An Investigation into University Students' Perceptions of Sustainability

Begüm Sertyeşilışık[1(✉)], Heyecan Giritli[1], Ecem Tezel[1], and Egemen Sertyeşilışık[2]

[1] Faculty of Architecture, Istanbul Technical University, Istanbul, Turkey
{bsertyesilisik, giritli, tezele}@itu.edu.tr
[2] Istanbul, Turkey
egemens@alumni.bilkent.edu.tr

Abstract. Sustainability efforts are consequences of concerns about future generations. These efforts need to be supported by all countries for permanent success. For this reason, universities, as multidisciplinary and multicultural platforms, are important for establishing international and multidisciplinary collaboration and move towards sustainability. This paper aims to analyze general tendencies, behaviors and consciousness about sustainability studies among universities' students. With this aim, after providing informative classes about sustainability to a class of international and multidisciplinary students studying in different universities in various countries, students were asked to fill in the questionnaire and to participate in the brainstorming session about sustainability education and sustainable behavior. Findings revealed that the awareness about sustainability should be improved through education and that universities play an important role in the fight against climate change especially with the help of courses on sustainability, sustainability practices and their green campuses.

Keywords: Sustainability · Sustainability tendency · Green campus

1 Introduction

The world's habitat is being deteriorated at an accelerated rate especially due to climate change fostered by the greenhouse gas (GHG) emissions. The European Union has set the following sustainable growth targets to fight against climate change [1]: reducing GHG emissions by 20% by 2020; increasing the share of renewables to 20%; increasing energy efficiency by 20%. These targets can be achieved through international and interdisciplinary collaboration as well as through sustainability conscious people acting as change agents for sustainability and having 'pro-environmental behavior'. The term "pro-environmental behavior" is one of the items considered in creation of effective resistance for this serious problem [2]. Investigating environmental effects of humankind in individual scale is one of the contemporary study areas of researchers (e.g. [2, 3]). Gatersleben et al. [4] indicated that "people are not always aware of the environmental impact of their behavior". However, due to direct and

S. Fırat et al. (eds.), *Proceedings of 3rd International Sustainable Buildings Symposium (ISBS 2017)*, Lecture Notes in Civil Engineering 7,
https://doi.org/10.1007/978-3-319-64349-6_27

indirect effect of individuals' consumption habits on environment, [5] and direct effect of occupants on buildings' occupancy and maintenance process [6] the actions taken against global warming is still insufficient. Therefore, a deep focus on human behavior should be implemented in sustainability studies [7] and current gap of insufficient action for preventing environmental harm may be limited by education.

According to Erten [8], regulations or technology won't be enough to solve environmental problems solely, but education and behavioral changes lead humankind's immediate response against negatively changing conditions of nature. As sustainability certificates of buildings is not a symbol of buildings' sustainable occupancy [9], green campuses may be achieved with green buildings and certifications, and environmentally oriented education which enhance pro-environmental behaviors.

Universities are sources of future professionals in different industries. They need to enhance their students' sustainability consciousness level and transform their behavior into pro-environmental one. These students equipped with sustainability requirements from technical, social and economic aspects can transform their professional fields into sustainable ones. Furthermore, they can contribute to the interdisciplinary and international action needed to fight against climate change. This paper analyses general tendencies, behaviors and consciousness about sustainability studies and behaviors among universities' students.

2 Universities' Roles in Sustainable Development

Green universities play an important role in regional sustainable development and in transforming societies into ecologically sound ones [10]. The United Nations 'Decade of Education for Sustainable Development' underlined the importance of integrating sustainable development values into learning and pro-environmental behavior [11, 12]. People's pro-environmental behavior and their consumption patterns are critical factors influencing success for transition towards sustainability and reducing carbon emissions [12]. Their behaviors can be influenced by education and education facilities. For this reason, the green curricula is important for Education for Sustainable Development [10]. Cotton et al. [12] emphasized the importance of knowledge in transforming the behavior and stated that "… a lack of knowledge may make it more difficult for them to select the most appropriate behavior" [12]. In the 4th UNESCO Chair Conference on Higher Education for Sustainable Development (HESD) in 2011, three roundtables on universities' roles in the sustainable development revealed the importance of integrating the campuses into the HESD curriculum and recommended the HESD courses to be elective to accelerate their opening procedure [13]. Students' pro-environmental behavior can be shaped not only through the courses but also through the green campuses. As there is relationship between campus sustainability and education [14], sustainability across the campus and the curriculum are inter-related [12].

Many universities have transformed their campuses into green ones [15, 16]. For example, Harvard University's sustainability plan [17] shows university's commitment to sustainability and provides roadmap for building and operating a more sustainable campus community [18]. Similarly, University of Copenhagen's strategy entitled as "Green Campus 2020: A Strategy for Resource Efficiency and Sustainability"

establishes university's 2020 targets for CO_2 reduction, energy consumption reduction, and in the fields of resources, chemicals, organization and behavior and campus as a living lab [19]. Furthermore, McGill University in Montreal inform their students about the sustainable food choices and provide them information on the environmental and resource use impacts of the most common meals available in the cafeterias [20]. Universities can get benefit from their sustainable campuses [16, 21]. For example, University of Copenhagen saved DKK 35 million a year and reduced its CO_2 footprint due to its green efforts, and reduced energy consumption [22].

National and international networks have been established to create synergy among sustainable universities and to foster sustainability performance. These networks enable the universities to learn from the practices. Examples for these networks include:

- The China Green University Network (CGUN) to enhance collaboration among different campuses, innovation, and to promote energy saving ideas [23, 24].
- The International Sustainable Campus Network (ISCN) "to support leading colleges, universities, and corporate campuses in the exchange of information, ideas, and best practices for achieving sustainable campus operations and integrating sustainability in research and teaching" [25].
- International Alliance of Research Universities (IARU)'s the campus sustainability initiative "to promote collaboration between member institutions and develop best practices strategies in environmental management" [26].
- Nordic Sustainable Campus Network (NSCN) of the Nordic higher education institutions "to strengthen Nordic collaboration, find new partners to collaborate with, and to have international visibility" [27].

3 Research Methods

This paper aims to analyze general tendencies, behaviors and consciousness about sustainability studies and behaviors among universities' students. After providing informative classes about sustainability to a class of international and multidisciplinary students studying in different European universities, a brainstorming session has been carried and a questionnaire has been applied. In the questionnaire, students evaluated according to their consciousness levels on (1) CO_2 emission, (2) electric consumption, (3) water consumption and (4) waste generation and recycling issues. The first part of the questionnaire was adopted from a book related to pro-environmental behaviors and their measurement [28]. These questions constituted of a 28-item list of pro-environmental behaviors proposed by Defra, UK. According to researchers, "pro-environmental behaviors were especially related to attitudinal variables" [4]. In this part, students were asked to self-report their general attitude about sustainability by indicating each item's importance level for them on a five-point Likert scale where 1 means "strongly disagree" and 5 means "strongly agree". In the second part of the questionnaire students were asked to self-report their daily life routines in their campuses by indicating "Yes" in terms of "I do" and "No" in terms of "I don't". 14 questions have been included in the second part of the questionnaire. Furthermore, the brainstorming session has been conducted about sustainability education and sustainable behavior.

4 Results and Discussion

4.1 Questionnaire

The sample consisted of 53 students 18 foreign students from different countries of Europe and 35 Turkish students respectively. The questionnaire has been distributed to the sample as hardcopy. Students were given 20 min to complete the questionnaire. The questionnaire was applied as a part of class study, thus there was no invalid answer, and all papers have been used for evaluation.

28 questions in the first part of the questionnaire aimed at identifying general consciousness level of students about sustainability into four categories; CO_2 emission, electric consumption, water consumption and waste generation and recycling. Students ranked each item according to the 5-point Likert scale. The results are shown in Fig. 1.

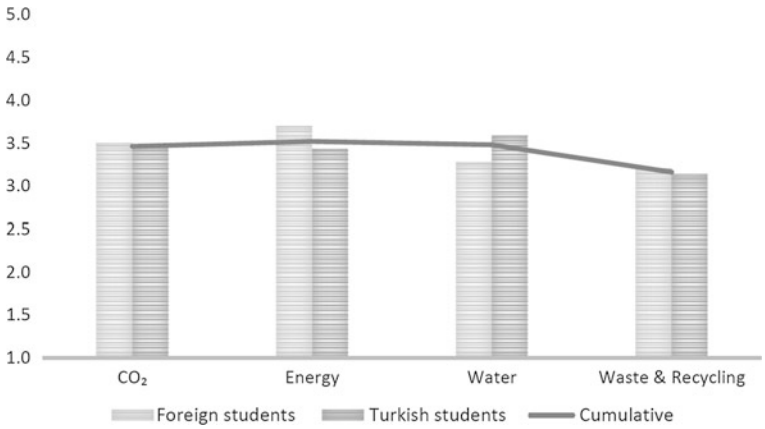

Fig. 1. Sustainability consciousness level of student groups

As it is seen Fig. 1, there are little differences in each item between European and Turkish students. Consciousness level on CO_2 emission (3.50), electric consumption (3.70) and waste generation and recycling (3.21) of foreign students are slightly higher than Turkish ones (3.45; 3.43 and 3.14) whereas Turkish students have higher consciousness level (3.59) on water consumption compared to others (3.28). Nevertheless, overall consciousness levels of all students on the four items indicate a relatively moderate distribution and revealed the importance and need for sustainability education at the undergraduate level.

14 questions in the second part of the questionnaire were designed in order to understand general behavioral pattern of students in their campuses. Students marked each item as "Yes" if they do the defined act and "No" if they don't, considering their routine behaviors. The descriptive results are shown in Table 1.

Considering Table 1, it can be said that, there exist much similarities between European and Turkish students' behaviors. There are two prominent behaviors namely; use of electronic resources for study and less energy mode of appliances. Turkish

Table 1. Daily life behavior of students (in percentage)

Behavior	Foreign		Turkish	
	Yes	No	Yes	No
Public transport/walk-bike	100	–	88.6	11.4
In-campus shuttle	16.7	83.8	28.6	71.4
Electronic source for study	33.3	61.1	82.9	14.3
Double-side use of paper	94.4	5.6	85.7	14.3
Turn off electrical appliance	88.9	5.6	85.7	14.3
Report broken lighting ap	44.4	55.6	28.6	71.4
Report broken plumbing fix	66.7	33.3	34.3	65.7
Less energy mode of app	38.9	55.6	82.9	17.1
Less water mode of plumb	38.9	44.4	54.3	45.7
Recycling bin	88.9	11.1	65.7	31.4
Multilayer wearing	61.1	38.9	68.6	28.6
Native food/drink	88.9	11.1	71.4	28.6
Sustainability education	100	–	94.3	5.7
Education in ITU	77.8	16.7	82.9	14.3

F foreign students, *T* Turkish students

students highly prefer electronic resources for their studies, whereas foreign students tend to study in traditional methods. In addition, sample of students in Turkey tends to pay more attention to use lighting appliances in less energy consuming way, while others don't. This difference between students may be connected to the situation that some of the European students in the sample indicated that they do not know about "less energy mode of electrical appliances".

The relationship between students' conscious level of sustainability issues and their behaviors has been analyzed through Pearson correlation analysis. Some statistically significant results were observed as shown in Table 2.

Table 2. Correlation analysis between conscious level and behavior of students

Behavior	Conscious			
	CO_2 emis.	Elect. con.	Water con.	Waste Rec.
In-campus shuttle	−0.301*			
Electronic source	−0.358**			−0.339*
Turning off elec. app		0.545**		
Recycling bins				−0.362**

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Students tend not to prefer travelling with shuttles in campus according to their high conscious level of CO_2 emission. This negative correlation might be interpreted in two folds. Since the distances from one place to other is not too much inside a campus,

students tend to prefer walking these distances. Furthermore, shuttle services are not available in some of campuses students come from.

Students tend to prefer print-out resources for their study or researches despite their high consciousness on electricity consumption and waste generation topics. Since this was also an unexpected result, students indicated that they study better if they have hard-copied resources. Furthermore, they added that it is much easier to find any subject from print-out sheets rather than electronic resources since it needs turning on computer, waiting it for getting ready to use, network connection, etc.

Results revealed that the higher consciousness level on electricity consumption generates a tendency on turning the appliances and lights off when leaving the space, they use in their campus. Despite their high consciousness on waste generation and recycling items, students tend not to pay attention to throw their recyclable wastes into fragmented bins, due to lack of available bins for recyclable wastes in their campuses.

Finally, students were asked to evaluate the importance of education about sustainability in their universities and whether or not the classes they had in ITU improved their knowledge about sustainability issues. Respondents' answers have been demonstrated in Table 3. According to the table, majority of the students (96.23%) think that sustainability education should be given as a part of university education. Besides, most of them (81.13%) think that the classes about sustainability in ITU have contributed to their point of view about sustainability topics.

Table 3. Response of students on sustainability education questions

	European students			Turkish students'		
	Yes	No	N/A	Yes	No	N/A
Importance of education about sustainability	18	0	0	33	2	0
Contributions of sustainability classes in ITU	14	3	1	29	5	1

4.2 Brainstorming

Following the questionnaire session, students have been invited to contribute to the study through brainstorming session. During this phase, a collaborative medium has been provided that ensured each student had the chance to reveal his/her opinion on the education of sustainability.

European students in the sample were asked to compare the practices in their own universities with the classes they have taken in ITU. They said that in their undergraduate programs, none of them have any compulsory or selective course related to sustainability. Just few of them mentioned that some courses included sustainability issue as a chapter in overall course flow and that they were not asked any question about sustainability part of the course in examinations.

Turkish students in the sample replied that there are some specific courses on "sustainability" and some courses covering sustainability in one or more chapters in overall course flow. Differing from the current application in Europe, the Turkish

students in the sample indicated that examinations of those classes in ITU mostly have at least one question about sustainability topic that lead students to study and focus on the issue more deeply.

The brainstorming session revealed the following recommendations for enhancing sustainability performance of the universities and for enhancing sustainability consciousness of the students:

- Using piezoelectric technology in crowded areas (e.g. university and department entrances; library entrance; sports halls; catering area entrance etc.) and informing the students about the availability of the technology in these areas
- Using impressive banners (which are framed and constantly changing) on sustainability
- Using interesting posters published abroad to motivate research
- Providing articles on food waste in the catering center
- Establishing students' clubs to provide short lectures and speeches on sustainability within 15–20 min during lunch breaks
- Providing sustainability related posters on the elevators
- Establishing sustainability projects competitions and giving awards
- Enabling disposal of waste
- Allocating broader space for paper waste in the Architecture Department
- Informing students from different departments that waste from their departments can be used by the students of the architecture department for the design purposes
- Giving lessons on the sustainability subject
- Giving sustainability courses to the students coming from different departments
- Enabling the companies to introduce and to provide environmentally sensitive products to the students in their professional field
- Providing design courses in the area of sustainability.
- Giving importance to students' sustainable design proposals and ensuring that their design is implemented in the campus

5 Conclusions

This paper has analysed general tendencies, behaviours and consciousness about sustainability studies and behaviours among universities' students. The findings can be summarized as it follows:

- Consciousness level of the sample on CO_2, energy, water, and waste and recycling aspects ranged between 3 and 3.5 in the Likert scale revealing moderate and homogenous consciousness level in these aspects. Consciousness level of students needs to be further enhanced especially in the field of waste and recycling.
- Pro-enviromental behaviors of the European and Turkish students in the sample showed similar patterns. They differed mainly in the usage of electronic resources for study and of energy mode of appliances. Correlation analysis between conscious level and behavior of students in the sample revealed that students tend to prefer

print-out resources for their study and that they tend not to pay attention to throw their recyclable wastes into fragmented bins despite their high consciousness.

- The importance of courses on sustainability has been emphasized. Majority of the students agreed that sustainability education should be given as a part of university education and that the sustainability course provided them has contributed to their knowledge of sustainability.
- Sustainability performance of the universities and sustainability consciousness of the students are recommended to be enhanced with the help of courses and sustainability practices in the campus including application of new technologies in the campuses, information boards and articles on sustainability, student clubs, project competitions, waste disposals, interdisciplinary collaboration among departments.

As the awareness about sustainability should be improved through education, universities play an important role in the fight against climate change especially with the help of courses on sustainability, sustainability practices and their green campuses.

As today's university students are the future's professionals, their consciousness about sustainability and their pro-environmental behaviors are important. Student exchange programs play an important role due to the need for international collaboration in the fight against climate change. Further research is recommended to be carried out on how to enhance collaboration among universities, industries, and politics globally in transforming the society into sustainable one.

References

1. The EU website: Sustainable Growth-for a Resource Efficient, Greener and More Competitive Economy. http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/sustainable-growth/index_en.htm
2. Turaga RMR, Howarth RB, Borsuk ME (2010) Pro-environmental behavior. Ann NY Acad Sci 1185:211–224
3. Brown ZB, Dowlatabadi H, Cole RJ (2009) Feedback and adaptive behavior in green buildings. Intell Build Int 1:296–315
4. Gatersleben B, Steg L, Vlek C (2002) Measurement and determinants of environmentally significant consumer behavior. Environ Behav 34:335–362
5. Fransson N, Garling T (1999) Environmental concern: conceptual definitions, measurement methods and research findings. J Environ Psychol 19:369–382
6. Hei C, Yu LSS (2014) Determinants of residential building occupants' behavior in sustainable living: a questionnaire survey in Hong Kong. In: ECSEE—the European conference on sustainability, energy and the environment, UK
7. Steg L, Vlek C (2009) Encouraging pro-environmental behavior: an integrative review and research agenda. J Environ Psychol 29:309–317
8. Erten S (2003) 5. sınıf öğrencilerinde çöplerin azaltılması bilincinin kazandırılmasına yönelik bir öğretim modeli. Hacet Üni Eğitim Fak Derg 25:94–103
9. Abdalla G, Maas G, Huyghe J, Oostra M (2011) Criticism on environmental assessment tools. Int Proc Chem Biol Environ Eng 6:443–446

10. Wang Y, Shi H, Sun M, Huisingh D, Hansson L, Wang R (2013) Moving towards an ecologically sound society? Starting from green universities and environmental higher education. J Clean Prod 61:1–5
11. UNESCO (2005) UN decade of education for sustainable development 2005–2014. UNESCO education for sustainable development (ED/PEQ/ESD). http://unesdoc.unesco.org/images/0014/001416/141629e.pdf
12. Cotton D, Shiel C, Paço A (2016) Energy saving on campus: a comparison of students' attitudes and reported behaviors in the UK and Portugal. J Clean Prod 129:586–595
13. Müller-Christ G, Sterling S, van Dam-Mieras R, Adomßent M, Fischer D, Rieckmann M (2014) The role of campus, curriculum, and community in higher education for sustainable development: a conference report. J Clean Prod 62:134–137
14. Jones P, Selby D, Sterling S (2010) Sustainability education: perspectives and practice across higher education. Earthscan Ltd., London. ISBN 978-1-84407-877-6
15. Isiaka A, Siong HC (2008) Developing sustainable index for university campus. In: EASTS international symposium on sustainable transportation incorporating Malaysian universities transport research forum conference 2008 (MUTRFC08). Malaysia
16. Abd-Razak MZ, Mustafa NKF, Che-Ani AI, Abdullah NAG, Mohd-Nor MFI (2011) Campus sustainability: student's perception on campus physical development planning in Malaysia. Procedia Eng 20:230–237
17. Harvard University Sustainability Plan (2015–2020). https://green.harvard.edu/sites/green.harvard.edu/files/Harvard%20Sustainability%20Plan-Web.pdf
18. Waddell J. Resident dean of Freshman, Elm Yard. https://green.harvard.edu/campaign/our-plan
19. Green Campus 2020: A strategy for resource efficiency and sustainability. http://greencampus.ku.dk/strategy2020/english_version_pixi_GC2020_webversion.pdf
20. Cheni DM, Tucker B, Badami MG, Ramankutty N, Rhemtulla JM (2016) A multi-dimensional metric for facilitating sustainable food choices in campus cafeterias. J Clean Prod 135:1351–1362
21. Alfieri T, Damon D, dan Smith Z (2009) From living building to living campuses. Plan High Educ 38:51–59
22. Schaltz T (2016) Green efforts save DKK 35 million a year at the University of Copenhagen Denmark. https://nordicsustainablecampusnetwork.wordpress.com/
23. China Green University Network. http://www.cgun.org/en/content.aspx?info_lb=107&flag=1
24. Li X, Tan H, Rackes A (2015) Carbon footprint analysis of student behavior for a sustainable university campus in China. J Clean Prod 106:97–108
25. International Sustainable Campus Network. http://www.international-sustainable-campus-network.org/
26. International Alliance of Research Universities. http://www.iaruni.org/sustainability/10y-green-campus/
27. Nordic Sustainable Campus Network. https://nordicsustainablecampusnetwork.wordpress.com/
28. Kurisu K (2015) Pro-environmental behaviors. Springer, Japan. ISBN 978-4-431-55832-3