1 **How university students are taught about sustainability, and how they want to be**

2 **taught, the importance of the hidden curriculum**

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24

25 **Abstract**

26 **Purpose**

27 India is unique, having enshrined in law the teaching of sustainability education (SE) within

28 all levels of formal education. The aims of this study were to examine the integration, and

29 perceptions of sustainability education within the HE sector in India, and to identify any

30 lessons that can be exported about the teaching of SE from the Indian HE environment.

31

32

33 **Design/methodology/approach**

34 Focusing on a science based teaching and research institute at a private university in India a

35 quantitative, cross-sectional study examined the extent to which SE was integrated into the

36 university and how it was perceived by students and staff. Data were collected though two

37 online questionnaires administered to lecturers and undergraduate students during the 2017

38 academic year.

39

40 **Findings**

41 Most students reported that their university experiences, had contributed significantly to their

42 knowledge about sustainability. Results also showed there was a positive association between

43 the teaching and learning about sustainability, although staff and students reported that this

44 could be improved by including more active, student-centred teaching and learning

45 approaches. However, students felt that they had learnt the most about sustainability from the

46 informal 'hidden' rather than the 'formal' curriculum. This suggests that research is now

47 required into ways to capitalise on this as a medium to further develop, not just Indian, but

48 students' worldwide sustainability literacy.

49

50 **Originality**

51 This paper is the first to present a detailed study of the perceptions of the contribution of the

52 'formal' and the informal 'hidden' curriculum to SE by students and staff at an Indian

53 university.

54

55 **Keywords**

56 Sustainability education; India; Environmental studies; Sustainable Development;

57 Sustainability; Hidden Curriculum

58

59 **Article classification**

60 Research Paper

1. Introduction

1.1. The role of universities in responding to global sustainability challenges

Universities have been identified as key players in responding to global sustainability challenges, not only through traditional outputs such as innovation, design and problem solving, but also through the delivery of sustainability education (Sterling, 2010; Sterling *et al.,* 2013) as advocated within the United Nation's Sustainable Development Goal 4 (SDG4) - Quality Education (Target 4.7) (United Nations, 2015). There is a growing trend for this to be explicitly embedded across the curriculum (Dmochowski *et al.,* 2016), in an increasing number of disciplines (Jones *et al.,* 2010), as well as a 'hidden' curriculum. First defined by Jackson (1968) the 'hidden' curriculum describes the 'divergence between what is overtly taught in educational institutions and what students actually learn' (page 3, Winter and Cotton, 2012). Internationally, a growing number of universities have made increasing efforts to include sustainable practices into their campuses and extra-curricular activities (e.g. Finnveden et al., 2020; Hernández-Diaz et al., 2021; Jun and Moon, 2021; Levesque and Wake, 2021), with students often benefitting from this 'hidden' curriculum and citizenship initiatives whilst pursuing their studies (Lipscombe, 2008; Peterson and Warwick, 2015; Winter *et al.,* 2015; Warwick, 2016). However, efforts to increase sustainability education in some higher education (HE) institutions have been met with indifference and/or resistance (Winter and Cotton, 2012), with staff citing time and financial pressures, as well as loss of academic freedom as their reasons for opposition (e.g. Knight, 2005). Nethertheless, whilst many countries have made commitments to improve sustainability education in HE, such as the UK, in which the government has published a series of reviews and action plans (e.g. HEFCE, 2008), ultimately these remain in the format of guidelines, rather than mandatory directives.

1.2. Sustainability education in India within HE

In many societies, issues surrounding sustainability are often considered modern concepts. This is not the case in India. The combination of traditional Hindu principles of awareness and respect for the natural world, Gandhi's teachings to use the earth's resources wisely together with a population that has only recently started to enjoy the trappings of a middle class lifestyle, have meant that sustainable practices in the business, education and home environment have long been present (Haydock and Srivastava, 2019). They have just not necessarily been labelled as such. Equally, whilst education, and specifically HE, has been

93   acknowledged as being integral to sustainable development in India, after nearly 60 years of

94   independence the challenges of widespread poverty, economic disparity, religious strife and

95   social inequality remained (Government of India, 1998). Therefore, in 2003 India took a

96   unique approach, enshrining in law sustainability education within all levels of formal

97   education, following a judgement to this effect handed down by the Supreme Court of India

98   in 1991.

99   This culminated in a compulsory undergraduate course, 'Environmental Studies' with the

100   syllabus and first textbook designed and commissioned by the University Grants

101   Commission, a governmental initiative aiming to address SDG 4 in HE within India (National

102   Coalition for Education India, 2019). Since then other organisations such as the non-

103   governmental organisation, Centre for Environment Education (www.ceeindia.org) have also

104   developed 'Environmental Studies' courses with associated textbooks and in some cases

105   teacher training (e.g. Chhokar *et al.,* 2004). These 'Environmental Studies' courses include

106   units on environmental topics, but also social issues such as human rights and gender

107   equality, and crucially the links between these (e.g. Bharucha, 2004). Recently though studies

108   have highlighted difficulties in ensuring the quality and effectiveness of these compulsory

109   undergraduate level sustainability education programmes (e.g. Chhokar, 2010), with perhaps

110   the most serious challenge cited being lack of student engagement. This has been attributed to

111   a combination of factors including, the fact that sustainability education as 'Environmental

112   Studies' type courses, whilst compulsory, do not count towards degree grades. They are also

113   not tailor-made to be discipline/degree programme specific, and commonly employ didactic

114   pedagogies that do not engage students in their learning (Chhokar, 2010).

115   *1.3. Challenges for the Indian HE sector and the delivery of sustainability education*

116   India's HE system is currently the third largest in the world and is predicted to produce 25%

117   of all graduates globally by 2030 (Planning Commission Government of India, 2013). One of

118   the Indian Government's major aims is to continue to increase participation in all levels of

119   education, including HE, recognising the importance of this to further drive development.

120   Whilst increasing participation remains important, there is now also an increased focus on

121   addressing the quality of HE teaching. The emphasis has been placed on research informed

122   teaching supported by a high quality research environment (Planning Commission

123   Government of India, 2013). As a result the Indian HE sector is going through a period of

124   change, with a growing focus on research and privately funded HE providers, rather than

125   state/public institutes (British Council, 2014). These private universities are typically newly

126   built, modern campuses with sophisticated facilities. One of the planning features of nearly

127   all HE institutes in India (new and old) is that their design is often underpinned by a focus on

128   self-reliance and sustainability (Bantanur *et al.,* 2015a,b). This, together with the fact that

129   there is compulsory delivery of Environmental Studies in India gives us therefore a unique

130   perspective to investigate the integration and perception of sustainability education in HE.

131   Thus, the aims of this study were to: examine (a) the integration and, (b) perceptions of

132   sustainability education within the HE sector in India, and to (c) identify any lessons that can

133   be exported from the Indian HE environment.

134   **2. Materials and Methods**

135   *2.1. Research context*

136   Nitte University, Mangalore, Karnataka, south-west India (nitte.edu.in) is an example of the

137   new tier of modern, private universities which have begun to reshape the Indian HE sector.

138   Following the national steer it has a focus on high-quality research driven education (British

139   Council, 2014) and is therefore an ideal model to frame the questions posed in this study.

140   Nitte University has faculties of medicine, dentistry, nursing, pharmacy, physiotherapy,

141   biosciences, architecture and communication. The research reported here was conducted in

142   the Faculty of Biosciences at the Nitte University Centre for Science Education and Research

143   (NUCSER). This is an interdisciplinary teaching and research institute with around 150

144   undergraduate and 100 postgraduate (taught and research) students in areas including

145   biomedical science, food safety, biotechnology, microbiology and marine biotechnology.

146   *2.2. Research Design*

147   As this was an exploratory study it adopted a cross-sectional research design to provide

148   insights and initial data from a specific point in time on which future work could be based

149   (Bryman, 2008). Related studies (e.g. Emmanuel & Adams, 2011; Kagawa, 2007) have

150   adopted a similar approach to gauge student opinion and inform strategies to promote student

151   engagement with sustainability. Specifically, they highlighted the value in adopting a cross

152   sectional approach in contexts where there is limited knowledge regarding student

153   perceptions of sustainability (Kagawa, 2007).

154   An online closed-question multiple-choice style questionnaire with Likert scale responses to

155   capture opinions from both students and staff at NUCSER was utilised. An online

156 questionnaire based methodology was chosen due to the advantages this can offer over

157 traditional (offline) survey methods which were particularly relevant for this study, being

158 conducted in a large educational institution in India, semi-remotely from the UK. Online

159 questionnaires are widely used in educational research due to the recognised benefits in

160 providing rapid, easy and affordable access to geographically dispersed populations (Gosling

161 *et al.,* 2004; Evans and Mathur, 2005; Tuten, 2010; Roberts & Allen, 2015). However, these

162 gains are often framed with respect to the potential challenges associated with online

163 questionnaires (e.g. low response rates, high-levels of item non-response, and reduced levels

164 of experimenter control (Shih & Fan, 2008; Heerwegh & Loosvedlt, 2008; Stieger and Reips,

165 2010). It has to be noted that many of these challenges were documented when online

166 questionnaires were a relatively new tool in pedagogic research. They are increasingly

167 ubiquitous, used widely for student evaluations for example, demonstrating their value.

168 Equally, researchers have highlighted the benefits of using incentives to promote response

169 rates, as well as the positive impact faculty-led promotion can have upon student engagement

170 with online questionnaires (Guder & Malliaris, 2013; Lipsey & Shepperd, 2021). Based on

171 this, and their use in related contemporary work, online questionnaires were deemed an

172 appropriate mechanism of data collection to use in this study.

173 Two online questionnaires were then developed; one staff facing and one for completion by

174 students. The questionnaires were structured into four main sections: (a) prior

175 knowledge/understanding of sustainable development/sustainability, to explore participants

176 own interpretation of the topic rather than imposing a set definition, questions concerning

177 participants' (b) views and (c) experiences of sustainable development/sustainability teaching

178 at university, and (d) personal perspectives of sustainable development/sustainability. Most

179 questions also included an 'other' option allowing participants to add their own

180 views/interpretations of each topic. Demographic data, e.g. gender, age, and prior education

181 were also captured to allow the interpretation of participants' answers in a wider context.

182 Colleagues at Nitte gave feedback on the initial questionnaire drafts to ensure local

183 compatibility, e.g. use of terminology and language. This step was taken to mitigate further

184 factors that may have affected the response rate, and was informed by recommendations

185 presented in Bryman (2008). The questionnaires were administered using BOS

186 (www.onlinesurveys.ac.uk). They were initially piloted with a subset of 45 students and 7

187 academic staff before being sent to all remaining students (undergrad, postgrad and PhD)

188 (n=108) and academic staff (n=8) at NUCSER. Targeted distribution of the questionnaires

189 heeded the recommendations of Cummings (2017) in terms of maximising response rates

190 from the respective sample populations. As an incentive (e.g. Kelly *et al.,* 2017), respondents

191 were offered the chance to be entered into a prize draw for a 3,000 INR (~£30) Amazon India

192 voucher. Seventy-five days (18/05/2017-31/07/2017) were allowed for the questionnaires to

193 be completed before it was closed and the data were analysed. Ethical approval was obtained

194 from the Ethics Committee of the University of Plymouth Postgraduate Certificate in

195 Academic Practice (PGCAP) programme, prior to commencing the study and informed

196 consent was built into the administration of the questionnaires.

197 *2.3. Data analysis*

198 Nominal data generated from individual questions were analysed using non-parametric

199 statistics in MS Excel and SPSS v. 22. Spearman's Rank Order Correlation was used to test

200 the association between the teaching and learning of sd/s at Nitte. Guided by the research

201 aims, the analyses looked for convergences, differentiations and contradictions that emerged

202 from a consideration of the questionnaire responses as a whole in order to examine the

203 integration and perceptions of sustainability education offered at the study institution. The

204 good response rates meant that there was a much lower chance of non-response bias in the

205 conclusions that could be drawn from the questionnaire results (Nulty, 2008). However, it

206 should be noted that only one institute at a single university was invited to take part in the

207 research, so it is possible that the results might provide answers that can be mapped to

208 disciplinary bias (Bantanur *et al.,* 2015b). However, in designing, implementing and

209 reporting this study, key features of the Pragmatic Pedagogic Research Framework

210 development by Evans et al. (2020) were reflected upon. Using this the researchers were able

211 to consider the factors such as the pedagogical clarity of the study, methodological

212 transparency and methodological congruence, which are identified by Evans et al., (2020) as

213 underpinning high quality pedagogic research.

214 **3. Results**

215 Both academic staff and students working at The Nitte University Centre for Science

216 Education and Research (NUCSER) were invited to participate in the online questionnaire.

217 The response rates were 47% (n=7) and 29% (n=45) (55% postgraduates (n=17) and 23%

218 undergraduates (n=28)) respectively.

219 Of the students who responded the majority were female with an average age of 20.9 years.

220 The vast majority of respondents were undergraduate rather than postgraduate or PhD

221   students. Of the staff who responded the majority were male with an average age of 35.6

222   years. All staff held a postgraduate degree or PhD and most held a teaching qualification.

223   *3.1. Prior knowledge/understanding of sustainable development/sustainability*

224   There were some differences between what students and staff understood by the terms

225   sustainable development/sustainability (sd/s) (Figure 1). For students the most popular

226   responses were 'interdependence – society, economy and government', 'needs and rights of

227   future generations', and 'sustainable change – development and carrying capacity', whereas

228   for staff it was 'quality of life, equity and justice', 'interdependence – society, economy and

229   government', 'green economy', and 'sustainable change – development and carrying

230   capacity'.
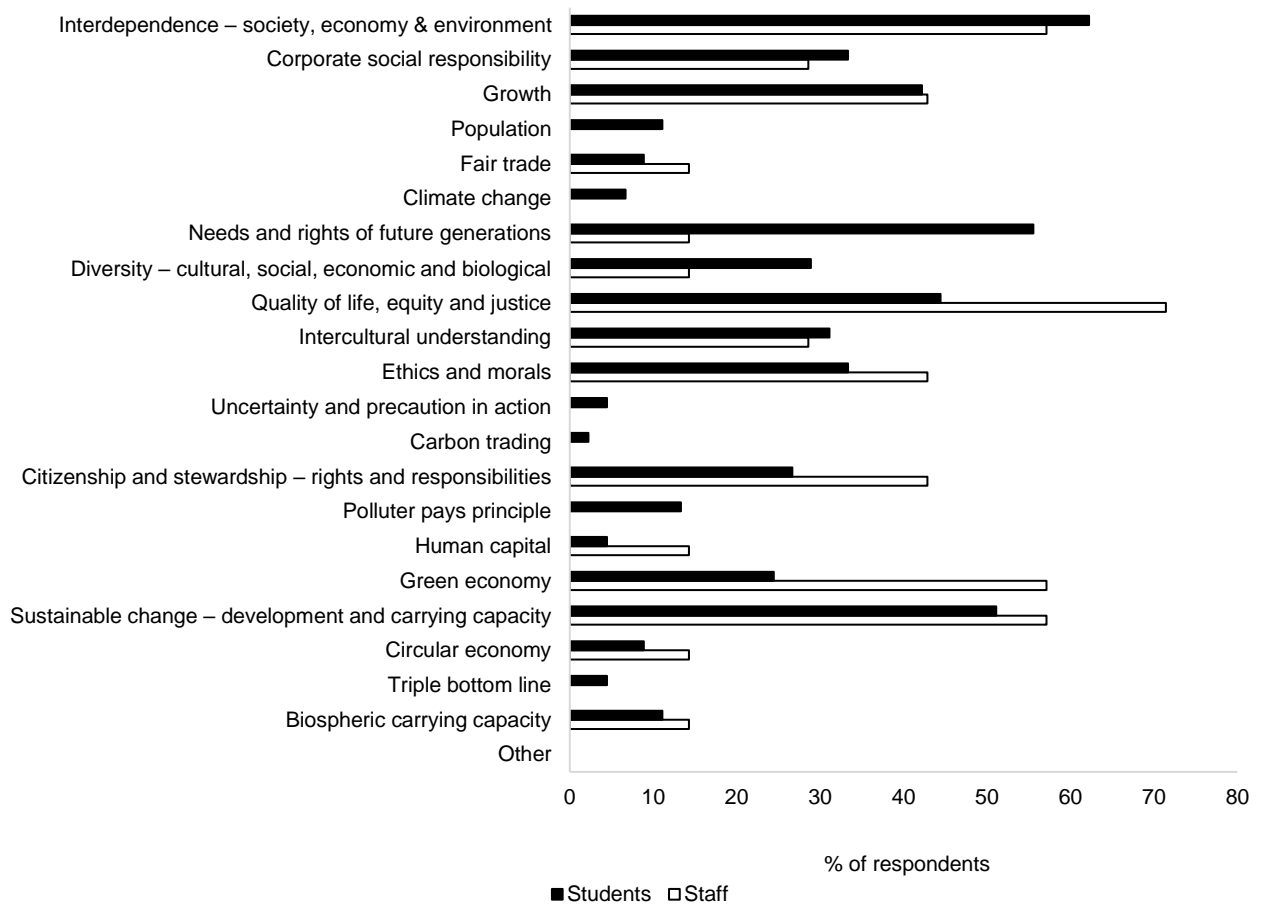
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232   **Figure 1.** What students and staff at Nitte University understand by the terms sustainable
233   development/sustainability.

234

For students, the internet, books, newspapers, and their UG university education played the
most important roles in forming these views. For staff, their PG university education,
upbringing, books, internet, and newspapers were the most important (Figure 2).
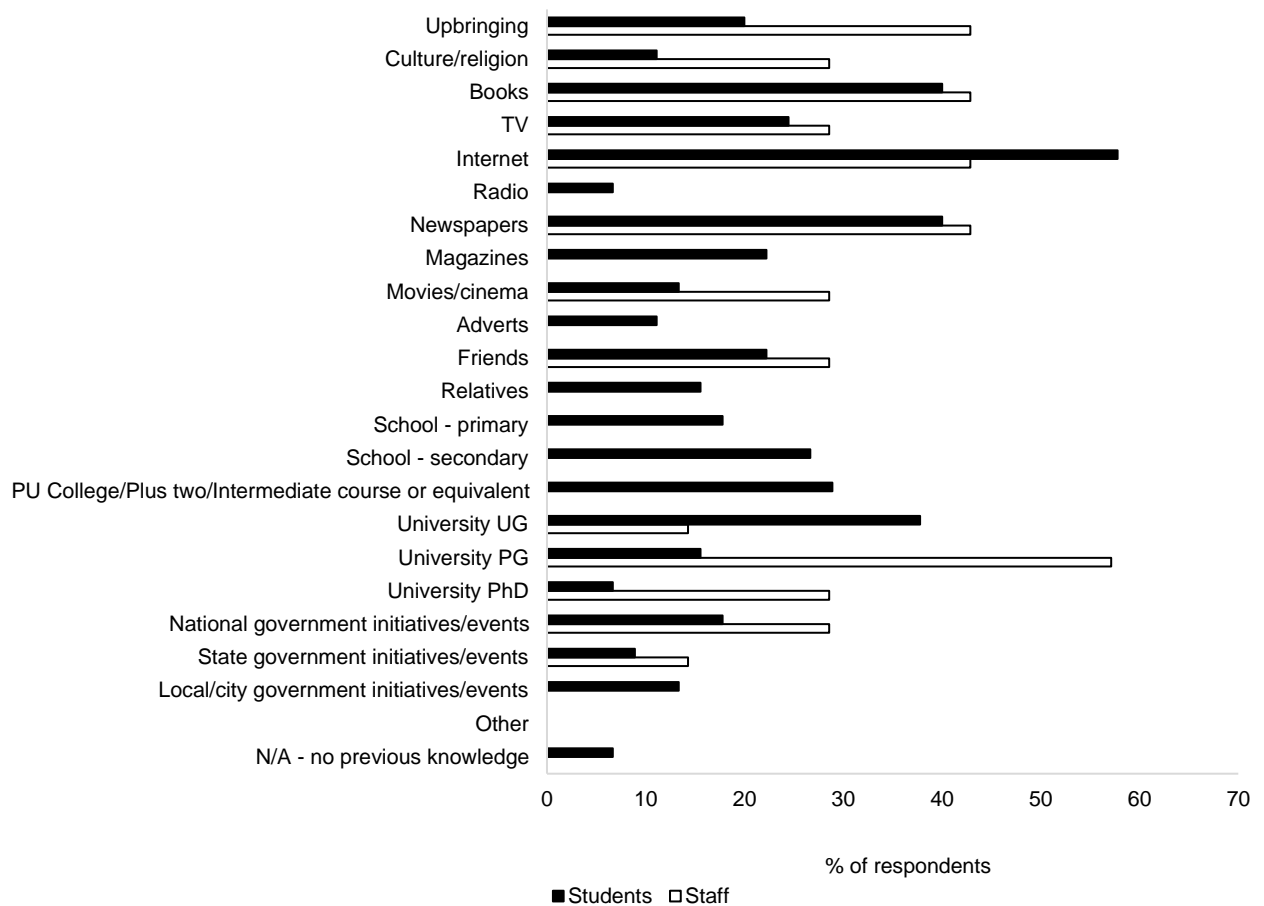
Figure 2. Where students and staff at Nitte University have obtained their previous
knowledge about sustainable development/sustainability, e.g. before studying/working at
Nitte University.

All students surveyed reported that they knew reasonably little about sd/s before they came to
Nitte, with most of these knowing 'not much' or only 'a little'. This was broadly the case,
regardless of whether Nitte was the first university they have attended.

3.2. Views of sustainable development/sustainability teaching at university

All students and staff thought it moderately to very important for sd/s to be taught at
university, and that this should be a compulsory part of the university curriculum. For the
small number of respondents who disagreed that the teaching of sd/s should be compulsory,
the reasons given were that 'students could learn about these issues from other sources', and

9

251 'that there is not enough time in the course/year to cover this content'. Student respondents

252 also cited that they thought it is 'not the duty of universities to teach this subject'. In terms of

253 the subjects that should be taught as part of sd/s at university, for students, the most important

254 were perceived to be 'waste, water, energy community resilience', 'natural resources

255 management', 'responses to climate change', 'ecosystems and ecological principles', and

256 'biological diversity'. For staff, 'natural resources management', 'ecosystems and ecological

257 principles', and 'rural and urban development' were the most important (Figure 3).


% of respondents

■ Students   □ Staff

258
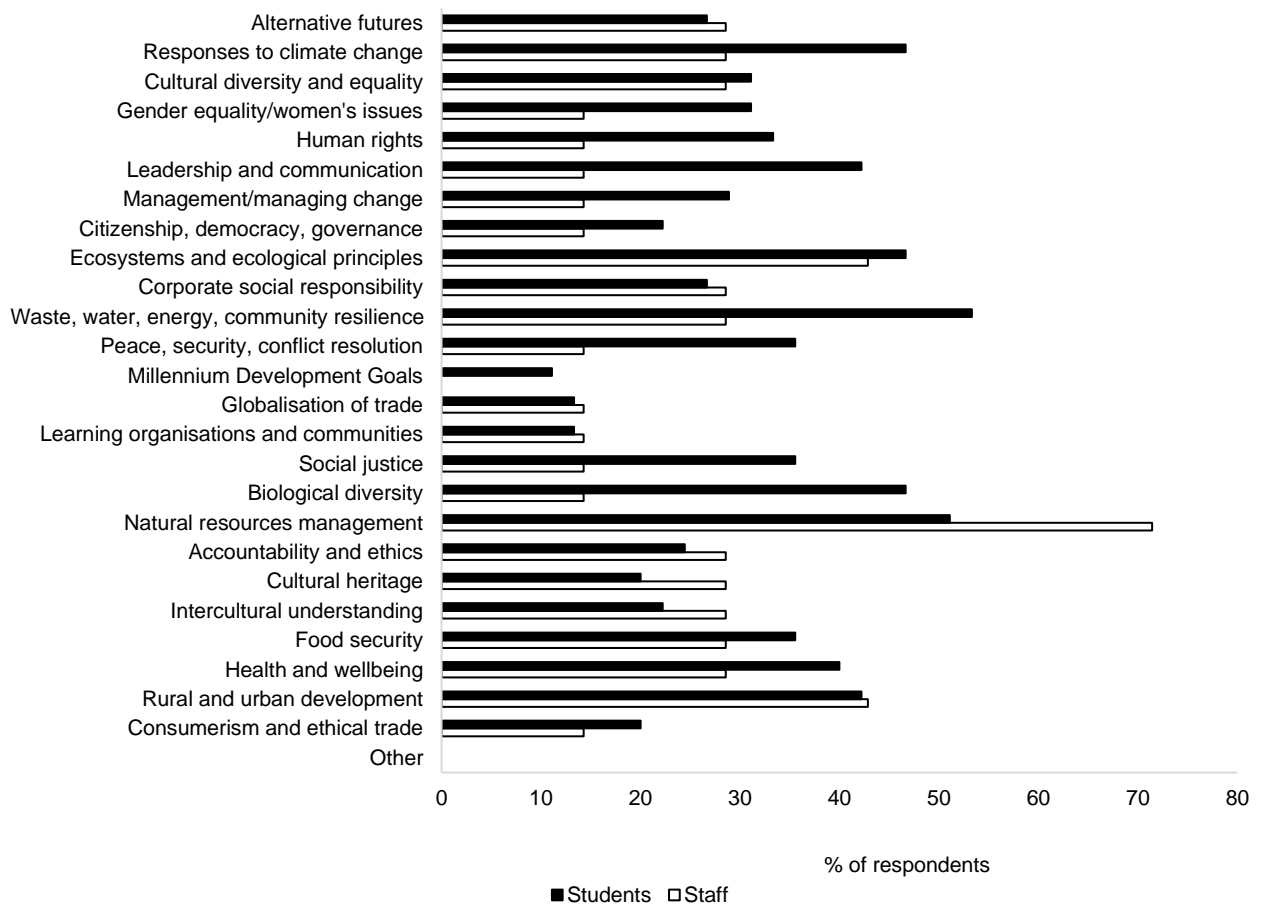
Figure 3. Which subjects should be taught as part of sustainable development/ sustainability
at university?

261

262 Regarding the teaching approaches that should be used to teach sd/s at university, students

263 were overall more in favour of formal timetabled sessions, including in partnership with

264 university campus initiatives and/or sports/arts events/societies/teams, compared to this

265 subject being taught outside of formal timetabled sessions, e.g. through university campus

266 initiatives and/or sports/arts events/societies/teams only. For staff, overwhelmingly the

267 opposite was true, with the majority favouring the teaching of sd/s outside of formal

268 timetabled sessions. Some staff did favour the teaching of sd/s through a compulsory

269 standalone module (rather than a specific component of a degree programme) e.g. as

270 'Environmental Studies' (ES), which was similar to the percentage of students who favoured

271 this approach (Figure 4). Those students that preferred being taught sd/s through university

272 campus initiatives and/or sports/arts events/societies/teams cited 'minimising/banning single

273 use plastic', 'reducing, reusing and recycling of waste available within the campus', 'water

274 conservation practices', 'wastewater management practices', and 'campus

275 greening/landscaping' as the initiatives that should be used for this type of approach. For

276 staff, there was no preference for any of the initiatives suggested (Figure 5).
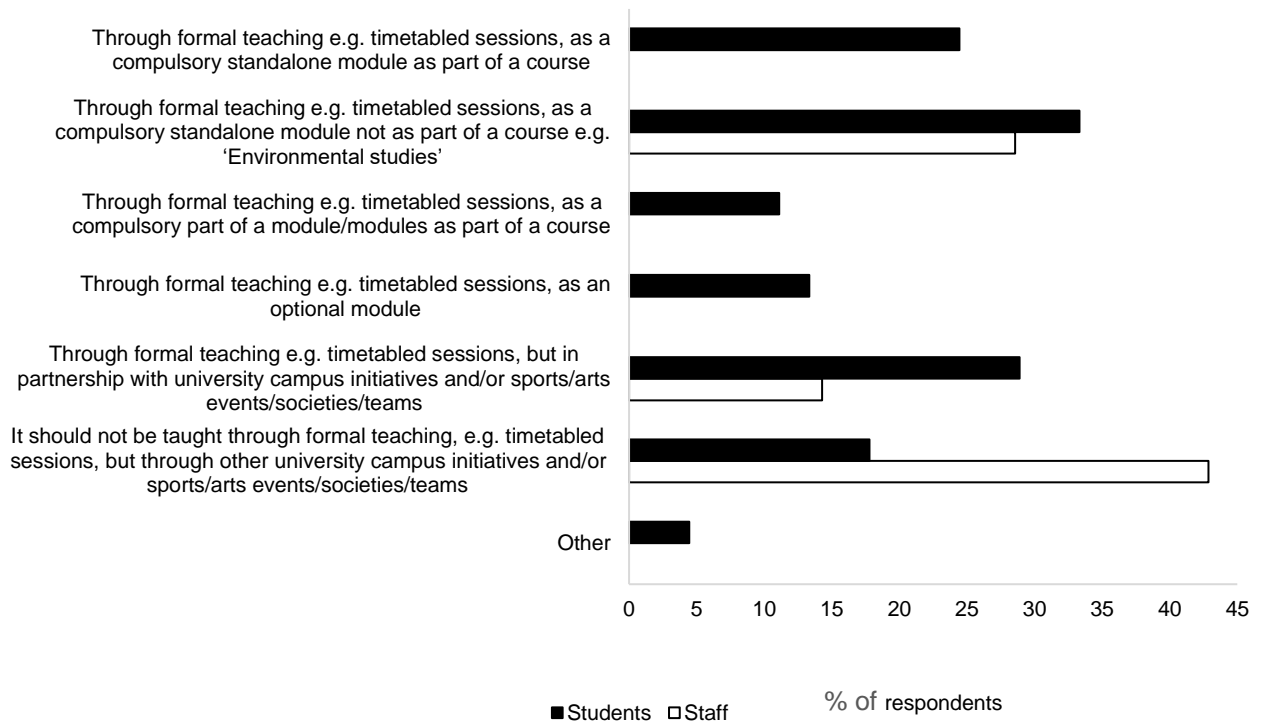
277

278 **Figure 4.** How should sustainable development/sustainability be taught at university?
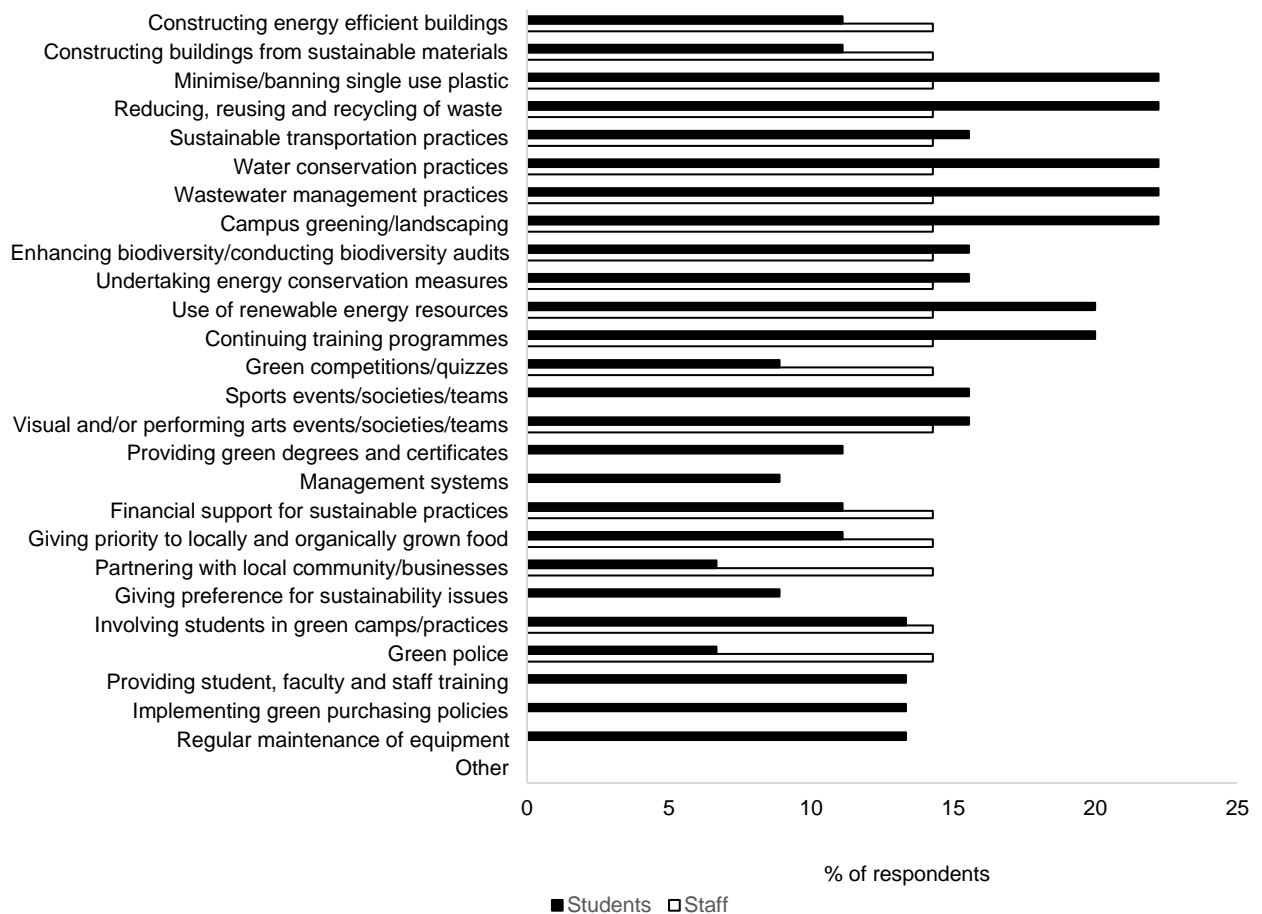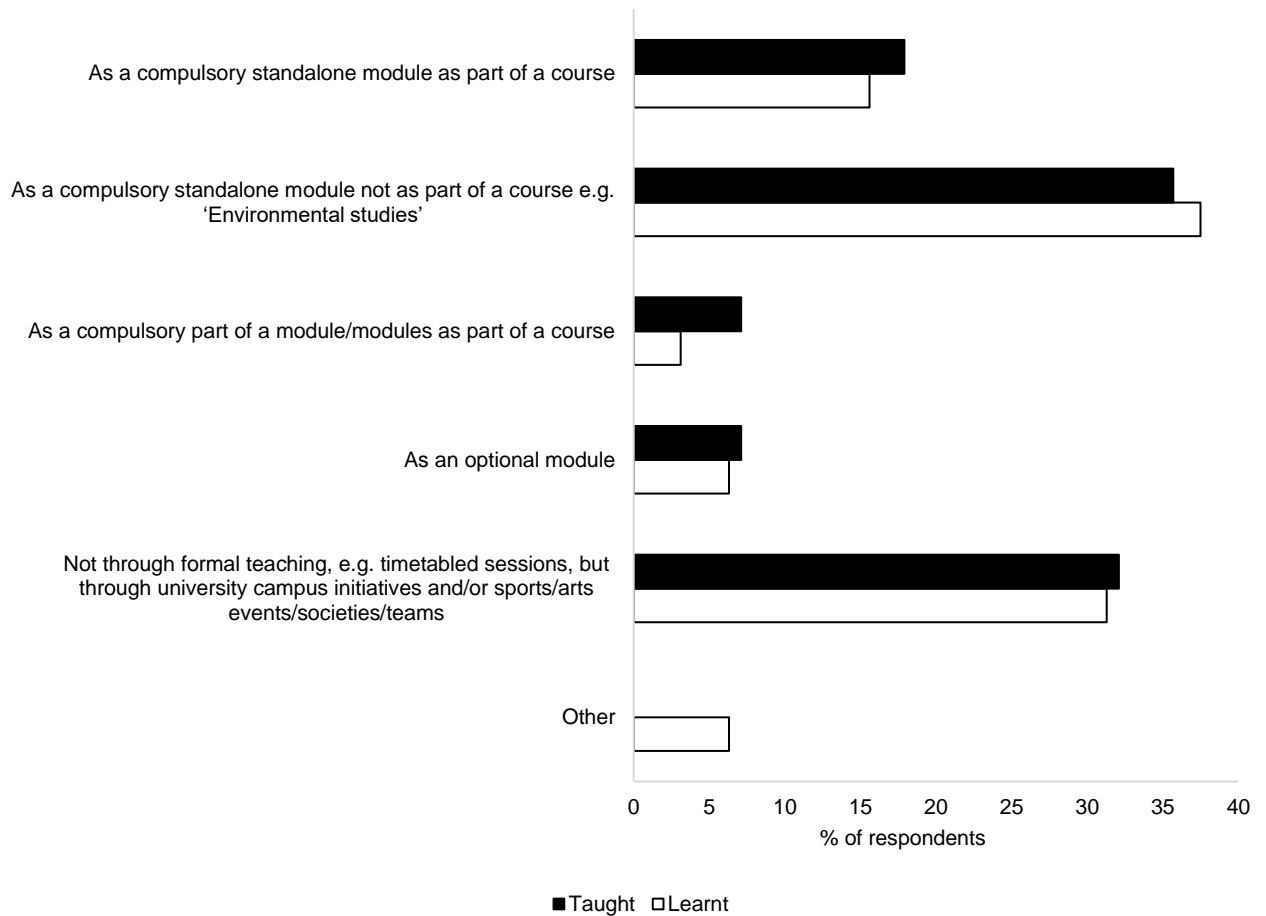
Figure 5. What types of non-formal teaching should be used to teach sustainable development/ sustainability at university?

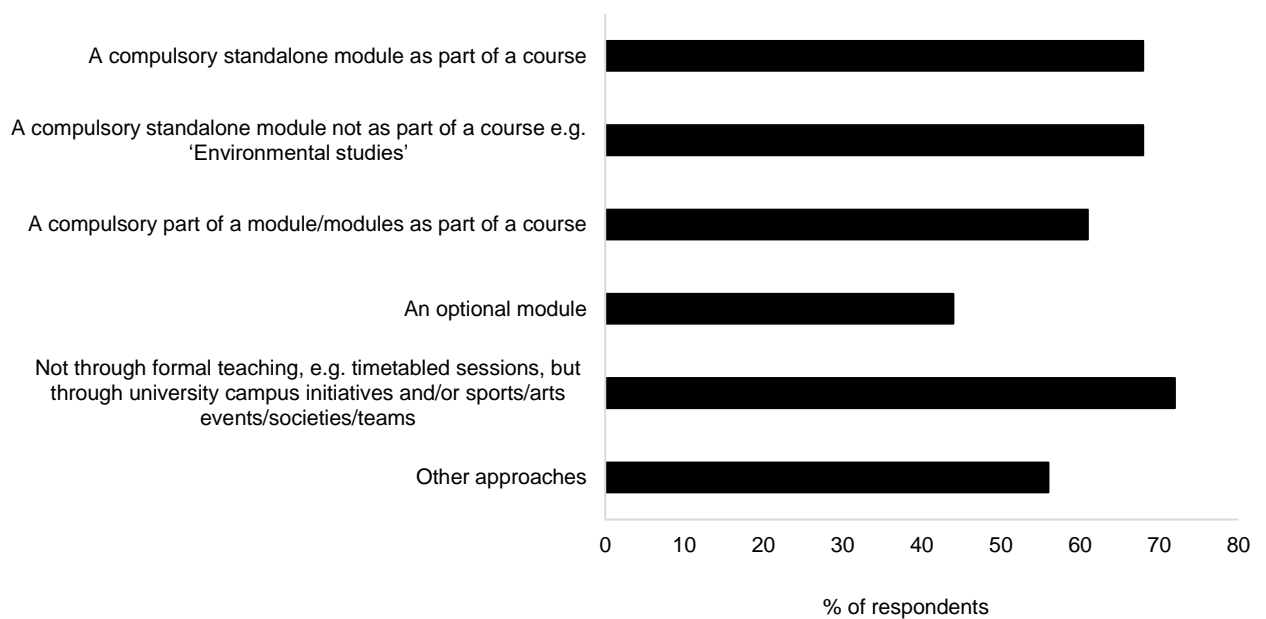### 3.3. Experiences of sustainable development/sustainability teaching at university

3.3.1. Students

Just over half of students reported being taught about sd/s at Nitte, with the majority of these taught through some form of formal timetabled sessions rather than university campus initiatives and/or sports/arts events/societies/teams. There was a positive association between the teaching and learning of sd/s at Nitte (Spearman's Rank Order Correlation; $r_s = 0.92$, d.f. $= 44$, $P < 0.001$). Several students who were not formally taught sd/s still reported learning about sd/s at Nitte. The majority of students reported learning about sd/s through some form of formal timetabled sessions with a large proportion of students referencing their ES module as an important medium for this (Figure 6). Interestingly, students felt that they had learnt the most about sd/s from 'campus initiatives and/or sports/arts events/societies/teams', 'compulsory standalone modules taken as part of their course' and 'compulsory standalone modules not taken as part of their course, e.g. Environmental Studies' (Figure 7).

12

As a compulsory standalone module as part of a course

As a compulsory standalone module not as part of a course e.g. 'Environmental studies'

As a compulsory part of a module/modules as part of a course

As an optional module

Not through formal teaching, e.g. timetabled sessions, but through university campus initiatives and/or sports/arts events/societies/teams

Other

% of respondents

■Taught □Learnt

Figure 6. Student perceptions of the contribution of different types of teaching approaches to their teaching and learning of sustainable development/ sustainability at Nitte University.
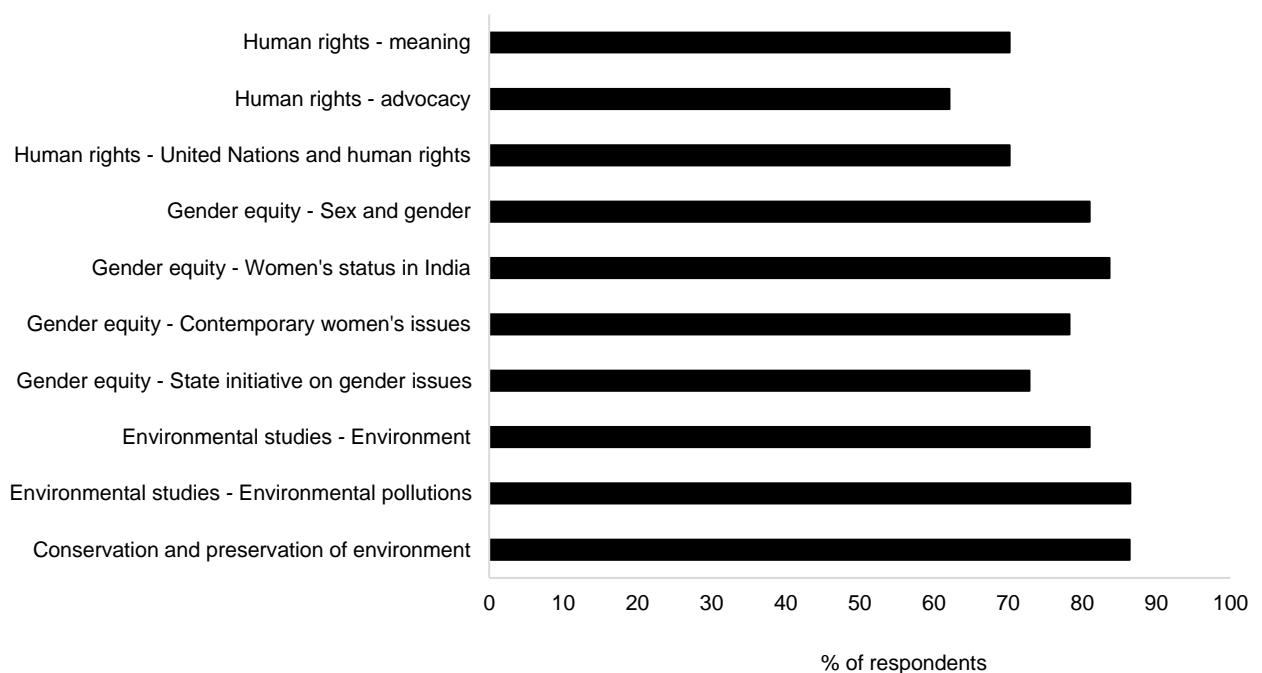

A compulsory standalone module as part of a course

A compulsory standalone module not as part of a course e.g. 'Environmental studies'

A compulsory part of a module/modules as part of a course

An optional module

Not through formal teaching, e.g. timetabled sessions, but through university campus initiatives and/or sports/arts events/societies/teams

Other approaches

% of respondents

Figure 7. Summary of student perceptions of the positive contribution of different types of teaching approaches to their learning of sustainable development/sustainability at Nitte

301 University. 'Positive' Likert scale responses include the 'somewhat', 'much' and 'a great
302 deal' categories.

303

304 At Nitte, the vast majority of students surveyed studied ES with most finding it informative,
305 covering the types of issues they were expecting. Areas such as 'Environmental pollutions',
306 'Conservation and preservation of environment', and 'Gender equity - Women's status in
307 India' were identified as the most informative parts of the programme (Figure 8). Most
308 students found their ES module engaging and that this module made a significant
309 contribution to their degree.

Bar chart categories (top to bottom):
Human rights - meaning
Human rights - advocacy
Human rights - United Nations and human rights
Gender equity - Sex and gender
Gender equity - Women's status in India
Gender equity - Contemporary women's issues
Gender equity - State initiative on gender issues
Environmental studies - Environment
Environmental studies - Environmental pollutions
Conservation and preservation of environment

X-axis: 0 10 20 30 40 50 60 70 80 90 100

% of respondents

310

311 **Figure 8.** Summary of student perceptions that their Environmental Studies module covered
312 the types of issues they were expecting. 'Positive' Likert scale responses include the
313 'somewhat', 'much' and 'a great deal' categories.

314

315 The vast majority of students reported that the teaching of ES was in large classes, with
316 lectures rather than project work or field visits the main pedagogic approach used. Just under
317 half of the students surveyed felt that they were taught ES by experts in sd/s. Most students
318 reported that social science approaches/examples were used, rather than ecological and
319 natural science approaches/examples (Figure 9). Most students felt that they 'had a voice'
320 about sd/s at Nitte and knew that Nitte had its own 'Education for Sustainable Development'

321   policy. The vast majority of students knew that the Supreme Court of India has ruled that a

322   course on 'Environmental Studies' be made compulsory as part of all UG programmes.
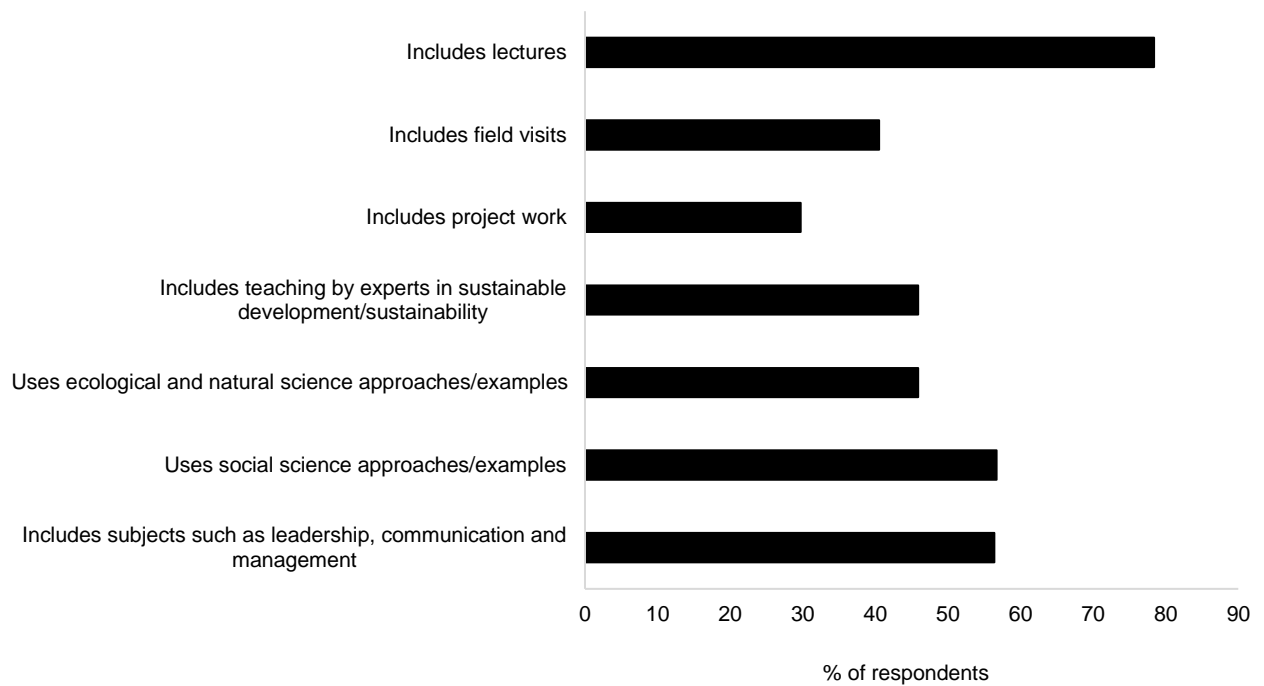

323

324   **Figure 9.** Summary of student perceptions of the use of different types of teaching
325   approaches used in the teaching of their Environmental Studies module. 'Positive' Likert
326   scale responses include the 'somewhat', 'much' and 'a great deal' categories.

327

328   Nearly all students felt that Nitte has a reputation for sd/s and most students reported that this

329   influenced their decision to study there. They also reported that they were enthusiastic to

330   learn more about sd/s. To enhance the teaching of sd/s at Nitte, students requested 'more field

331   visits', increased use of 'ecological and natural science examples/approaches' and the

332   integration of subjects such as 'leadership, communication and management'. These

333   responses were broadly in line with those improvements suggested by staff (Figure 10).
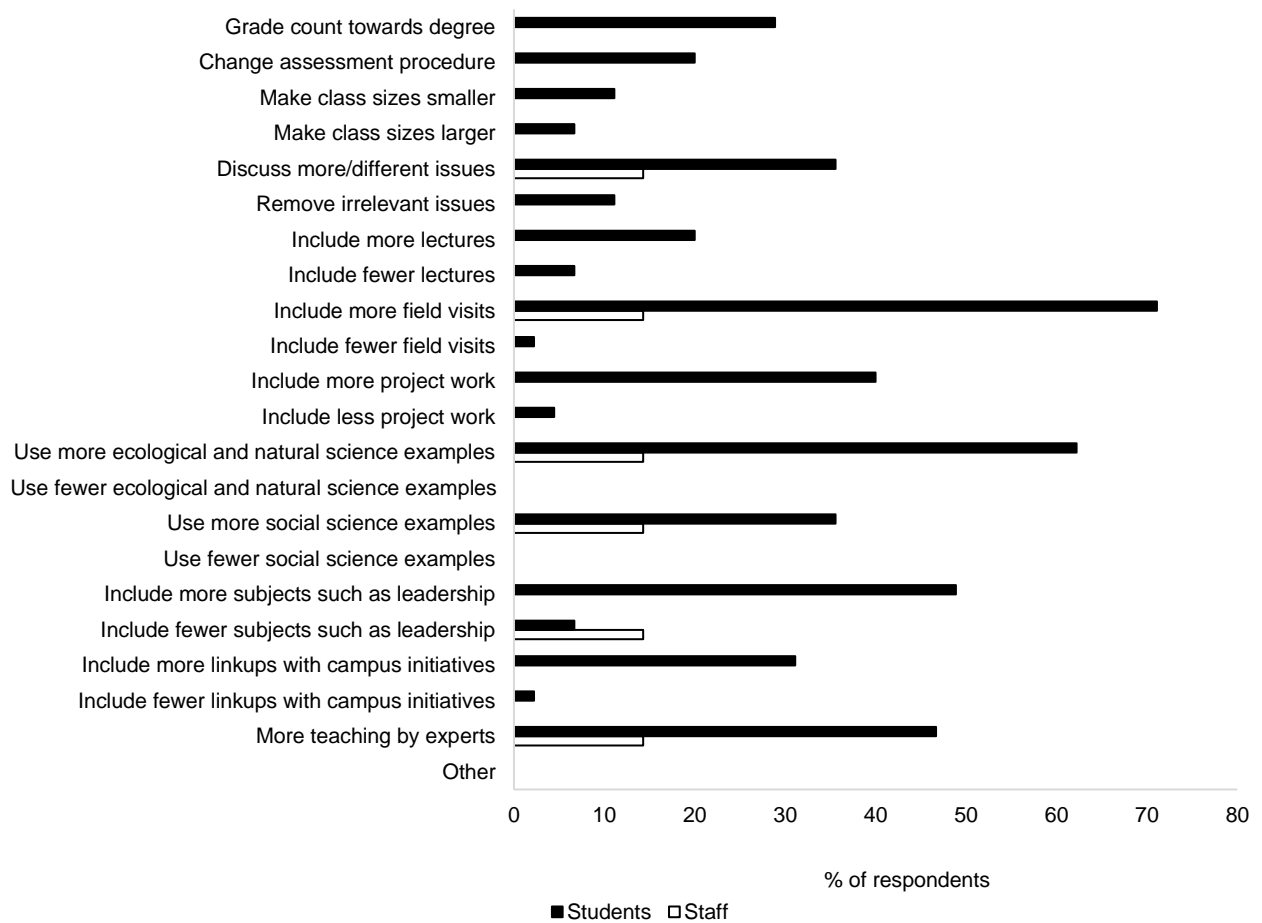
Figure 10. Student and staff perceptions of what can be done to further enhance the teaching of sustainable development/ sustainability at Nitte University.

*3.3.2. Staff*

Just over a quarter of staff who responded taught sd/s at Nitte (n=2). They also taught biology. One of these staff members taught sd/s through 'formal teaching, but in partnership with university campus initiatives and/or sports/arts events/societies/teams', specifically as 'continuing training programmes, seminars and informative courses on sustainability' using 'group work' as the main teaching method. The other staff member taught sd/s through 'university campus initiatives, e.g. in promoting the minimisation of single use plastic, energy saving measures, and sports/arts events/societies/teams' using a mixture of 'lectures', 'seminars', 'discussions', and 'independent study'. Both staff members reported that they used these teaching methods as they were the most effective. The member of staff who used 'group work' reported this was a methodology specific to their teaching of sd/s whereas this was not the case for the other staff member.

350 Both staff respondents reported that the reason they taught sd/s at Nitte were because they

351 considered it 'an important part of students' education.' Neither staff member had undergone

352 any formal training to teach sd/s, but one staff member responded that they would like to

353 undertake some. Neither staff member had encountered any barriers to their teaching of sd/s.

354 Overall staff respondents felt that Nitte has a reputation for sd/s and the same proportion

355 reported that this influenced their decision to work there, and most staff respondents felt that

356 they 'had a voice' about sd/s at Nitte.

357 *3.3.3.Personal perspectives on sustainability*

358 The overwhelming majority of students and staff surveyed felt that it was at least 'moderately

359 important' to live sustainably with the most important reasons being a combination of 'moral

360 duty', 'better for the environment', and 'better for society' (Figure 11). Students and staff

361 undertook similar personal 'sustainable living' behaviours (Figure 12).
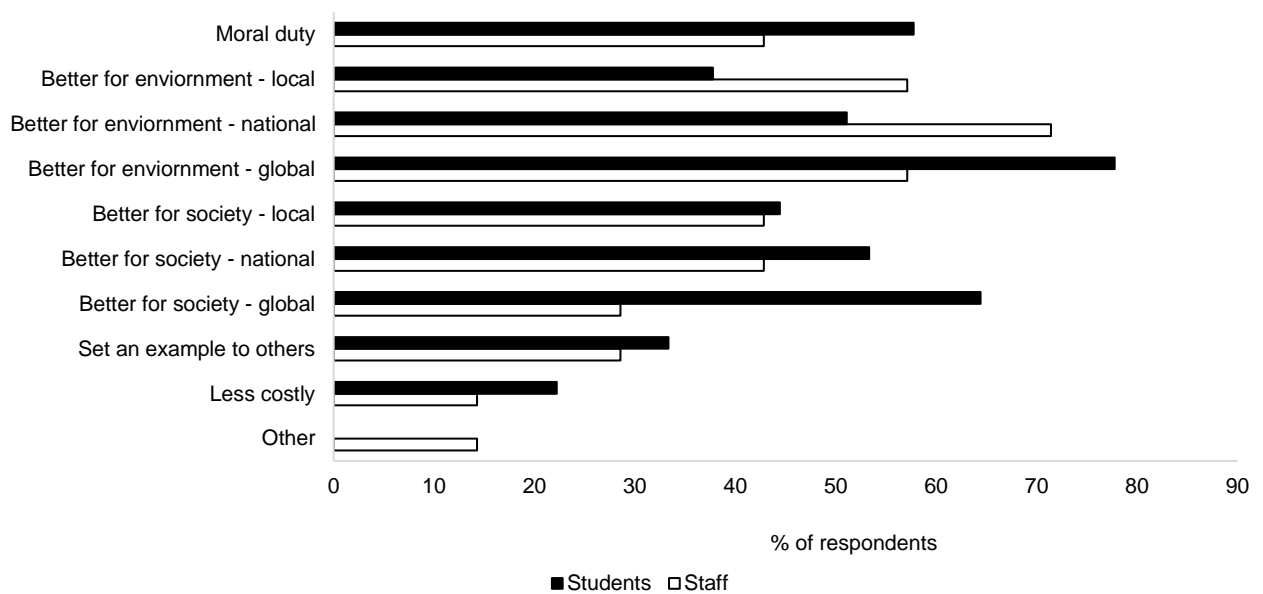
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363 **Figure 11.** Nitte University student and staff reasons for their decision to live sustainably.
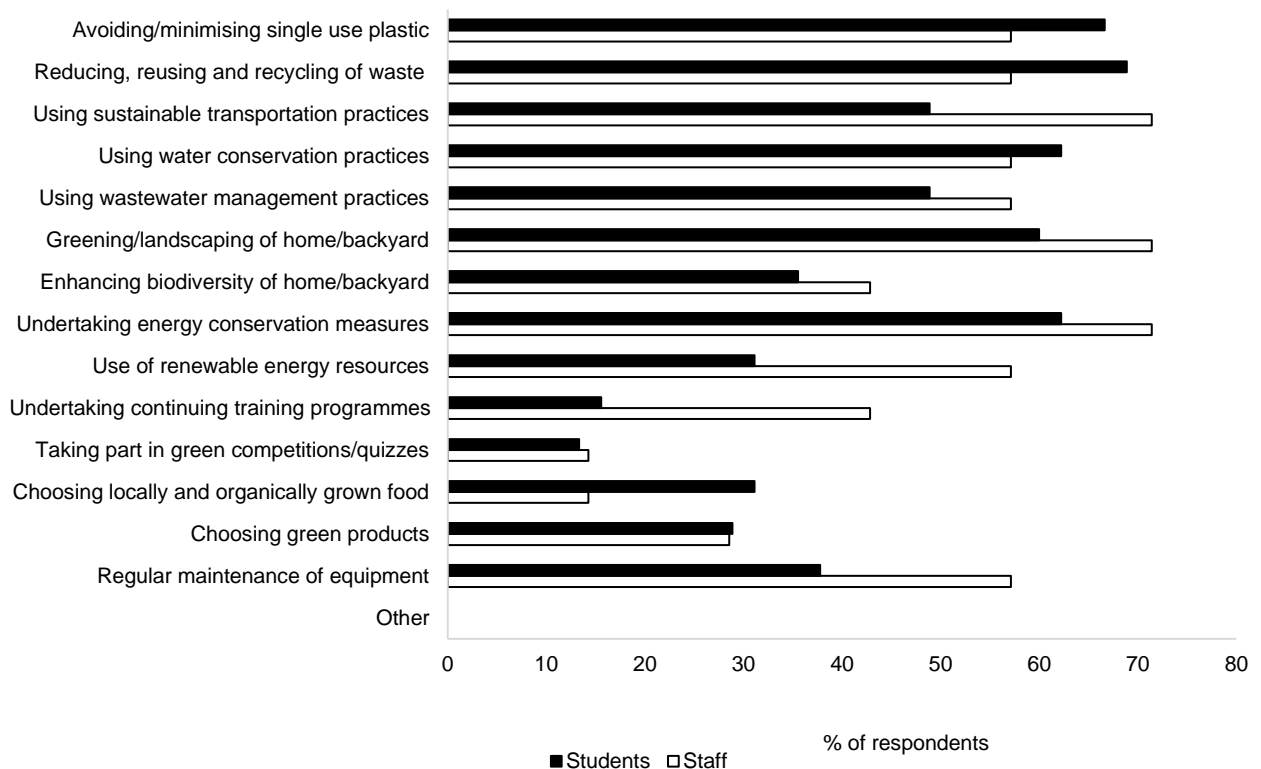
Figure 12. 'Sustainable living' behaviours adopted by Nitte University students and staff.

Lessons learned about the teaching of sustainable development/sustainability

Table 1 summarises the lessons learned from this study about the teaching of sustainable development/sustainability.

Table 1. Lessons learned about the teaching of sustainable development/sustainability for students, staff and senior managers

Students
• Students are receptive to learning and engaging with sustainable development/sustainability from a number of perspectives.
• A range of teaching methods can be used to promote student learning about sustainable development/sustainability; these can be integrated into the formal curriculum, as well as exploring more innovative, informed approaches using the environment in which they are studying as well as the University campus.
Staff
• Review and reflect on the methods used to teach sustainable development/sustainability and consider where active learning approaches, including group work, field work and project work could be integrated.
• Extend the breadth of examples used to support the teaching of sustainable development/sustainability to be inclusive of ecological and natural science perspectives. Potential to explore also interdisciplinary perspectives.
• Engage in teaching-related continuing professional development.

	• Review the teaching of sustainable development/sustainability; and reflect on the potential role of the 'hidden curriculum' to further engage students with sustainability education.
Senior managers	
	• Embed sustainability education within relevant institutional strategies. • Dedicate resources to support the continuing professional development of those involved in teaching sustainable development/sustainability.

371

4. Discussion

373 Drawing on data captured through two online questionnaires this study considered the extent

374 to which sustainability education is integrated, and how it is perceived, by students and staff

375 at Nitte University. The results from these questionnaires revealed that there was broad

376 support for the principles of sd/s and sd/s education by both students and staff, the vast

377 majority of whom felt that sd/s should be a compulsory part of a university education. This

378 supports the idea that there is a strong relationship between those individuals who have an

379 appreciation of the natural sciences and those who are the most receptive to the fundamentals

380 of sd/s. However, this is often biased towards environmental aspects (Bantanur *et al.,* 2015b).

381 Encouragingly though, when asked to choose from a list of 'curriculum entry points into

382 sustainability'(Ryan and Tilbury, 2011), the most popular topics that students and staff felt

383 should be included in sd/s education programmes were a mixture of those with an

384 environmental, economic and social focus. This was further reflected in the responses of both

385 students and staff when asked to choose from a list of topics to define what they understood

386 by sd/s (Cotton *et al.,* 2007; Winter and Cotton, 2017). This was one of the opening questions

387 in each questionnaire. It was designed to explore participants own interpretation of the topic,

388 as the researchers felt it was important to avoid imposing a set definition of sd/s at the outset

389 of the study. Taken together this suggests that amongst the students and staff surveyed there

390 is an appreciation of the 'gold standard' tripartite model of sustainability, that draws from the

391 three 'pillars' of the environmental, economic and social sciences (Schoolman *et al.,* 2010).

392 This has been highlighted as especially important to respond to the challenges of sd/s within

393 the Indian context where there remains an ongoing need to link an understanding of the

394 environment with human and social aspects of development issues (Chhokar, 2010). These

395 results add to those of Bantanur *et al.,* (2015b) (and references therein) who suggest that there

396 is a greater level of understanding of sd/s amongst students in newly industrialised countries,

397 such as India, who are faced with the multifaceted challenges of sustainable development

398 compared to those in industrialised nations.

399   The majority of students reported that they felt they knew reasonably little about sd/s before

400   they came to university and that their university experiences had contributed significantly to

401   their knowledge. This was supported by the positive association between the teaching and

402   learning of sd/s by students at Nitte (Spearman's Rank Order Correlation; $r_s = 0.92$, d.f. = 44,

403   $P < 0.001$). Several students who were not formally taught sd/s still reported learning about

404   sd/s at Nitte, potentially highlighting the importance of the 'hidden' curriculum (Winter and

405   Cotton, 2012; Cotton *et al.,* 2013). However, the majority of students who completed the

406   questionnaire reported being taught, and learning about sd/s through formal timetabled

407   sessions with a large proportion of students referencing their ES module as an important

408   medium for this. Again, students cited a mixture of environmental, economic and social

409   science based topics as being the most informative, which also suggests a well-balanced and

410   effective delivery by teaching staff. However overall, students felt that they had learnt the

411   most about sd/s from 'campus environment/initiatives' e.g. not from formal timetabled

412   sessions. This aligns with the practice of using the hidden curriculum to expose and educate

413   students about sustainability and environmental issues, which has been identified as

414   successful in other contexts (Winter and Cotton, 2012). This is an area that warrants further

415   investigation to quantify and characterise the contribution of such activities to examine ways

416   to capitalise on these to further develop students' sustainability literacy, not just in India, but

417   worldwide. It should be noted though, that regardless of the method (e.g. the formal vs

418   hidden curriculum), the vast majority of the students surveyed felt they had gained

419   knowledge about sd/s from being at Nitte.

420   Despite the perceived positive contribution of ES to their knowledge of sd/s, most students

421   reported that the teaching of this was in large class sizes, with lectures the predominant

422   teaching method. The teaching of sd/s particularly benefits from an interdisciplinary (Feng,

423   2012), but more importantly, an active teaching approach, including field visits and project

424   work (Winter *et al.,* 2015). Furthermore, these pedagogies have been shown to increase

425   student engagement with sd/s, specifically with the social dimension of the subject, and were

426   set out as 'necessary' methodologies for the teaching of sd/s when it was included into the

427   curriculum in India (Chhokar, 2010). Indeed, the students requested 'more field visits' as a

428   change they would like to see to the module. Thus at Nitte, there appears to be a mismatch

429   between how students are taught sd/s and how they want to be taught sd/s. Though overall

430   most students report a positive experience from their SE sessions, this would imply that with

431   the incorporation of active teaching formats, e.g. 'transformative pedagogies' would benefit

432 students, and the knowledge gained could be even greater (Mintz and Tal, 2018). The

433 absence of active pedagogies was reported in the nationwide evaluation of sd/s education

434 three years after its introduction (Chhokar and Chandrasekharan, 2007). Here, a lack of

435 funding was cited as the main reason for the exclusion of these types of approaches. At Nitte,

436 the staff did not report that there were any significant barriers to the teaching of sd/s, so this

437 could be a recommendation for Nitte to take forward to improve their practice (Cotton *et al.,*

438 2007). If any changes are made to the module delivery of the sd/s course at Nitte it will be

439 beneficial to repeat the questionnaire used in this study to allow the impact of these changes

440 can be assessed.

441 The majority of students reported that they found their ES module engaging and a large

442 proportion felt they were taught by experts. This study did not examine a measure of

443 'expertness' to teach sd/s but it did record that staff taught this subject because they think it is

444 'an important part of students' education' rather than purely being 'part of my job'. As is the

445 case in most academic subjects, it has been shown that if sd/s is taught by motivated teachers

446 then this has a positive effect on student engagement, learning and practicing of sd/s

447 (Chhokar, 2010). Only one staff member had received specific training, though the other was

448 keen to engage in formal training. There is an ongoing debate within the teacher training

449 community in India as to whether this should be a compulsory part of the teacher training

450 curriculum (Ravindranath, 2007). A number of successful initiatives to support the

451 development of teachers to teach sd/d have been highlighted; these have including the

452 incorporation of sd/s community projects into the training curriculum, peer-to-peer mentoring

453 and networking schemes (Ravindranath, 2007). It is likely therefore, staff at Nitte who teach

454 sd/s would benefit from on-going development and training to support their practice, as it

455 may also lead to pedagogic innovation in the curriculum design of the sd/s programme at

456 Nitte. Staff could also be encouraged to explore models of co-curricular work with

457 undergraduate students, building on the principals of students as partners, to stimulate

458 pedagogic innovation as well as actively engage students with this agenda (e.g. Heron and

459 Reason, 2001; Summers and Turner, 2011; Angus-Cole *et al*., 2020).

460 Overall, it appears that Nitte is justified in its reputation for sd/s, as recently highlighted on its

461 website (nitte.edu.in/green-campus.php). The vast majority of students and staff agreed with

462 the statement 'Nitte has a reputation for sustainable development/sustainability' reporting that

463 this influenced their decision to study or work there. In terms of ownership, the majority of

464 students and staff felt that they 'had a voice' about sd/s at Nitte and knew that Nitte had its

465 own 'Education for Sustainable Development' policy. In terms of the wider picture, the vast
466 majority of students knew that the Supreme Court of India has ruled that a course on ES is
467 compulsory as part of all UG programmes. Nitte is an example of the new tier of modern,
468 private universities which have begun to reshape the Indian HE sector with a focus on high-
469 quality research driven education. Perhaps it is not surprising that a young, life sciences
470 based, middle-class, well-educated cohort of students and staff should be fully supportive of
471 sd/s and that they were enthusiastic to teach and/or learn more about this subject. It is clear
472 that the ES programme at Nitte is delivering a non-biased gold standard' tripartite model of
473 sd/s education. However, care should also be taken during future curriculum design to
474 continue to ensure that these life science students receive sessions at sufficient depth on the
475 economic and social aspects of sd/s education as it is likely that their prior knowledge and
476 understanding of such areas will be less than the environmental aspects.

477 This research was reliant on online questionnaire to generate empirical data. Whilst there are
478 recognised challenges with online surveying, including in pedagogic research (Roberts and
479 Allen, 2015), overall this study benefitted from the advantages of this methodology. This
480 study also returned high response rates. This may have been a combination of the HE
481 environment, and society in India which remains dominated by hierarchical discipline. An
482 incentive was offered to complete the survey, an entry into a prize draw. Careful
483 consideration of the ethical implications of this was carried out, namely to ensure that the
484 prize draw actually took place and promptly, and that the size of the incentive offered was
485 proportional to avoid bias (Cobanoglu and Cobanoglu, 2003).

486 This research was focussed on one institution at Nitte, the NUCSER. From the responses of
487 the staff and students, it was clear that to some extent there was a bias towards the
488 environmental aspects of sd/s. However, when the questionnaire responses were considered
489 overall, it is clear that the teaching of sd/s and ES is delivering a non-biased gold standard'
490 tripartite model of sd/s with a focus on both environmental and societal aspects. Another area
491 for further study would be to extend the questionnaire to the entire university to compare the
492 situation across disciplines, and also to other institutions in India, integrating a range of state
493 and private providers within the sample.

494 **5. Conclusions**

495 Although conducted at a single university department, this study highlights the lessons that
496 can be learnt from India, especially surrounding the disconnect between student and staff

perceptions of sustainability theory, education and practice, suggesting that the results from this study have the potential to make an important contribution to our knowledge of sustainability education in India. It is known that there is often a departmental/disciplinary bias in the questions asked and pedagogies surrounding the teaching of sd/s at university (Aznar Minguet *et al.,* 2011). At present only one department, the Nitte University Institute of Architecture explicitly emphasises that sustainability underpins their teaching and research. However, this is not captured by any kind of formal strategy. Thus the results of this study will now be used to start to formulate a global sd/s education strategy for Nitte University. To achieve this support will be required from senior managers to allow educators to make the curriculum innovations that they need to address this. At the same time, this study has highlighted where some improvements can be made in the delivery of sd/s education at Nitte, namely the incorporation of field trips and group work into the programme. These changes would ensure the next generation of Nitte students are fully sd/s literate and able to contribute to the challenge of sd/s within India.

In recent years, work has been done to assess the environmental literacy of university students, in short to ascertain the effectiveness of sd/s education programmes (Shephard *et al.,* 2014). This study highlights the importance of effective sd/s education for the future of India. Given the ultimate aim for the Indian HE system is to produce graduates that live, work and do business in a sustainable fashion, it would appear work still needs to be done to achieve this ambitious goal.

6. Funding

7. Declaration of interest statement

The authors have no competing interests to declare.

8. Data availability statement

The data that support the findings of this study are available from the corresponding author, (LMT), upon reasonable request.

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739 **Biographies**

740 Lucy Turner is a Lecturer in Marine Biology. She is an aquatic ecophysiologist and has

741 worked in India for a number of years on interdisciplinary natural-social science projects on

742 climate change and sustainable aquaculture. This study formed part of the research project for

743 her PGCAP teaching qualification at the University of Plymouth.

744

745 Smitha Hegde is a Professor of Plant Biology at the Nitte University Centre for Science

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747 extensively on tissue culture, conservation, biodiversity and molecular markers of tree and

748 fern species. At Nitte she has championed a number of campus sustainability outreach

749 initiatives including cataloguing via QR code, and calculating the carbon sequestration of all

750 campus trees.

751

752 Indrani Karunasagar is a Director of the Nitte University Centre for Science Education and

753 Research. She is a Professor of Microbiology with research interests in medical

754 microbiology, fisheries and marine microbiology, biotechnology and food safety. She has

755 promoted greening of the Nitte University Paneer campus where she is based, including

756 implementing rainwater harvesting and water recycling facilities.

757

758 Rebecca Turner is an Educational Developer at the University of Plymouth and recognised as

759 a Principal Fellow of the Higher Education Academy. Rebecca's research addresses themes

760 included the professionalisation of higher education practice, learning gain and student

761 transitions through higher education.

762