



Students' attitudes towards campus sustainability: a comparison among three universities in Sweden

M. Mujiya Ulkhaq¹ · Reinu S. George Joseph²

© The Author(s), under exclusive license to Springer Nature B.V. 2024

Abstract

The role of higher education institutions (HEIs) in promoting and supporting sustainability has outstretched over the past decades as a result of various declarations and commitments related to the need for sustainability in HEI. As a consequence, HEIs tried to achieve campus sustainability by integrating sustainability concept into their projects, partnerships, assessments, programs, curricula, and research. Accordingly, achieving campus sustainability is not feasible without the involvement of students as the biggest stakeholders of HEI. The students have a substantial impact on sustainability by contributing to and supporting campus sustainability. This research aims to compare and analyse the attitudes of students towards campus sustainability in relation to the influence of the university. The research is conducted at three universities in Sweden, which have different environmental management system certification status. A questionnaire-based survey is employed to collect the data from students at these three universities. It aims to investigate the university's efforts to support sustainability and students' awareness towards those efforts and also to measure students' attitudes towards campus sustainability. The (one-way) analysis of variance is then used to investigate whether there is any difference (statistically) among the means of students' attitudes at these three universities. The result shows that there is a statistically significant difference in these universities. Analysis and discussion are also provided to identify the reasons behind the result.

Keywords Campus sustainability · Higher education · Students' attitudes · Sweden · University

✉ M. Mujiya Ulkhaq
ulkhaq@live.undip.ac.id

¹ Department of Industrial Engineering, Jl. Prof. Soedarto SH, Diponegoro University, Tembalang, Semarang 50275, Indonesia

² Jönköping International Business School, Jönköping University, Gjuterigatan 5, 55111 Jönköping, Sweden

1 Introduction

Sustainable development (SD) can be expressed as a development that satisfied the needs of the present without compromising the capacity of future generations to meet their own needs (Brundtland, 1987). The goal is to achieve a balance between environment, economic, and social sustainability (Hopwood et al., 2005). In such, sustainability encompasses three domains, namely environmental, social, and economic; there are called as three pillars of sustainability. Since SD could bring many benefits (e.g. protect the planet, reduce poverty, restore water quality, and diminish inequality), efforts have been being made to achieve sustainability.

Higher education institutions (HEIs) are considered to be in a unique position to address this challenge. Since the Stockholm Conference in 1972, there has been a rising of international attention in the role of HEIs in promoting, fostering, and implementing sustainability (Filho, 2010). Consequently, there are a growing number of HEIs which have incorporated sustainability into their research, curricula, operating activities, assessments, as well as reporting (Cortese, 2003). There is a shared understanding that a sustainable university entails a balance among environmental issue, public participation and social responsibility, as well as teaching and research in its policy formulation (Alshuwaikhat & Abubakar, 2008). HEIs are expected to give an education to the students with interdisciplinary knowledge that could have effects on the environment and influences on local communities (Uhl & Anderson, 2001). Therefore, HEIs have a responsibility to promote environmental-friendly behaviour, to foster energy efficiency, and to campaign sustainability practices.

Accordingly, achieving campus sustainability is not feasible without the involvement of all stakeholders, such as students, alumni, staff and faculties, funding agencies, and the community (Wright, 2010; Yuan et al., 2013). Among those, students are one of the biggest stakeholders who can cause a meaningful impact on sustainability by contributing to and supporting the sustainability of campuses and beyond (Emanuel & Adams, 2011). Moreover, they play a vital role in a bottom-up approach to stimulate awareness and urge interactions among the stakeholders (Christensen et al., 2009; Wright, 2002). Given that students are among the key stakeholders, understanding their attitudes towards campus sustainability may give insight into how a university is likely to employ sustainable practices (Coy et al., 2013).

The objective of this research is therefore to compare the attitude of student in relation to the university's influence towards campus sustainability. A case study is conducted to assess and compare three universities in Sweden, namely "C University" (CU), "G University" (GU), and "J University" (JU). The rationale behind choosing these three universities is due to the environmental management system (EMS) certification status. GU was environmentally certified according to ISO 14001 and registered under eco-management and audit scheme (EMAS); CU has been certified according to ISO 14001; and JU has none. This difference in the EMS certification status is expected to result in the different finding towards students' attitudes among these three universities. The research question is then formulated as "*Is there any difference in students' attitudes at universities that have different EMS certification statuses?*".

This study contributes to the literature as follows:

- There are several studies investigating student's attitude towards campus sustainability, see Sect. 2.3 for a brief literature review. However, studies on the influence of university to students' attitudes are still in the initial phase—moreover, they produced inconsis-

ent results. The study from Dagiliūtė et al. (2018) reported that there was no significant difference when they compared student's attitude at two universities (one represents as the green university, while the other does not). Contrarily, it is expected that sustainable universities will contribute more to the sustainability since, in fact, committed universities (e.g. which have signed declarations or initiatives about SD) tend to involve more in the implementation of SD compared to uncommitted universities (Lozano et al., 2015). This claim was confirmed by Ulkhaq et al. (2019a) who stated that students from greener university have higher attitudes than students from less green university. As further research is necessary to explain more about these conflicting findings, this study then aims to compare the attitude of students in relation to the campus sustainability at three universities in Sweden, which have different environmental management system (EMS) status: GU with two EMS certifications, CU with one certification, and JU with none. This difference in EMS certification status is expected to result in a different finding towards student's attitude among those three universities.

- We argue that the difference of students' attitudes at these three universities is not because of the difference in EMS certification. Notice that the result of this study reveals that GU that has two EMS certifications performs relatively the best among others, while JU that has none performs relatively the worst. By looking at the statistics only, one might mislead to jump to a conclusion that the difference is due to the EMS certification status. We then provide a detailed discussion towards these findings to explore the reasons why the student's attitude at each university might be similar or different for each indicator of campus sustainability.

2 Theoretical framework

2.1 Sustainability

For the last two decades, there is a surge in publications on sustainability. However, it remains an open concept with numerous interpretations and context-specific understanding (Purvis et al., 2019). One predominantly description of sustainability includes three interconnected pillars (Boyer et al., 2016), dimensions (Lehtonen, 2004), components (Zijp et al., 2015), perspectives (Arushanyan et al., 2017), or aspects (Tanguay et al., 2010), including environmental, social, and economic factors. Those three might be drawn in various ways, including pillars, concentric circles, or overlapping circles. Note that those terms are used interchangeably, and our preference for pillars is largely arbitrary.

The environmental pillar often gets the most attention. It is focusing on reducing carbon footprints, water usage, packaging waste, and other effects on the environment. It is established on the premise that healthy ecosystems provide vital goods and services to humans and other organisms. The social pillar is the ability of society to persistently achieve good social well-being in the long term. Economic pillar refers to the ability of an organization that uses its resources efficiently so that it can operate in a sustainable manner to consistently produce an operational profit. Only through balancing those pillars, true sustainability could be achieved.

Sustainability is common to be seen as SD as it refers to "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 41). Currently, it seems that organizations are changing to become more sustainable in practice (Kell, 2003). However, many managers had

difficulties in getting along with SD requirements (Hall & Vredenburg, 2003) as it might be considered as a threat to organizational profit. SD should not be considered as a threat since the organization that adopts SD principles can enjoy positive benefits, including improving operational efficiency, improving risk management, enhancing brand value and reputation, promoting innovation, building and sustaining shareholder value, as well as generating revenues (Nejati et al., 2010).

2.2 Campus sustainability

The 1972 UN Conference on the human environment in Stockholm denoted the first global summit to consider human impacts on the environment. It is widely recognized as the first reference about sustainability in HEIs. Since then, there are conferences and declarations discussed the role of HEIs in supporting sustainability, from Belgrade Charter in 1975 to Turin Declaration in 2009 [see Lozano et al., (2013) and Ulkhaq et al., (2016), for the list of the declarations on HEIs and SD]. As a result, HEIs are currently competing—or under pressured (Savely et al., 2007)—to integrate sustainability into their curricula, research, operations, service, outreach, assessment, and reporting (Cortese, 2003).

As earlier mentioned, that sustainability constitutes three pillars, i.e. environmental, social, and economic, however, the term sustainable campus cannot suitably embrace those pillars. This is because HEIs mostly engage in the field of education and research, not in the field of environmental, social, and even not intended to gain much profit; hence, the sustainable campus is defined differently. A sustainable campus has to harmonize among environmental concern, partnership or cooperation dispute, social issue, as well as teaching and research in policy formulation (Alshuwaikhat & Abubakar, 2008; Velazquez et al., 2006). There are some frameworks to achieve campus sustainability, such as ISO 14001 (Fisher, 2003; Pramono et al., 2017; Setyorini et al., 2016), eco-management and audit scheme (Delakowitz & Hoffmann, 2000), green building initiative (Owens & Halfacre-Hitchcock, 2006), environmental impact assessment (Ramos et al., 2008), graphical assessment of sustainability in universities (Lozano, 2006), and sustainability tracking, assessment and rating system (Urbanski & Filho, 2015); see Ceulemans et al. (2015) for the comprehensive review of sustainability assessment tools and reporting in HEIs.

Implementing any of the previous practice alone will not ensure campus sustainability to be achieved as there are several weaknesses embedded in those practices (Fischer et al., 2015; Yarime & Tanaka, 2012). Therefore, it is required to adopt a systematic framework that could integrate the dimensions of campus sustainability and handle the observed limitations. This research employed a framework by Alshuwaikhat and Abubakar (2008), which engages three dimensions of campus sustainability comprehensively, namely university environmental management system (EMS), public participation and social responsibility, and sustainability teaching and research. This framework has been widely used to assess campus sustainability practices (e.g. de Castro & Jabbour, 2013; Ulkhaq et al., 2016, 2019b).

The university EMS forms a set of guidelines, procedures, processes, along with resources to establish, develop, review, implement, and maintain the policy to achieve a sustainable environment. It constitutes two approaches, i.e. environmental management and improvement, along with the green campus. The first approach can be achieved by diminishing the undesirable effects of university operations, lowering the pollution, using energy and resource efficiently, protecting and improving the environment, reducing waste,

and recycling. The second approach could be performed by enabling green building, supporting green transportation, and executing campus preservation.

Public participation and social responsibility deal with the involvement of any stakeholder of the university in attaining campus sustainability; and the university social responsibility of encouraging justice, fairness, and equality to all race and gender. It also relates to fulfilling the needs of the handicap and people with special treatments. There are three approaches to deal with: public participation, community services, and social justice. The first approach can be performed by the alumni, campus community, and partnership with third parties. The second approach is through public lectures and community projects, while the last approach could be done through equality and care for handicapped people.

The last dimension is related to workshops, seminars, meetings, or conferences conducted by the university in supporting sustainability. The university must also offer courses related to sustainability. Lastly, research and development related to environmental protection, renewable energy, green technology, and climate change also might support the university to achieve sustainability.

2.3 Student's attitude towards campus sustainability

Research related to student's attitude towards sustainability is abundant as a result of a huge awareness of scholars towards this issue. Several recent—worth mentioning—and related articles with their brief summaries are presented as follows.

Emanuel and Adams (2011) investigated student's perception at two public universities in Alabama and at one community college in Hawaii. There seems to be little or no knowledge gap as the students have similar knowledge about sustainability and similar views about who is responsible for sustainability. However, there is a commitment gap since students from Hawaii expressed more concern for and willingness to participate in sustainable practices, meaning that students follow where their community leads.

Nejati and Nejati (2013) provided a reliable scale to assess HEI's sustainability practices from the perspective of students. Zwickle et al. (2014) presented a tool for assessing the sustainability knowledge of an undergraduate student that covers foundational concepts from three pillars domains.

Zeegers and Clark (2014) explored whether a course that focused on raising student's awareness of sustainability would produce graduates with the knowledge and commitment required to drive sustainability issue. The finding showed that students had a range of different levels of conceptions of sustainability; they tended to only focus on the environmental pillar. It leads to a conclusion that students need to be taught for sustainability through a balanced point of view, i.e. giving equal consideration to three pillars of sustainability.

Fisher and McAdams (2015) examined how both the amount and type of coursework affect student's knowledge of sustainability. Results showed that type of course taken has a significant impact on the way students conceptualize sustainability, while the number of courses taken has no statistically significant impact. It suggests that more exposure rather than continued exposure to a particular theme in the class.

The findings from Abubakar et al. (2016) showed that although students have high awareness and concern about campus sustainability, they lack interest and willingness to participate in initiatives towards achieving sustainability. The reason could be identified from the study of Figueredo and Tsarenko (2013), which found that educational programs and promotional activities in conjunction with enhancing student's sustainability concern have a significant effect on willingness to participate in sustainability initiatives.

Ulkhaq et al. (2018) attempted to analyse the gap between what are the sustainability programs conducted by the university and what the students have perceived about the programs. Results showed that from twelve indicators used, only one has positive gap, one has zero gap, and the rest have negative gaps, indicating that the sustainability programs are not perceived well by the students.

Lozano et al. (2015) stated that sustainable university will contribute more to sustainability. Accordingly, students at a sustainable university will tend to have higher attitudes than students at non-sustainable university. This claim is confirmed by Ulkhaq et al. (2019a) who stated that students from greener university have higher attitudes than students from less green university. However, the finding from Dagiliūtė et al. (2018) showed the opposite way. The study compared student's attitude towards campus sustainability at two universities in Lithuania (one is considered as the sustainable university, while the other is not). Even though result showed that students from the sustainable university tend to more frequently involved in sustainability activities and events compared to students from the non-green university, another result showed that there was no significant difference regarding sustainability aspects in general coming from the students at those two universities. Therefore, further research is necessary to explain more about these conflicting findings.

3 Research design

The objective of this research is to compare and analyse the attitude of students towards campus sustainability in relation to the influence of the university. A case study is conducted to assess and compare three universities in Sweden, namely CU, GU, and JU. These three universities have different EMS certification status. The certification requires systematically improvement and organization of activities related to sustainability. It tends that certified universities are constantly improving their operations with a view to reduce any negative environmental impact and support the positive effects for SD through research, education, and cooperation with the surrounding society. Two well-known international EMS certifications are ISO 14001 and EMAS.

ISO 14001 standard is the main international reference developed by the International Organization for Standardization (ISO), which is intended for an organization aiming to implement EMS and obtain an environmental certification process. On the other hand, EMAS that was developed by the European Commission in 1993 enables an organization to assess, manage, and continuously improve its environmental performance. It is similar to ISO 14001 in its components and requirements. Nevertheless, unlike ISO 14001, EMAS is more rigorous in instructing the organization to reduce environmental impacts (Sulzer, 1999).

GU was environmentally certified according to ISO 14001 and registered under EMAS. CU has been certified according to ISO 14001, but this university has no EMAS certification. On the other hand, JU has none. This difference in EMS certification status is expected to result in a different finding towards students' attitudes among these three universities.

3.1 Data collection

A questionnaire-based survey is employed to collect the data. The requirement to participate in this survey is only the fact that s/he is a student of these three universities. The

potential respondents are first approached and asked if they agreed to participate in the survey. There are two types of data collection in this research. The first is a fieldwork survey using off-line (printed version) questionnaire, where the researchers collect the data by approaching the potential respondents and asking them to fulfil the questionnaire. To raise the response rate, we provide a trivial present for the respondents who have completed the survey. The second is a web-based survey using an online questionnaire. It is a low-cost technique and the respondents who are not reachable can be reached conveniently. The online questionnaire is currently gaining popularity since it is fast, cheap, and effortless. The duration for data collection is about two months.

3.2 Measurement

In this study, student's attitude towards campus sustainability refers to the degree to which a student has a favourable or unfavourable evaluation towards campus sustainability. The attitude is directly proportional to the salient belief and subjective evaluation. Since the attitude is the antecedent of human behaviour (Ajzen, 1991), it implies that to behave in a sustainable manner, the student must have a good (or high) attitude towards it.

Students' attitudes towards campus sustainability are assessed by using the questionnaire. The questionnaire is divided into four main sections. The first section aims to collect demographic data of the respondents (i.e. the students of CU, GU, and JU), such as name, nationality, age, gender, school or faculty. All of those are required to be filled, but the name is optional (anonymity is kept). The information that the students have taken any courses related to sustainability (mandatory or voluntary) is also required to identify whether the students are familiar with the sustainability concept or not.

The second section aims to investigate the university's efforts to support sustainability and student's awareness towards those efforts. It comprises of five questions. The first is whether the university informed the students (through leaflet, banner, notification, or announcement) about: to leave the computer on standby mode when it is no longer used (Q1.i), to turn off the lights whenever it is not necessary or when leaving the room (Q1.ii), to close the windows and the door when leaving the room (Q1.iii), to turn off the taps to save water usage (Q1.iv), to dispose waste in trash bin (Q1.v), and to avoid printing when it is not necessary (Q1.vi). Second question is whether the university encouraged student's attitude by providing: separate trash bins to sort the waste (Q2.i), digital materials to avoid printing on paper (Q2.ii), environmentally friendly products (e.g. recycled materials, reused products, organic foods, etc.) (Q2.iii), kitchen room and/or facility to reheat and refrigerate foods (Q2.iv), special care and assistance to the handicap and people with special needs (Q2.v), and free transportation to go to the university (Q2.vi). Third question is whether the university showed any involvement/partnership/cooperation: with government agencies, private sectors, and/or non-governmental organizations (NGOs) in supporting sustainability (Q3.i), in promoting gender and racial equality (Q3.ii), with local communities that are working towards sustainability (Q3.iii), with alumni in supporting sustainability (Q3.iv), and with students association or community to promote sustainability (Q3.v). Fourth question is whether the university has: workshops, seminars, meetings, and/or conferences on sustainability (Q4.i), programs (i.e. undergraduate or graduate) related to sustainability (Q4.ii), courses or classes related to sustainability (Q4.iii), research group related to sustainability (Q4.iv), and events promoting sustainability (Q4.v). The fifth question is asking

whether the university is easily accessible by public transportation or not (Q5). There are three options to answer those questions, i.e. “yes”, “no”, and “I have not heard of it”. “Yes” answer means that the students are sure that the university does it; “no” answer means that they are sure that the university does not do it; and “I have not heard of it” answer means that they are not sure whether the university does it or does not do it.

The third and fourth sections aim to measure student’s attitude towards campus sustainability. Twenty-three indicators generated from three dimensions of campus sustainability framework by Alshuwaikhat and Abubakar (2008) were used. As discussed previously, the attitude is directly proportional to the salient belief and subjective evaluation of campus sustainability indicators. The indicators are similar to the second section, but different wording was used in these sections. The belief indicates how important each campus sustainability indicator to the students. It is measured by using a five-point Likert scale, ranging from 1 (very unimportant) to 5 (very important). A sample question is: “How important is it to you for the university to have partnership/cooperation with students’ association to promote sustainability?” (Q3.v). The subjective evaluation indicates students’ perspective of perceived consequences for each indicator. It is measured by using a five-point Likert scale, ranging from 1 (very unlikely/never) to 5 (very likely/always). A sample question is such: “It is ... that I would involve in workshops, seminars, meetings, and/or conferences on sustainability if the university conducts it” (Q4.i). The detailed of the questionnaire is available upon the request.

3.3 Statistical analysis

The collected data are first tested its (convergent) validity by using the confirmatory factor analysis (CFA). The rules of thumb given in Hair et al. (2014) are used to validate the convergent validity. First, the standardized factor loading estimates should be 0.5 or higher; second, the average value explained (AVE) should be 0.5 or greater. Next, to check the internal reliability, the Cronbach’s alpha coefficient (Cronbach, 1951) is calculated. In practice, the coefficient of at least 0.70 has been suggested to indicate adequate reliability (Nunnally & Bernstein, 1994).

To test the research question, i.e. whether there is any difference in the attitudes of students at CU, GU, and JU, the null and alternative hypotheses are formulated as follows.

$$H_0: \mu_1 = \mu_2 = \mu_3.$$

$$H_1: \text{at least two group means are not equal,}$$

where μ_j is the mean of group j ($j = 1, 2, 3$)—group means the university. The one-way analysis of variance (ANOVA) is used to test this hypothesis (see the statistical textbooks for more detailed discussion).

Suppose that after performing the ANOVA, the null hypothesis is rejected; hence, there is a difference between the groups but groups(s) which is(are) different is(are) not specified. The ANOVA is an omnibus test statistic; it means that it only tells that the groups are equal or at least two groups are not equal. To determine which specific groups differed from each other, a post hoc analysis has to be conducted. In this sense, we wish to compare only pairs of means, to be precise, μ_1 vs μ_2 , μ_1 vs μ_3 , and μ_2 vs μ_3 :

$$H_0: \mu_i = \mu_j \ (i = 1, 2, 3; j = 1, 2, 3, i \neq j).$$

$$H_1: \mu_i \neq \mu_j, \text{ for all } i \neq j.$$

In this research, the Gomes–Howell test is used since this test is designed for unequal variances and unequal sample sizes.

4 Result

4.1 Sample characteristics

There are two hundred and fifty-seven respondents spreading across those three universities. They are having diverse nationality, where Swedish students have the highest percentage among all. In terms of gender, male students dominate by 51.3%. More than one-third of the respondents are coming from engineering school (36.6%), while 32.7% of the respondents are from business-related school. The respondents also are asked if they have taken any course related to sustainability in their previous studies to know the number of respondents familiar with the concept. The result shows that 44.7% chose “Yes”, confirming they have taken a sustainability course. For those who said “Yes”, 49.1% of them said that the course is mandatory. Profile of the respondents is summarized in Table 1.

4.2 Scale purification

To check construct validity of the indicators used, the confirmatory factor analysis is employed. Hair et al. (2014) recommended that the standardized factor loading estimates should be 0.50 or higher and the average value explained (AVE) should be 0.50 or greater. According to our calculation, all indicators have factor loadings more than 0.50 unless Q5 which has 0.419. The AVEs are 0.487, 0.646, and 0.704 for first, second, and third dimensions, respectively. Poor factor loading simply means that the indicator is not contributing to measuring the dimension (or construct). The particular indicator which has poor factor loading is Q5. It measures whether the university is easily accessible by public transportation or not. This indicator somehow overlaps with another indicator, which also measures the same matter, i.e. Q2.vi; hence, the indicator which has low factor loading, i.e. Q5, is removed. We repeat the calculations to get the revised factor loadings and AVEs. All factor loadings now are above 0.5 and the AVEs for all factors are above 0.50, meaning that the questionnaire supports construct validity. In addition, standardized covariances among the dimensions are also high, i.e. the first vs. the second dimension is 0.70; the first vs. the third dimension is 0.69; and the second vs. the third dimension is 0.91.

Lastly, to check the internal reliability, the Cronbach's alphas (Cronbach, 1951) are computed for each dimension. The result shows that all values are above 0.7 (precisely, 0.917, 0.908, and 0.921 for the first, second, and third dimensions, respectively), indicating that the questionnaire is reliable (Nunnally & Bernstein, 1994).

4.3 Student's awareness

The second section of the questionnaire asks the respondents whether they are familiar with the university's efforts to support sustainability. The result is shown in Table 2. About 62.3% of the respondents answered that the university does not inform them to leave the computer on standby mode when it is no longer used, while 26.5% of them claimed that they have no idea about this. The university does not have information to turn off the lights whenever it is not necessary or when the students leave the room, mentioned by 60.3% of

Table 1 Profile of the respondents (in %)

Variables	Total	JU	CU	GU
<i>Nationality</i>				
Swedish	39.3	14.8	14.4	10.1
Other European countries	21.4	9.7	4.7	7.0
Asian countries	29.9	12.8	10.9	6.2
African countries	7.7	1.9	0.4	5.4
American countries	1.6	0.4	0.4	0.8
<i>Gender</i>				
Male	51.3	21.0	21.0	9.3
Female	46.7	18.3	9.7	18.7
Prefer not to say	2.0	0.4	0.0	1.6
<i>Age</i>				
19–22	22.9	10.1	6.6	6.2
23–26	51.3	20.2	18.3	12.8
27–30	15.5	5.8	3.9	5.8
31–34	7.4	1.2	1.9	4.3
35–38	2.0	1.6	0.0	0.4
> 39	0.8	0.8	0.0	0.0
<i>School or faculty</i>				
Business-related	32.7	25.7	3.5	3.5
Engineering	36.6	7.0	24.5	5.1
Social science	11.7	1.6	0.4	9.7
Nature science-related	3.9	0.0	1.6	2.3
Medical-related	7.0	1.9	0.4	4.7
Arts-related	0.4	0.0	0.0	0.4
Education-related	6.6	3.1	0.0	3.5
Others	1.2	0.4	0.4	0.4
<i>Level of study</i>				
Master	65.0	21.4	21.4	22.2
Bachelor	35.0	18.3	9.3	7.4
<i>Type of study</i>				
Full time	94.6	36.2	29.2	29.2
Part time	0.2	0.2	0.0	0.0
Exchange	4.7	2.7	1.6	0.4
<i>Years of study</i>				
1st year	53.3	19.8	15.2	18.3
2nd year	28.1	12.5	8.6	7.0
3rd year	12.1	5.1	3.9	3.1
> 3rd year	6.6	2.3	3.1	1.2
<i>Taking course related to sustainability</i>				
Yes	44.7	16.7	15.2	12.8
No	55.3	23.0	15.6	16.7
<i>Course is mandatory</i>				
Yes	49.1	22.6	17.0	9.4
No (optional)	50.9	22.0	13.8	15.1

Table 2 Student's awareness at each university (in %)

Dimensions/indicators		Total	JU	CU	GU
<i>University EMS</i>					
Q1.i	Yes	11.3	5.4	4.7	1.2
	No	62.3	22.2	18.3	21.8
	I have not heard of it	26.5	12.1	7.8	6.6
Q1.ii	Yes	23.0	13.6	5.1	4.3
	No	60.3	17.9	20.2	22.2
	I have not heard of it	16.7	8.2	5.4	3.1
Q1.iii	Yes	16.7	8.6	5.1	3.1
	No	62.3	20.6	19.1	22.6
	I have not heard of it	21.0	10.5	6.6	3.9
Q1.iv	Yes	13.6	5.4	5.1	3.1
	No	65.8	22.2	20.2	23.3
	I have not heard of it	20.6	12.1	5.4	3.1
Q1.v	Yes	81.7	28.8	25.7	27.2
	No	8.9	5.8	2.7	0.4
	I have not heard of it	9.3	5.1	2.3	1.9
Q1.vi	Yes	21.0	9.3	7.8	3.9
	No	58.8	18.7	18.3	21.8
	I have not heard of it	20.2	11.7	4.7	3.9
Q2.i	Yes	95.3	36.2	29.6	29.6
	No	3.5	2.7	0.8	0.0
	I have not heard of it	1.2	0.8	0.4	0.0
Q2.ii	Yes	89.5	32.7	28.4	28.4
	No	7.0	6.2	0.8	0.0
	I have not heard of it	3.5	0.8	1.6	1.2
Q2.iii	Yes	58.4	14.0	24.5	19.8
	No	19.5	12.8	3.1	3.5
	I have not heard of it	22.2	12.8	3.1	6.2
Q2.iv	Yes	94.2	36.2	29.2	28.8
	No	2.7	1.9	0.4	0.4
	I have not heard of it	3.1	1.6	1.2	0.4
Q2.vi	Yes	8.2	2.3	4.7	1.2
	No	79.0	31.5	22.2	25.3
	I have not heard of it	12.8	5.8	3.9	3.1
<i>Public participation and social responsibility</i>					
Q2.v	Yes	75.9	24.1	24.9	26.8
	No	3.9	2.3	0.4	1.2
	I have not heard of it	20.2	13.2	5.4	1.6
Q3.i	Yes	56.4	13.6	20.2	22.6
	No	8.6	4.7	1.6	2.3
	I have not heard of it	35.0	21.4	8.9	4.7
Q3.ii	Yes	68.5	21.0	24.1	23.3
	No	5.1	3.9	0.4	0.8
	I have not heard of it	26.5	14.8	6.2	5.4
Q3.iii	Yes	31.1	11.3	12.1	7.8
	No	12.8	4.7	3.5	4.7

Table 2 (continued)

Dimensions/indicators		Total	JU	CU	GU
	I have not heard of it	56.0	23.7	15.2	17.1
Q3.iv	Yes	21.0	9.7	8.2	3.1
	No	23.0	7.4	6.2	9.3
	I have not heard of it	56.0	22.6	16.3	17.1
Q3.v	Yes	77.0	23.0	26.8	27.2
	No	3.1	1.9	0.4	0.8
	I have not heard of it	19.8	14.8	3.5	1.6
<i>Sustainability teaching and research</i>					
Q4.i	Yes	82.1	27.6	26.8	27.6
	No	3.9	2.3	0.4	1.2
	I have not heard of it	14.0	9.7	3.5	0.8
Q4.ii	Yes	87.9	31.1	28.4	28.4
	No	1.9	0.8	0.8	0.4
	I have not heard of it	10.1	7.8	1.6	0.8
Q4.iii	Yes	90.3	32.7	29.6	28.0
	No	1.2	0.8	0.0	0.4
	I have not heard of it	8.6	6.2	1.2	1.2
Q4.iv	Yes	67.3	16.7	24.1	26.5
	No	1.2	1.2	0.0	0.0
	I have not heard of it	31.5	21.8	6.6	3.1
Q4.v	Yes	78.2	24.9	24.9	28.4
	No	5.1	2.7	1.6	0.8
	I have not heard of it	16.7	12.1	4.3	0.4

the total respondents. However, the majority of the respondents (81.7%) said that the university does encourage them to dispose of the waste in the trash bin. Almost all respondents answered that the university provides: separate trash bins to sort the waste (95.3%), digital materials (89.5%), and kitchen room to reheat and refrigerate foods (94.2%).

Majority of the students said that they have not heard that the university has partnerships with the local community (56.0%) and alumni (56.0%) in supporting sustainability issues. However, the students are aware that the university does engage a cooperation with government agencies, private sectors, and/or NGOs (56.4%) and with students' association (77.0%) in supporting sustainability. In terms of equality, about more than 75% of the respondents answered that the university provides special care and assistance to the handicap and people with special needs and 68.5% of them said that the university does involve in a partnership in promoting gender and racial equality.

Related to sustainability teaching and research, majority of the students are considered to be aware of this issue; for instance, 82.1% of them know that the university held workshops, seminars, meetings, and/or conferences on sustainability and 78.2% of them are familiar to the university' events that promote sustainability. They also have knowledge that the university has programs (87.9%) and courses or classes (90.3%) related to sustainability. However, more than one-third are not familiar that the university has research groups studying sustainability issues.

4.4 Student's attitude

Student's attitude towards campus sustainability contains salient belief and subjective evaluation towards campus sustainability indicators. The attitude towards a particular indicator is the products of the answers from the third and the fourth section of the questionnaire. The average value (\bar{x}) and standard deviation (s) across all respondents for each valid indicator at each university are shown in Table 3.

In the university EMS dimension, students at JU have the lowest average values among all unless in Q2.ii (higher than GU) and Q2.iv (the highest among all). Students at GU, on the other hand, score the highest values for all indicators unless in Q2.ii (the lowest), Q2.iii (lower than CU), and Q2.iv (the lowest). In terms of magnitude, students at JU, on average, have high attitudes in Q2.i indicator, moderate to low in two indicators: Q1.i and Q1.vi, while the rests are moderate to high. Students at CU have high attitudes in indicators Q1.v, Q2.i, and Q2.vi, while the rests are moderate to high. On the other hand, students at GU have very high attitudes in indicator Q2.i, high attitudes in three indicators: Q1.iv, Q1.v, and Q2.vi, while the rests are moderate to high. Note that we used six classes

Table 3 Mean and standard deviation of students' attitudes at each university

Dimensions/ indicators	JU		CU		GU	
	\bar{x}	s	\bar{x}	s	\bar{x}	s
<i>University EMS</i>						
Q1.i	11.549	7.239	13.333	6.642	14.909	5.432
Q1.ii	13.843	7.418	14.051	6.168	14.571	5.009
Q1.iii	13.490	7.354	14.115	6.152	14.390	4.924
Q1.iv	15.314	8.408	16.462	7.364	17.260	6.439
Q1.v	16.069	7.700	18.256	7.773	18.545	6.090
Q1.vi	11.814	7.431	14.128	6.972	14.351	6.093
Q2.i	18.794	7.261	20.295	6.723	21.468	5.564
Q2.ii	15.971	7.743	16.718	6.590	15.740	5.775
Q2.iii	15.402	7.791	15.987	6.366	15.831	5.745
Q2.iv	16.824	8.155	16.141	6.397	14.883	6.020
Q2.vi	16.196	7.236	17.910	7.391	20.974	5.375
<i>Public participation and social responsibility</i>						
Q2.v	13.853	8.206	14.487	7.094	14.610	6.100
Q3.i	12.980	7.100	17.910	7.391	18.442	6.355
Q3.ii	14.020	7.720	17.513	6.948	15.636	5.219
Q3.iii	13.853	6.926	14.782	5.761	14.351	4.823
Q3.iv	12.510	7.306	14.564	6.021	12.740	5.488
Q3.v	14.529	7.424	13.038	5.986	19.312	6.040
<i>Sustainability teaching and research</i>						
Q4.i	14.108	7.652	18.000	7.471	20.416	5.994
Q4.ii	13.471	7.800	15.859	6.027	14.766	5.407
Q4.iii	13.431	6.228	16.808	5.829	15.403	5.483
Q4.iv	13.500	7.488	14.795	5.834	14.636	5.525
Q4.v	15.314	7.206	17.692	7.374	20.766	5.871

to differentiate the attitude according to its magnitude, i.e. (i) very low (1–5), low (6–9), moderate to low (10–13), moderate to high (14–17), high (18–21), and very high (22–25).

In public participation and social responsibility dimension, again, in average, students at JU have the lowest values except only for the indicator of Q3.v (higher than CU). While students at GU also dominate this dimension by scoring the highest scores unless in Q3.ii, Q3.iii, and Q3.iv (lower than CU). In terms of magnitude, attitudes of students at JU are moderate to high in four indicators: Q2.v, Q3.ii, Q3.iii, and Q3.v, while the rests are moderate to low. Students at CU have high attitudes in indicators Q3.i, and Q3.ii, while the rests are moderate to high. Students at GU have high attitudes in two indicators: Q3.i and Q3.v, moderate to high attitudes in three indicators: Q2.v, Q3.ii, and Q3.iii, and moderate to low in Q3.iv.

In the last dimension, students at GU have the highest average value in two indicators: Q4.i and Q4.v; CU have the highest average values in three indicators: Q4.ii, Q4.iii, and Q4.iv, while JU have the lowest average values in all indicators. In terms of magnitude, students at JU have moderate-to-high attitudes in all indicators. Students at CU and GU are similar; their attitudes are high in indicators Q4.i and Q4.v, and moderate to high in three indicators: Q4.ii, Q4.iii, and Q4.iv.

The one-way analysis of variance (ANOVA) was used to investigate whether there is any statistically difference among the means of three universities. To determine whether any of the difference between the means are statistically significant, one might compare the p -value at the particular significance level. The calculated p -value is 0.009, which is less than the chosen significance level of 5%. This result gives an insight that the students of CU, JU, and GU have different attitudes (statistically significant) towards campus sustainability.

We also investigated student's attitude according to three dimensions of campus sustainability and—to be more detail—for every indicator as shown in Table 4. Note that the asterisk marks indicate that the difference is statistically significant at the significance level of 5%. The dimension which is not different is university EMS. It seems that the students from three universities have the same attitudes towards this particular dimension but differ to the other two dimensions. The indicators of campus sustainability which are different among the students are Q1.i, Q1.v, Q1.vi, Q2.i, Q2.vi, Q3.i, Q3.v, Q4.i, Q4.iii, and Q4.v, while the others are not statistically significant. Further discussion and analysis for these findings will be given in the next section, digging more detail into the reasons why the attitudes are different or similar.

The ANOVA is an omnibus test, meaning that if there is a statistically different among the groups, one cannot tell which group(s) is(are) different with other(s). The post hoc analysis is used for this identification. In this research, since the ANOVA result stated that the difference is statistically significant, so the post hoc analysis is necessary to be conducted. In this research, the Gomes–Howell test was used since the test is designed for unequal variances and unequal sample sizes. The result of the post hoc analysis is shown in Table 5. According to Table 5, apparently, the attitudes of students at JU are different from CU's students at the significance level of 10% and with students at GU at the significance level of 5%, while the attitudes of CU's students are not statistically different from GU students at any significance level. Furthermore, from the mean different analysis (see the third column of Table 5 and Fig. 1), the attitude of students at GU is placed at the highest level among others, while CU is in the second position and lastly, JU is located at the last position. Further discussion and analysis for these findings also will be given in the next section.

Table 4 The ANOVA results for each dimension and indicator

Dimensions/indicators	<i>p</i> -Value
<i>University EMS</i>	0.095
Q1.i	0.003*
Q1.ii	0.747
Q1.iii	0.620
Q1.iv	0.224
Q1.v	0.043*
Q1.vi	0.024*
Q2.i	0.027*
Q2.ii	0.645
Q2.iii	0.834
Q2.iv	0.189
Q2.vi	0.000*
<i>Public participation and social responsibility</i>	0.020*
Q2.v	0.752
Q3.i	0.000*
Q3.ii	0.256
Q3.iii	0.721
Q3.iv	0.861
Q3.v	0.000*
<i>Sustainability teaching and research</i>	0.000*
Q4.i	0.000*
Q4.ii	0.056
Q4.iii	0.001*
Q4.iv	0.334
Q4.v	0.000*

*Significance at the level of 0.05

Table 5 The Gomes–Howell test result

University (A)	University (B)	Mean different (A-B)	SE	<i>p</i> -Value
JU	CU	- 35.590	16.624	0.085*
	GU	- 47.167	15.761	0.009**
CU	JU	35.590	16.624	0.085*
	GU	- 11.578	15.189	0.727
GU	JU	47.167	15.761	0.009**
	CU	11.577	15.189	0.727

*Significance at the level of 0.10

**Significance at the level of 0.05

5 Discussion

This section aims to discuss and dig more detail towards the result and find the reasons why the student's attitude at each university might be similar or different for each indicator

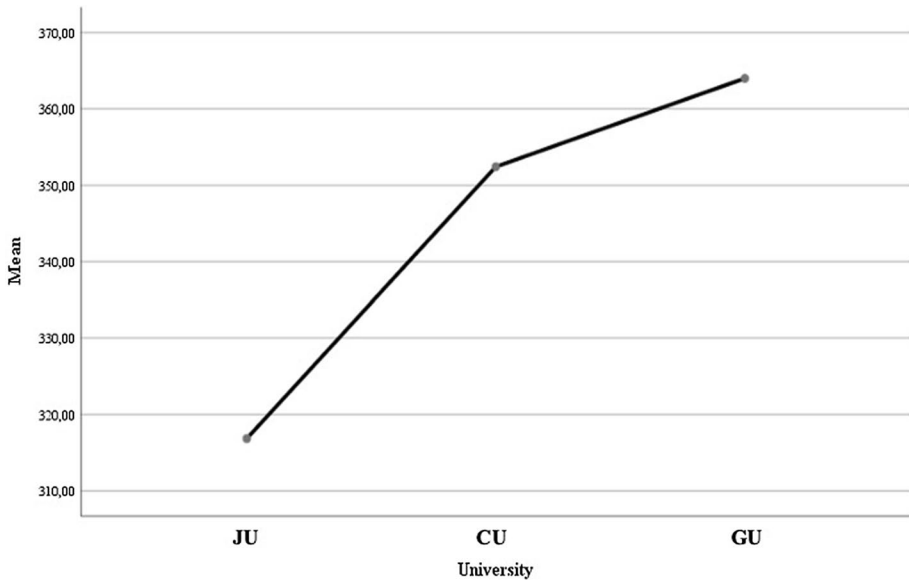


Fig. 1 Means plot of the Student's Attitude for Each University

of campus sustainability.

5.1 University environmental management system

University is responsible to implement environmental practices and regulations to ensure environmental issues are managed constantly and systematically. The implementation deals with the environmental problems throughout the university and enables to reduce environmental impacts and to increase its operating efficiency. EMS can be a successful tool to effectively manage diverse environmental concerns and improve campus sustainability (Barnes & Jerman, 2002). There are eleven indicators in this dimension, and only five of them resulted in difference in student's attitudes (see Table 4). Following is the discussion for indicators which students have similar or different attitudes towards them.

5.1.1 Environmental management system indicators in which students have similar attitudes

The first indicator in this discussion is Q1.ii. Turning off the lights before leaving the room is as one of the sustainable behaviours (Jaquinto, 2015). The students have the same attitudes since all universities have installed an automatic sensor in each room so that whenever there is no activity inside, the lights will automatically be shut down.

The second indicator is Q1.iii. Actually, this initiative works best in a room having an air conditioner (AC) inside since AC is considered as the most effective solution for reducing heat stress and protect from heat exposure by providing indoor thermal comfort to avoid heat-related health problems. However, AC use is not without problems; it faces several challenges, from environmental, socio-economic, to behavioural challenges (Lundgren-Kownacki et al., 2018). Regarding this initiative, students in three universities have

similar attitudes. As a matter of fact, there is no AC installed in each room at the universities since it is not common to use AC in Sweden.

The third indicator is informing students to turn off the taps to save water usage. Currently, water depletion and contamination are among the main environmental problems faced worldwide; thus, reducing water consumption can ensure the efficient and sustainable use of the resource. Despite some studies reported socio-demographic factors influencing water consumption (e.g. Willis et al., 2009), students at three universities—regardless of their backgrounds—think that it will have a good impact on the environment by doing this action, resulting they have similar attitudes.

The students stated that their universities provided digital materials, environmentally friendly products, as well as kitchen room and/or facility to reheat and refrigerate foods. Lecturers in Sweden have to put their study materials on PING PONG, a learning management system used for web-based education. This initiative is expected to influence the students to avoid printing since printing is considerably causing harms for the environment. Most students indicated that they did prepare their lunch in a food container; hence, providing a kitchen room containing several microwaves is a good initiative since students can reheat their foods for having their lunch. Lastly, the students, in average, stated that they are likely to purchase an environmentally friendly product if the universities provide it. It is a good signal since consuming environmentally friendly products is considered as having a pro-environmental behaviour (Leonidou et al., 2010).

5.1.2 Environmental management system indicators in which students have different attitudes

There are five indicators in the environmental management system dimension in which students in these three universities have different attitudes. The first indicator to be discussed is Q1.i (to leave the computer on standby mode when it is no longer used). As energy costs increase and adverse effects of energy production become more apparent, improving power management on computers, has estimated savings of over a billion dollars per year (Korn et al, 2004). Using system standby mode is considered as the most effective power saving features, where the system is saved to main memory and memory is kept in a low power mode while the system is asleep (Talebi & Way, 2009). It is then recommended to inform the students to leave the computer on standby mode; or to set the computer so that when users leave it inactively for more than let say 10 min, the computer will be logged off automatically.

The second indicator is Q1.vi (to avoid printing when it is not necessary). Printing has several environmental impacts, such as the use of non-renewable resources, use of toxic or harmful substances, and producing toxic waste (Viluksela, 2008). Due to these harms, it is suggested to these three universities for having explicit information to influence their students to avoid printing when it is not necessary. The universities could, perhaps, provide digital materials as learning materials, or set a more expensive cost of printing a paper inside the university.

The third and fourth indicators are Q1.v (to dispose waste in trash bin) and Q2.i (providing separate trash bins to sort the waste). In these three universities, efforts have been done regarding these initiatives, such as asking the students to dispose of the waste via printed notification posted in several visible spots and providing separate trash bins to sort waste. If one only looks at those two initiatives solely, s/he might think that the attitudes of students are similar since the universities have similar efforts. However, the result shows that

the attitudes differ; JU are the lowest, while GU are the highest. The reason might come from how to handle the waste. CU and GU are certified under ISO 14001 (JU is not); this standard demand the universities to have a good waste management plan. Therefore, it is recommended—especially for JU—to improve the waste management plan and to do more endeavour in engaging the students to actively participate in these initiatives.

The fifth indicator is Q2.vi (providing free or accessible public transportation). Green transportation can be promoted by providing free or access to public transportation and discouraging vehicles commuting to the university so that it can reduce emission and congestion. Evidently, all universities do not provide free transportation but accessible public transportation, meaning that students can reach the universities by bus, tram, or ferry. Public transportation in the city which lies CU and GU is apparently much better than in city of JU, ranging from the availability of transportation's alternatives, frequency of the transportation's modes, to the spots' accessibilities. In addition, finding car parking for students at JU is much easier than at CU and GU. Those might be the reason why the attitudes of students at JU are not as high as the attitudes of students at CU and GU. It confirms the study by Emanuel and Adams (2011) that the community or surrounding condition affects the perceptions of students towards sustainability. Therefore, it is recommended for JU to cooperate with city municipality to provide not only students, but also the residents more accessible and convenient public transportation.

5.2 Public participation and social responsibility

This dimension involves university stakeholders' participation in achieving campus sustainability. University has the social responsibility of promoting environmental justice and equality as well as taking care of the handicap and people with special needs. There are six indicators regarding this dimension; among those, the result shows that there is no difference in student's attitudes towards four indicators and difference in two indicators.

5.2.1 Public participation and social responsibility indicators in which students have similar attitudes

The first indicator having similar attitude is Q2.v. All students in Sweden who have long-term disabilities can apply for pedagogical support through NAIS (in Swedish: *Nationellt administrations-och informationssystem för samordnare*). Through this information system, the universities could facilitate special education support for students with disabilities. Another national issue related to this dimension is providing gender and racial equality for all students (Government Offices of Sweden through Discrimination Act 2998:567). Since these are national issues, they somehow shape the attitudes of the students so that the attitudes are not different among three universities.

Two other indicators are Q3.iii and Q3.iv. In these indicators, students have moderate attitudes in terms of magnitude. This might be resulted from students' ignorance. There are 56% of students (for each indicator) answering that they have not heard about these. This is the biggest percentage among all indicators, meaning that the indifference does not show the good image; instead, the universities have to work hard to increase the attitudes of their students by not only escalating the number of cooperation and partnerships but also informing to their students that they do engage with local communities and alumni to support sustainability.

5.2.2 Public participation and social responsibility indicators in which students have different attitudes

There are only two indicators in the public participation and social responsibility dimension in which students in these three universities have different attitudes. The first indicator is Q3.i (the university showed any involvement/partnership/cooperation with government agencies, private sectors, and/or NGOs in supporting sustainability). Regarding this indicator, CU and GU have been joining together for more than two decades to form a centre for SD and environmental research. They also collaborated with some NGOs that work towards SD. JU also has a partnership with NGOs and city municipality towards sustainability issues. However, students at three universities differ in their attitudes irrespective to the universities' involvement with third parties to promote sustainability. The attitudes of students at CU and GU as well as their awareness are high compared to JU. This means that JU has to work harder to increase the awareness of the students so that they can be well informed about these initiatives.

The second indicator is Q3.v (the university showed any involvement/partnership/cooperation with student's association or community to promote sustainability). Students' association is involved to improve universities' sustainability efforts by being part of campus development and working for integrating sustainability into all education programs. Apparently, there are students' associations at these three universities working to promote sustainability. However, irrespective of these efforts, result shows that the attitudes differ. Students at GU have high attitudes, whereas students at JU and CU have moderate-to-high attitudes. According to Table 2, more than 90% of students at GU are aware of this initiative, while 87.3% of CU's students and only 57.8% JU's answered that they know about this initiative. The high awareness and the highly engaged students' associations with GU's students could be the reason why students at GU have high attitudes. On the other hand, the majority of JU's students are not aware about this initiative; thus, JU should take necessary steps that would inform their students about this and even encourage them to be actively involved in. Such an anomaly happened in CU: the awareness is high, but the attitude is moderate. Obviously, most students at CU know about students' association, but they do not really have any interest in joining the event since the participation rate was very poor. This condition is similar to the study of Abubakar et al. (2016) who reported that students at University of Dammam have high awareness and concern about campus sustainability, but they were reluctant to take part and participate in some initiatives to support sustainability.

5.3 Sustainability teaching and research

Universities have a responsibility to serve multiple mission that includes education and research as well as public services. Campus sustainability then could be achieved by integrating sustainability through teaching and research. There are five indicators regarding this dimension. All three universities apparently have those indicators in order to not only help to promote sustainability, but also to influence their students to have good attitudes towards sustainability.

5.3.1 Sustainability teaching and research indicators in which students have similar attitudes

All universities do have programs and research groups related to sustainability. Finding shows that the difference is not statistically significant, meaning that students have the same attitudes. It implies that the universities' efforts resulted in a good outcome.

5.3.2 Sustainability teaching and research indicators in which students have different attitudes

There are three indicators in the sustainability teaching and research dimension in which students in these three universities have different attitudes. The first and second indicators having different attitude are Q4.i (the university has workshops, seminars, meetings, and/or conferences on sustainability) and Q4.v (the university has events promoting sustainability). It is no question that all universities have such events, proving that they are supporting sustainability. However, the result shows that student's attitude differs. Looking at the awareness, it seems that students at GU are very aware of this initiative, making the students have the highest attitudes. For Q4.i initiative, about 24.5% of students at JU answered they have not heard that their university has this initiative. For Q4.v initiative, only 62.75% of students at JU are aware of this, making them score the lowest among all. Therefore, we come to an understanding that this difference is not because the universities have nothing to do regarding this initiative; instead, it is due to students' lack of awareness towards the initiative. Therefore, JU is recommended to do more endeavour in engaging the students (e.g. by better promotion, socialization, and campaign) to actively participate in this initiative.

The third indicator is Q4.iii (the university has courses or classes related to sustainability). It is expected that giving such course would produce graduates with the knowledge and commitment required to drive sustainability issues (Zeegers & Clark, 2014). Three universities do have classes related to sustainability. However, the result shows that the attitudes differ. At CU, the students have to take at least one course about SD to ensure that they have sufficient knowledge about sustainability. Moreover, it is expected that in the future all courses must be related to sustainability. GU, even though does not have similar policy, they have labelled the courses related to sustainability with "sustainability focused" to make students who have concerns about sustainability easier to pick courses. Contrarily, JU seems not to force the students to take any course related to sustainability, and in fact, it does not explicitly state that the particular course supports sustainability issues. It could be the reason why students at CU have the highest attitudes while students at JU have the lowest one.

5.4 Students' attitude in general

Analysis and discussion have been provided to find the reasons why the attitudes might be similar or different for each indicator of campus sustainability. Initiatives Q2.ii, Q2.iii, Q2.iv, Q4.ii, and Q4.iv are provided well by the universities since the students have high awareness. On the other hand, although the universities have initiatives Q3.iii and Q3.iv, the awareness of the students are low; therefore, it is recommended that the universities making the students well-informed towards those initiatives. Three

indicators (Q1.ii, Q1.iii, and Q1.iv) result in similar attitudes even though the universities do not provide any information regarding those. Technological advancement and cultural situation make indicators Q1.ii and Q1.iii are no longer relevant to be applied. However, it is still recommended to have indicator Q1.iv due to its importance to preserve the environment. Lastly, since two indicators (Q.v and Q3.ii) become the national issues, they will obviously influence not only the attitudes of students at those three universities but also students in Sweden widely.

On the other hand, there are ten indicators resulting in different attitudes. Some indicators are different not because the universities do not have the initiatives, yet due to the difference in student's awareness. Three universities have different efforts regarding to indicators Q3.i, Q3.v, and Q4.iii. CU and GU have been joining together to form the centre for SD and environmental research. The existence of this centre could increase the attitudes of students there. In regard to indicator Q3.v, students at CU have the lowest attitudes among all. CU could adopt the policy from GU or JU to increase the attitudes of the students. Contrarily, students at CU are considered as having the best policy in initiative Q4.iii, resulting in the highest attitudes among all, whereas JU has the weakest policy that results in the lowest attitudes. The community or surrounding condition could somehow affect the attitudes of the students as has been shown in indicator Q2.vi.

Overall, the result shows that there is a difference in student's attitude at those three universities, whereas GU ranks the first position due to having the highest attitude and JU ranks the bottom. By looking at the position only, one might mislead to jump to a conclusion that the difference is due to the EMS certification status since it is coincidence with the fact that GU has two certifications, CU has one, while JU has none. However, it is too early to say so since it has been clearly discussed that there are various factors affecting the difference.

6 Conclusion

This research aims to compare and analyse the attitudes of students towards campus sustainability in a relation to the influence of the university at three universities in Sweden: CU, GU, and JU. Campus sustainability framework by Alshuwaikhat and Abubakar (2008) containing three dimensions, i.e. university EMS, public participation and social responsibility, as well as sustainability teaching and research, is employed to generate the indicators. The one-way ANOVA is conducted to compare the student's attitudes.

Understanding student's attitude is considered vital since this could provide the decision-makers a portrait of the performance of the university in a relation to the sustainability issue in the perspective of the students. It also would give a better insight by means of how the students evaluate their universities in terms of sustainability and allow more students' involvement in campus sustainability programs. Furthermore, the study about students' attitudes is essential since the campaign of the university to pursue sustainability might be easier when students are enthusiastic and proactive (Newport et al., 2003).

The result shows that there is significant difference regarding students' attitudes at these three universities in general. In detail, only ten out of twenty-two valid indicators are different. Post hoc analysis reveals that all three universities differ, as GU has the highest and JU has the lowest attitudes. There are several reasons why the difference (or the similarity) occurred, such as student's awareness, difference in universities' efforts in supporting sustainability, and the surrounding condition. In addition, it is suspected that it could be any

other factor that affects the differences. Therefore, it is not wise to say that the differences are merely due to the EMS certification status of the universities.

The limitations of this study are as follows. This study is conducted at universities in Sweden. Since Sweden is regarded as one of the most sustainable countries, it somehow shapes the attitudes of people there, with no exception for the students. Although three universities being investigated have different EMS certification statuses and the students' attitudes are different, the discrepancies are not much substantial. Therefore, it is of interest to study the attitudes of students at non-sustainable university located in less sustainable country. Comparing the result with this research is a fascinating area to be pursued. Second, as has been mentioned in the discussion section, the universities do have similar initiatives regarding campus sustainability, but the attitudes of students vary. We explore the reason behind this difference by looking at student's awareness. However, it is of interest to complement the analysis by not only investigating universities' efforts or student's awareness, but also any other factors constitute to this issue, for example, the economic, social, and cultural status of the students, as well as the demographic information of the students.

Acknowledgements The authors thank to Dinara Tokbaeva, Ph.D. and Tommaso Minola, Ph.D. for their valuable supports and comments for this work.

Funding The authors received no financial support for this work.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

References

- Abubakar, I., Al-Shihri, F., & Ahmed, S. (2016). Students' assessment of campus sustainability at the University of Dammam, Saudi Arabia. *Sustainability*, 8, 59.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211.
- Alshuwaikhat, H. M., & Abubakar, I. (2008). An integrated approach to achieving campus sustainability: Assessment of the current campus environmental management practices. *Journal of Cleaner Production*, 16, 1777–1785.
- Arushanyan, Y., Ekener, E., & Moberg, Å. (2017). Sustainability assessment framework for scenarios—SAFS. *Environmental Impact Assessment Review*, 63, 23–34.
- Barnes, P., & Jerman, P. (2002). Developing an environmental management system for a multiple-university consortium. *Journal of Cleaner Production*, 10, 33–39.
- Boyer, R. H., Peterson, N. D., Arora, P., & Caldwell, K. (2016). Five approaches to social sustainability and an integrated way forward. *Sustainability*, 8, 878.
- Brundtland, G. H. (1987). *Our Common Future (Report of the World Commission on Environment and Development)*. The United Nations.
- Ceulemans, K., Molderez, I., & van Liedekerke, L. (2015). Sustainability reporting in higher education: A comprehensive review of the recent literature and paths for further research. *Journal of Cleaner Production*, 106, 127–143.
- Christensen, P., Thrane, M., Herreborg Jørgensen, T., & Lehmann, M. (2009). Sustainable development: Assessing the gap between preaching and practice at Aalborg University. *International Journal of Sustainability in Higher Education*, 10, 4–20.
- Cortese, A. D. (2003). The critical role of higher education in creating a sustainable future. *Planning for Higher Education*, 31, 15–22.
- Coy, A. E., Farrell, A. K., Gilson, K. P., Davis, J. L., & Le, B. (2013). Commitment to the environment and student support for “green” campus initiatives. *Journal of Environmental Studies and Sciences*, 3, 49–55.

- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297–334.
- Dagilūtė, R., Liobikienė, G., & Minelgaitė, A. (2018). Sustainability at universities: Students' perceptions from Green and Non-Green universities. *Journal of Cleaner Production*, *181*, 473–482.
- de Castro, R., & Jabbour, C. J. C. (2013). Evaluating sustainability of an Indian university. *Journal of Cleaner Production*, *61*, 54–58.
- Delakowitz, B., & Hoffmann, A. (2000). The Hochschule Zittau-Görlitz-Germany's first registered environmental management (EMAS) at an institution of higher education. *International Journal of Sustainability in Higher Education*, *1*, 1467–6370.
- Emanuel, R., & Adams, N. J. (2011). College students' perceptions of campus sustainability. *International Journal of Sustainability in Higher Education*, *12*, 79–92.
- Figueredo, F. R., & Tsarenko, Y. (2013). Is “being green” a determinant of participation in university sustainability initiatives? *International Journal of Sustainability in Higher Education*, *14*, 242–253.
- Filho, W. L. (2010). *Sustainability at universities: Opportunities*. Peter Lang.
- Fischer, D., Jenssen, S., & Tappeser, V. (2015). Getting an empirical hold of the sustainable university: A comparative analysis of evaluation frameworks across 12 contemporary sustainability assessment tools. *Assessment & Evaluation in Higher Education*, *40*, 785–800.
- Fisher, P. B., & McAdams, E. (2015). Gaps in sustainability education: The impact of higher education coursework on perceptions of sustainability. *International Journal of Sustainability in Higher Education*, *16*, 407–423.
- Fisher, R. M. (2003). Applying ISO 14001 as a business tool for campus sustainability: A case study from New Zealand. *International Journal of Sustainability in Higher Education*, *4*, 138–150.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th edn.). Pearson.
- Hall, J., & Vredenburg, H. (2003). The challenges of innovating for sustainable development. *MIT Sloan Management Review*, *45*, 61–68.
- Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable development: Mapping different approaches. *Sustainable Development*, *13*, 38–52.
- Iaquinto, B. L. (2015). “I recycle, I turn out the lights”: Understanding the everyday sustainability practices of backpackers. *Journal of Sustainable Tourism*, *23*, 577–599.
- Kell, G. (2003). The global compact: Origins, operations, progress, challenge. *Journal of Corporate Citizenship*, *11*, 35–49.
- Korn, D., Huang, R., Beavers, D., Bolioli, T., & Walker, M. (2004). Power management of computers. *Proceedings of the IEEE International Symposium on Electronics and the Environment*, Scottsdale, AZ, 128–131.
- Lehtonen, M. (2004). The environmental–social interface of sustainable development: Capabilities, social capital, institutions. *Ecological Economics*, *49*, 199–214.
- Leonidou, L. C., & Leonidou, & C. N., Kvasova, O. (2010). Antecedents and outcomes of consumer environmentally friendly attitudes and behaviour. *Journal of Marketing Management*, *26*, 1319–1344.
- Lozano, R. (2006). A tool for a Graphical Assessment of Sustainability in Universities (GASU). *Journal of Cleaner Production*, *14*, 963–972.
- Lozano, R., Ceulemans, K., Alonso-Almeida, M., Huisingh, D., Lozano, F. J., Waas, T., Lambrechts, W., Lukman, R., & Hug, J. (2015). A review of commitment and implementation of sustainable development in higher education: Results from a worldwide survey. *Journal of Cleaner Production*, *108*, 1–18.
- Lozano, R., Lukman, R., Lozano, F. J., Huisingh, D., & Lambrechts, W. (2013). Declarations for sustainability in higher education: Becoming better leaders, through addressing the university system. *Journal of Cleaner Production*, *48*, 10–19.
- Lundgren-Kownacki, K., Hornyanszky, E. D., Chu, T. A., Olsson, J. A., & Becker, P. (2018). Challenges of using air conditioning in an increasingly hot climate. *International Journal of Biometeorology*, *62*, 401–412.
- Nejati, M., & Nejati, M. (2013). Assessment of sustainable university factors from the perspective of university students. *Journal of Cleaner Production*, *48*, 101–107.
- Nejati, M., Shahbudin, B. M., & A. S., & Bin Amran, A. (2010). Sustainable development: A competitive advantage or a threat? *Business Strategy Series*, *11*, 84–89.
- Newport, D., Chesnes, T., & Lindner, A. (2003). The “environmental sustainability” problem: Ensuring that sustainability stands on three legs. *International Journal of Sustainability in Higher Education*, *4*, 357–363.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3d ed.). McGraw-Hill.
- Owens, K. A., & Halfacre-Hitchcock, A. (2006). As green as we think? The case of the College of Charleston green building initiative. *International Journal of Sustainability in Higher Education*, *7*, 114–128.
- Pramono, S. N. W., Ulkhaq, M. M., Trianto, R., Setiowati, P. R., Rasyida, D. R., Setyorini, N. A., & Jauhari, W. A. (2017). Integrating the analytic hierarchy process and importance-performance analysis into ISO 14001 framework for assessing campus sustainability. *AIP Conference Proceedings*, *1902*, 020035. <https://doi.org/10.1063/1.5010652>

- Purvis, B. Mao, Y., & Robinson, D. (2019). Three pillars of sustainability: In search of conceptual origins. *Sustainability Science*, *14*, 681–695.
- Ramos, T. B., Cecílio, T., & Joana de Melo, J. (2008). Environmental Impact Assessment in higher education and training in Portugal. *Journal of Cleaner Production*, *16*, 639–645.
- Savely, S. M., Carson, A. I., & Delclos, G. L. (2007). A survey of the implementation status of environmental management systems in US colleges and universities. *Journal of Cleaner Production*, *15*, 650–659.
- Setyorini, N. A., Ulkhaq, M. M., Rasyida, D. R., Setiowati, P. R., & Trianto, R. (2016). Assessing campus sustainability: An ISO 14001 approach. *International Journal of Advances in Agricultural & Environmental Engineering*, *3*, 245–248.
- Sulzer, G. (1999). EMAS—Environmental management in the European Union. *Proceedings of the ASQ's 53 Annual Quality Congress*, 150–157.
- Talebi, M., & Way, T. (2009, March 4–7). Methods, metrics and motivation for a green computer science program. [Paper presentation] *40th ACM Technical Symposium on Computer Science Education, Chattanooga, TN*.
- Tanguay, G. A., Rajaonson, J., Lefebvre, J. F., & Lanoie, P. (2010). Measuring the sustainability of cities: An analysis of the use of local indicators. *Ecological Indicators*, *10*, 407–418.
- Uhl, C., & Anderson, A. (2001). Green destiny: Universities leading the way to a sustainable future. *BioScience*, *51*, 36–42.
- Ulkhaq, M. M., George Joseph, R. S., Javed, B., & Nadekar, N. R. (2019a). Campus sustainability practice assessment: An empirical finding from Jönköping University, Sweden. *IOP Conference Series: Materials Science and Engineering*, *598*, 012010. <https://doi.org/10.1088/1757-899X/598/1/012010>
- Ulkhaq, M. M., Prakoso, M. F. A., Sari, V. K., Maduma, L., & Hazazi, M. H. (2019b). Assessing students' perceptions to sustainability: A comparison between two universities. In *Proceedings of the 5th International Conference on Education and Training Technologies* (pp. 25–29). <https://doi.org/10.1145/3337682.3337683>.
- Ulkhaq, M. M., Prayogo, P. I., Firmansyah, M., & Agustina, D. (2016). Assessing campus sustainability: A report from Diponegoro University, Indonesia. *International Journal of Information and Education Technology*, *6*, 616–621.
- Ulkhaq, M. M., Wijayanti, W. R., Wiganingrum, R., Dewi, W. R., & Ardi, F. (2018). Assessing university's sustainability programs from the perspective of university students: A gap analysis. *MATEC Web of Conferences*, *154*, 01073. <https://doi.org/10.1051/mateconf/201815401073>.
- Urbanski, M., & Filho, L. W. (2015). Measuring sustainability at universities by means of the Sustainability Tracking, Assessment and Rating System (STARS): Early findings from STARS data. *Environment, Development and Sustainability*, *17*(2), 209–220.
- Velazquez, L., Munguia, N., Platt, A., & Taddei, J. (2006). Sustainable university: What can be the matter? *Journal of Cleaner Production*, *14*, 810–819.
- Viluksela, P. (2008). *Environmental sustainability in the Finnish printing and publishing industry* (Master's Thesis, Helsinki University of Technology).
- Willis, R., Stewart, R. A., Talebpoor, M. R., Mousavinejad, A., Jones, S., & Giurco, D. (2009, October 26–29). Revealing the impact of socio-demographic factors and efficient devices on end use water consumption: case of Gold Coast Australia. [Paper presentation]. *5th International Water Association Efficient, Cairns, Australia*.
- Wright, T. S. A. (2002). Definitions and frameworks for environmental sustainability in higher education. *Higher Education Policy*, *15*, 105–120.
- Wright, T. S. A. (2010). University presidents' conceptualizations of sustainability in higher education. *International Journal of Sustainability in Higher Education*, *11*, 61–73.
- Yarime, M., & Tanaka, Y. (2012). The issues and methodologies in sustainability assessment tools for higher education institutions: A review of recent trends and future challenges. *Journal of Education for Sustainable Development*, *6*, 63–77.
- Yuan, X., Zuo, J., & Huisingh, D. (2013). Green Universities in China-what matters? *Journal of Cleaner Production*, *61*, 36–45.
- Zeegers, Y., & Clark, I. F. (2014). Students' perceptions of education for sustainable development. *International Journal of Sustainability in Higher Education*, *15*, 242–253.
- Zijp, M. C., Heijungs, R., van der Voet, E., van de Meent, D., Huijbregts, M. A., Hollander, A., & Posthuma, L. (2015). An identification key for selecting methods for sustainability assessments. *Sustainability*, *7*, 2490–2512.
- Zwickle, A., Koontz, M., & T. M. Slagle, K., T. & Bruskotter, J. (2014). Assessing sustainability knowledge of a student population: Developing a tool to measure knowledge in the environmental, economic and social domains. *International Journal of Sustainability in Higher Education*, *15*, 375–389.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.