (1.66) | 2.683 (1.76) | 0.000* |
| Item 8: The University of _____'s sustainability reputation influenced my choice of university | 1.86 (1.80) | 3.51 (2.02) | 1.54 (0.95) | 2.77 (1.56) | 2.98 (1.67) | 1.52 (0.90) | 3.21 (1.66) | 2.550 (1.71) | 0.000* |

M: Mean, SD: Standard Deviation.
* Indicates significant differences (Kruskal-Wallis test).

enhanced when individuals possess climate change knowledge, and this knowledge can minimise the negative relationship between ideology and climate change attitudes (Fielding et al., 2014).

The nursing students in our study considered that 'all university students should learn about the impact of climate change when studying their subject'. The climate change consciousness was seen to cross all disciplines within the higher education sector and not only the responsibility of those in healthcare. The perception that climate change endangers human health by destabilising the ecological and social systems that satisfy basic human needs (Maxwell and Blashki, 2016) could explain this expansive view that a stable ecological and social system is intrinsically linked to public health and impacts on all persons.

There was high heterogeneity among the participant universities for some specific aspects that determine students' attitudes towards climate change and sustainability. This result is consistent with previous studies (Chen and Price, 2020; Cruz et al., 2018). Thus, students from some universities stand out in recognising the importance of climate change for nursing (UJA). However, there were also those from other universities who were more supportive of its inclusion in the training curriculum (Esslingen-Tübingen) or who chose a university influenced by its environmental policy (DU). Climate change and sustainability as subject content is still new, and their inclusion in the curricula of many countries in primary, secondary, university, and vocational training is still in development (Breunig et al., 2014; Schwerdtle et al., 2019; Walpole et al., 2019). The results may encourage some educators to consider including content on globalisation, the environmental impact of climate change, health promotion, use of resources and proper management of waste, food, the effects of smoking and its environmental effects on childhood health and wellbeing, among others (Álvarez-Nieto et al., 2017).

Embedding health, wellbeing, and sustainability in higher education received international legitimacy in 1998, when the World Health Organization (WHO) published the book on Health Promoting Universities (Orme and Dooris, 2010). The Healthy University approach adopts an ecological model of health, understanding it to be determined through a complex interplay of environmental, behavioural, and organisational factors. Despite the efforts of universities to be sustainable and environmentally friendly and use that as a trademark, it does not seem to consistently influence the student's choice of university for nursing training. In our study, students most influenced by this were from the Dalarna and Australian universities. Considerable differences of results between universities may possibly be explained by the fact that there are universities that have a longer tradition of environmental health policies and others that have only recently incorporated them into their university policies. This concept of "healthy universities" to promote and facilitate the synergy between public health, sustainable development, and climate change is not a new approach but now demands attention and a higher and more consistent visibility (Dooris et al., 2021).

Data from two previous studies (Richardson et al., 2016; Richardson et al., 2017) confirm a longitudinal trend consistent with climate change and sustainability being positively viewed within a nursing context by nursing students early in their academic and professional trajectory. Our study showed a significant increase in the mean scores for Global SANS_2 and items 1 to 5 in 2019. The more considerable differences found between 2014 (Richardson et al., 2016) and 2019 were for the Global SANS_2 score and item 1 ('Climate change is an important issue for nursing'). This is evidence of greater awareness among nursing students towards the inclusion of sustainability and climate change competencies in university nursing education in the countries studied. This could be because of the increasing number of activities in this field over the last few years, from formal summits, to increased media, to activist movements.

The students at the Dalarna and Esslingen-Tübingen universities have strong positive attitudes towards the importance of sustainability and climate change for nursing and differ from other participating universities. Similarly, Richardson et al. (2016) showed significant differences among countries, with German nursing students showing more awareness of sustainability attitudes than students in the United Kingdom and Spain. Some studies have indicated that healthcare students and health professionals are aware of the effects of climate change on health but admit that they are not prepared to practice it (Maxwell and Blashki, 2016; Teherani et al., 2017; Wellbery et al., 2018).

Our study revealed that students at the beginning of their nursing studies support the introduction of climate change and sustainability education into nursing curricula, which could lead to environmentally literate nurses who can advocate for sustainable practices within healthcare. Furthermore, over the past seven years, nursing students have consistently expressed a willingness to engage with the science of climate change and sustainability (Richardson et al., 2016; Richardson et al., 2019).

There is still a long way to go before sustainability and climate change competencies are fully embedded in the curricula of higher education institutions. On the positive side, nurses scored quite high on the inclusion of sustainability and climate change in their nursing curriculum, which could mean that education has made progressive developmental steps. However, there is an apparent continuing gap between the

**Table 3**
Post-Hoc differences between universities.

| University Contrasts | *Item 1: Climate change is an important issue for nursing* | | | *Item 4: Sustainability should be included in the nursing curriculum* | | | *Item 6: All university students should learn about the impact of climate change when studying their subject* | | | *Item 7: Concerns about the environment influenced my choice of university* | | | *Item 8: The University of _____'s sustainability reputation influenced my choice of university* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Universities | *Average range* | *p* | *r* | *Average range* | *p* | *r* | *Average range* | *p* | *r* | *Average range* | *p* | *r* | *Average range* | *p* | *r* |
| *UJA* | | | | | | | | | | | | | | | |
| UCAM | 116.84–116.14 | 0.931 | – | 117.38–115.57 | 0.834 | – | 123.27–109.37 | 0.086 | – | 107.48–126 | 0.014 | – | 119.8–113.03 | 0.341 | – |
| Plymouth | 248.26–195.57 | 0.000* | 0.251 | 172.94-225.35 | 0.000* | 0.250 | 247.48-195.88 | 0.000* | 0.246 | 131.42–241.77 | 0.000* | 0.525 | 137.91-239.2 | 0.000* | 0.482 |
| Brighton | 130.79-109.3 | 0.012 | – | 101.42–138.43 | 0.000* | 0.310 | 130.78-109.31 | 0.010 | – | 87.02-152.71 | 0.000* | 0.550 | 88.54-151.2 | 0.000* | 0.524 |
| QUT | 120.32–105.91 | 0.080 | – | 106.01–121.83 | 0.063 | – | 121.95–104.1 | 0.027 | – | 81.21-149.41 | 0.000* | 0.604 | 83.74-146.6 | 0.000* | 0.556 |
| DU | 81.47–71.26 | 0.200 | – | 72.84–98.3 | 0.002* | 0.324 | 88.8148.29 | 0.000* | 0.516 | 63.71–126.88 | 0.000* | 0.805 | 67.55-114.84 | 0.000* | 0.602 |
| Ess-Tüb. | 92.85–62.06 | 0.000* | 0.369 | 75.09–106.08 | 0.000* | 0.371 | 86.38-78.1 | 0.272 | – | 80.26–93.28 | 0.062 | – | 84.12–83.71 | 0.954 | – |
| *UCAM* | | | | | | | | | | | | | | | |
| Plymouth | 234.46–197.38 | 0.004 | – | 176.52–219.13 | 0.001* | 0.206 | 222.54-201.86 | 0.104 | – | 163.81–223.9 | 0.000* | 0.290 | 143.67-231.46 | 0.000* | 0.424 |
| Brighton | 125.28–109.2 | 0.056 | – | 101.88–131.24 | 0.001* | 0.252 | 119.43-114.71 | 0.575 | – | 98.2-134.7 | 0.000* | 0.313 | 89.53-142.87 | 0.000* | 0.458 |
| QUT | 115.96–104.73 | 0.163 | – | 104.12–117.24 | 0.119 | – | 111.93–108.99 | 0.717 | – | 89.03-133.18 | 0.000* | 0.401 | 84.29-138.18 | 0.000* | 0.490 |
| DU | 77.69–70.97 | 0.375 | – | 70.57–92.16 | 0.007 | – | 83.11–54.86 | 0.000* | 0.374 | 64.81-109.28 | 0.000* | 0.589 | 66.25-104.99 | 0.000* | 0.513 |
| Ess-Tüb | 87.92–64.7 | 0.002* | 0.288 | 73.69-98.21 | 0.002* | 0.305 | 80.33-82.58 | 0.764 | – | 82.04–78.54 | 0.626 | – | 79.92–83.54 | 0.568 | – |
| *Plymouth* | | | | | | | | | | | | | | | |
| Brighton | 207.02–220.97 | 0.271 | – | 206.24–222.94 | 0.188 | – | 206.39–222.55 | 0.203 | – | 208.42–217.48 | 0.481 | – | 206.98–221.09 | 0.272 | – |
| QUT | 200.08–216.94 | 0.189 | – | 209.19–191.3 | 0.164 | – | 200.12–216.82 | 0.192 | – | 195.4–230.09 | 0.008 | – | 193.62–235.1 | 0.001* | 0.203 |
| DU | 168.43–182.43 | 0.390 | – | 167.79–187.53 | 0.226 | – | 177.24–112.67 | 0.000* | 0.381 | 162.16-232.07 | 0.000* | 0.412 | 167.13-192.71 | 0.121 | – |
| Ess-Tüb | 178.14–155.29 | 0.132 | – | 171.51–196.85 | 0.094 | – | 171.61–196.23 | 0.104 | – | 185.13–111.49 | 0.000* | 0.422 | 186.52-102.78 | 0.000* | 0.480 |
| *Brighton* | | | | | | | | | | | | | | | |
| QUT | 112.39–115.8 | 0.685 | – | 122.25–104.74 | 0.038 | – | 113.38–114.7 | 0.874 | – | 106.17–122.78 | 0.053 | – | 106.15–122.8 | 0.053 | – |
| DU | 78.91–81.37 | 0.764 | – | 78.52–82.61 | 0.617 | – | 87.48–54.3 | 0.000* | 0.420 | 72.03–103.08 | 0.000* | 0.393 | 78-84.22 | 0.457 | – |
| Ess-Tüb | 89.13–72.92 | 0.043 | – | 82.98–88.29 | 0.504 | – | 82.76–88.84 | 0.443 | – | 95.55–56.88 | 0.000* | 0.460 | 97.06-53.09 | 0.000* | 0.523 |
| *QUT* | | | | | | | | | | | | | | | |
| DU | 72.86–73.41 | 0.942 | – | 69.31–83.39 | 0.068 | – | 80.61–51.58 | 0.000* | 0.400 | 69.52–82.79 | 0.090 | – | 74.68–68.28 | 0.413 | – |
| Ess-Tüb | 82.78–67.34 | 0.041 | – | 72.84–89.5 | 0.028 | – | 76.61–81.09 | 0.545 | – | 90.46–50.22 | 0.000* | 0.519 | 91.5-47.9 | 0.000* | 0.563 |
| *DU* | | | | | | | | | | | | | | | |
| Ess-Tüb | 48.34–39.67 | 0.099 | – | 43.26–43.69 | 0.934 | – | 32.86–51.93 | 0.000* | 0.443 | 61.64–29.14 | 0.000* | 0.756 | 57.91-32.09 | 0.000* | 0.600 |

* Significative differences $p < 0.0023$ (Mann-Whitney test), r (biserial correlation of Glass).

**Table 4**
SANS_2 scores 2014, 2019, bivariate contrasts and effect size.

| SANS_2 (items 1–5) | 2014 N = 916 | 2019 N = 846 | Average range | p | r |
|---|---|---|---|---|---|
| | M (SD) | | | | |
| Global SANS_2 | 4.64 (1.05) | 5.472 (1.05) | 700.14–1089.22 | 0.000* | 0.442 |
| Item 1: Climate change is an important issue for nursing | 4.524 (1.39) | 5.732 (1.27) | 683.64–1107.26 | 0.000* | 0.482 |
| Item 2: Issues about climate change should be included in the nursing curriculum | 3.988 (1.44) | 5.085 (1.54) | 715.39–1072.55 | 0.000* | 0.406 |
| Item 3: Sustainability is an important issue for nursing | 5.122 (1.35) | 5.796 (1.25) | 760.45–1023.28 | 0.000* | 0.299 |
| Item 4: Sustainability should be included in the nursing curriculum | 4.71 (1.44) | 5.422 (1.45) | 762.67–1020.85 | 0.000* | 0.294 |
| Item 5: I apply sustainability principles at home | 4.856 (1.29) | 5.325 (1.35) | 795.01–985.48 | 0.000* | 0.217 |

* Significative differences $p < 0.05$ (Mann-Whitney test), r (biserial correlation of Glass).

regulatory bodies for nursing education and nursing practice on the importance of climate change and sustainability (Butterfield et al., 2021).

Given the significant impacts of climate change on health we recommend the integration of relevant topics into nursing curricula. Furthermore, as the delivery of healthcare contributes to environmental damage, nurses need to be equipped with knowledge and skills in order to promote sustainable practice. National nursing regulatory bodies should incorporate climate change and sustainability competences into practice requirements.

### Limitations

There were large differences in the sample sizes (from Plymouth university with 3 DU with 38 students) and in the response rate (DU the lowest: 25%). Non-probability sampling and survey access might have led to selection bias. As a result, results may not be truly representative of the cohorts under study. To minimise this bias, future surveys will use simple random sampling. Furthermore, social desirability may play a role in participants' answers; thus, attitudes may be overestimated. Relationships between environmental knowledge and environmental attitudes are related to education level and age, but students were not asked to state their age or school qualification. In addition, the questionnaires were self-reported, meaning the results cannot be independently verified, and generalisation to the population of first-year nursing students is limited. Collecting contextual information per university about interventions that have taken place between 2014 and 2019 on environmental and sustainability education would have provided insight into the temporal evolution of the results.

## 5. Conclusions

This study has demonstrated that nursing students from the universities studied had increasingly positive attitudes towards the inclusion of sustainability and climate change in the nursing curriculum. Students also recognised the importance of education regarding the impact of climate change and would welcome formal preparation to become environmentally literate. Incorporation of sustainability sessions must be integrated into undergraduate nursing curricula and focus on aspects of clinical relevance. It is time to act on this positive trend in nursing students' attitudes by integrating sustainability, climate change, and health competencies into undergraduate nurse education.

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### Ethical approval

Ethical approval for the study was granted by all Universities from their respective Research Ethic Committees (Plymouth: 18/19-1126, Jaen: JUL.19/3.PRY, Brighton: 2019-2653, QUT: 1900000699, Dalarna: HDa dnr 4.2-2016/556, Esslingen- Tübingen: 706/2019BO2, UCAM: ethical approval was not required).

### CRediT authorship contribution statement

All authors contributed to conception and design, acquisition and interpretation of data, writing - review & editing the draft and approved the final version to be submitted. **Janet Richardson**: Conceptualization, Writing – original draft, Methodology, Supervision **Carmen Álvarez-Nieto**: Writing – original draft, Methodology, Data curation, Formal analysis, Supervision, **M. Ángeles Navarro-Perán**, **Naomi Tutticci**, **Norma Huss**, **Marie Elf**, **Anna Anåker**, **Jennie Aronsson**, **Heather Baid and Isabel M. López-Medina**: conception and design, acquisition and interpretation of data, writing - review & editing the draft.

### Declaration of competing interest

None.

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